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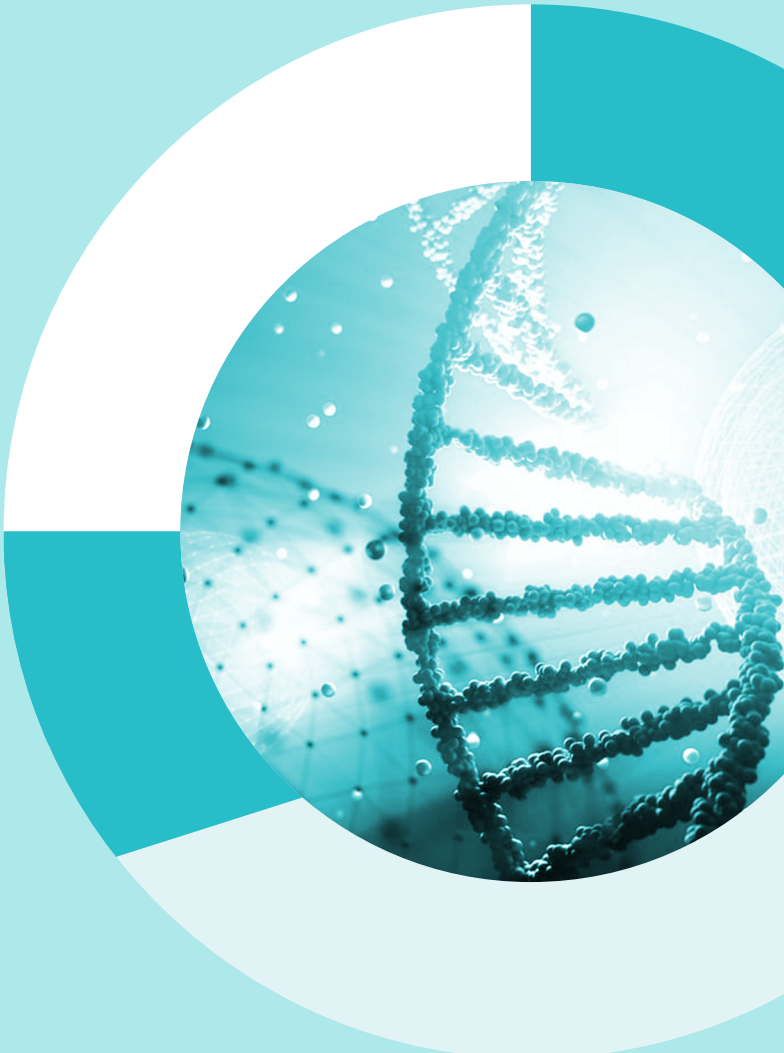

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The journal's clinical trial and data sharing policy will be valid for the articles submitted from 1 February 2020.

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| Type of manuscript | Word limit | Abstract word limit | Reference limit | Table limit | Figure limit |
|---|---|---|---|---|---|
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| Review Article | 5000 | 250 | 50 | 6 | 10 or total of 15 images |
| Case Report | 1200 | 200 | 15 | No tables | 4 or total of 8 images |
| Letter to the Editor | 400 | No abstract | 5 | No tables | No media |

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**Conference Proceedings:** Bengisson S. Sothemin BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92.

Proceedings of the 7th World Congress on Medical Informatics; 1992 Sept 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. pp.1561-5.

**Scientific or Technical Report:** Cusick M, Chew EY, Hoogwerf B, Agrón E, Wu L, Lindley A, et al. Early Treatment Diabetic Retinopathy Study Research Group. Risk factors for renal replacement therapy in the Early Treatment Diabetic Retinopathy Study (ETDRS), Early Treatment Diabetic Retinopathy Study Kidney Int: 2004. Report No: 26.

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# Microfluidic Organ-Chips and Infectious Diseases: Insights from the Development and Applications Perspective

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## Abstract

Artificial human organs or organ-on-chip technologies have rapidly evolved as a powerful tool for clinical diagnostics and drug discovery. Organ-on-chips, engineered microfluidic cell culture devices, reconstitute the microarchitecture and functions of living human organs by essentially mimicking the three-dimensional (3D) cross-sections of their major smallest functional units. The development of biomimetic microfluidic systems provided a bridge between the gap of *in vitro* and *in vivo* models by accommodating human cells in physiologically relevant microenvironments to accurately design and mimic the *in vivo* niche. Organ-on-chip technology is currently considered the most advanced model to recapitulate human physiology and pathophysiology with the possibility of using patient-specific cells. The implementation of new features such as the mechanical forces, blood flow, incorporation of immune cells with constant flow and the microbiome component represent a major step toward providing a window to the innerworkings of human cells and tissues. Currently, the most advanced organ-chip models include lung, intestine, kidney, liver, skin and blood-brain barrier. There are several applications of organ-chips including clinical diagnostics, drug discovery, drug delivery, biomarker discovery and disease modeling. Infectious disease research is an emerging field of organ-on-chip platforms. Investigations of bacterial, viral and parasitic pathogens and their interactions with host tissue in human-relevant systems hold the potential to drive novel advances in the biomedical field.

**Keywords:** Organ-on-chip, human emulation, infectious disease, drug discovery, future

## INTRODUCTION

Organs-on-chips (also known as organ chips) are microfluidic cell culture systems with controlled, dynamic conditions that emulate the physico-chemical microenvironment of tissues found in the human body. Nowadays considered as one of the top emerging technologies, the micro-level approach so called microfluidic technology originates from "miniaturized total chemical analysis systems (μTAS)," a term first coined by Manz et al.[1] in 1990 and refers to performing small-volume related reaction. With the fast-evolving pace of scientific knowledge and technology, the term "microfluidics" came into existance, and denotes the concept of dealing with behaviour and manipulation of fluids through micro-channels in a precisely controlled system.[2] This concept quickly developed into microchips to perform miniaturized laboratory experiments and into their application to medicine and biomedical science as organs-on-a-chip. Organ-on-chip devices are in the size range of an AA battery and allow *in vitro* experimentation with controlled parameters.[3] Although static cell-on-chip platforms also exist which use cells trapped in a particular region of a microfluidic device for single cell analysis,[4,5] dynamic organ-on-chip platforms with constant flow have particularly

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attracted the attention of the drug industry. The microfluidic devices are engineered to culture human cells and mimic their physiological microenvironment as well as replicating both human physiology and pathology. Due to the rising ethical issues of animal experimentation, inherent differences between human and animal physiology that led to failures in clinical trials, failure of conventional *in vitro* cultures to emulate human biology, and the inability of some pathogens to grow outside the human host, organ-on-chip technology is becoming a preferred choice in the medical field and the pharmaceutical industry.[6] By providing key features that are normally lacking within conventional *in vitro* models such as the flexibility to recreate breathing motions or muscle contractions, presence of mechanical forces, expression of human receptors molecules, the possibility of creating dynamic immune cell components and tailoring patient-specific chips essential for personalized medicine, microfluidic chips are becoming a commonly used tool to study distinctive stages of pathogenesis of diverse microorganisms via merging all the interactive components of an infection. Organ-on-chips have so far been applied to viral pathogens which target the human lungs such as influenza virus and to bacterial pathogens which infect the human intestine such as enteroinvasive and enterohemorrhagic *Escherichia coli* (EIEC, EHEC), hepatitis B infection of the liver, alpha-herpesvirus infections of the nervous system, as well as parasitic infections such as malaria by modeling the human spleen.[7-12] While organs on chips are already advancing infectious disease research, the technology holds the promise of answering many open questions regarding disease mechanisms of important human pathogens such as human immunodeficiency virus (HIV) and Zika virus (ZIKV) infections in the future. In this article, we will describe organ-chip devices, microfabrication procedures, their applications to infectious diseases and pharmaceutical industry.

## What are Organs-on-Chips?

Microfluidic organs-on-chips are defined as controlled microfluidic systems in which human cells are cultured in engineered microenvironments that recapitulate the essential characteristics of tissue geometry, actuation, dynamics, flow and gradients as found in a given organ of the human body.[13] The goal of organ chips is to recreate the smallest functional unit of living organs, rather than building whole organs.[14] To establish this, organ-specific cells are cultured, differentiated on chip devices recreating a 3D reconstruction of human tissue units. This technology offers numerous unique benefits over existing technologies used for functional testing by allowing control of biological, chemical and physical cell culture parameters in a single microsystem, and hence provides physiologically relevant readouts predictive of organ-level responses. A comparison of organ-on-chips and existing *in vitro* cell culture models is given in Table 1.

Microengineering technique is used to fabricate a multilayered microfluidic chip device that contains two parallel elastomeric microchannels separated by a thin porous flexible membrane[15] (Figure 1). The top channel constitutes the epithelial channel which is lined with human epithelial cells and the bottom channel, referred to as the lower vascular channel contains the microvascular endothelial cells. For each organ chip, the characteristic signals present *in vivo* need to be replicated *in vitro* via engineering methods to drive cell differentiation, tissue assembly, and functional maturation (Figure 2). The implementation of perfusion flow at a desired rate in both channels using a syringe or peristaltic pump allows the constant circulation of air, nutrients, growth factors, drugs, blood, immune cells, bacterial/viral/parasitic/fungal pathogens or toxins which can be tailored depending on the experimental model.

Microfluidic cell culture devices provide many advantages over macroscopic cell culture such as the requirement of a small number of cells, reduced reagent consumption, real-time and on-chip analysis, automation, flexibility of device design and direct coupling to downstream analysis systems. However, typical challenges associated with microfluidics technology exist and include the use of novel culture biomaterial surfaces, the complexity of operational control, and the non-standard nature of culture protocols.[3]

Various organ models have so far been developed with the lung, liver, kidney, gut, skin, brain and heart chips being the most advanced in the developmental phase.[16] The biomimetic microsystem that reconstituted the alveolar-capillary interface of the human lung was primarily developed. It comprised of alveolar epithelial cells and microvascular endothelial cells with physiological flow and cyclic suction applied to side chamber

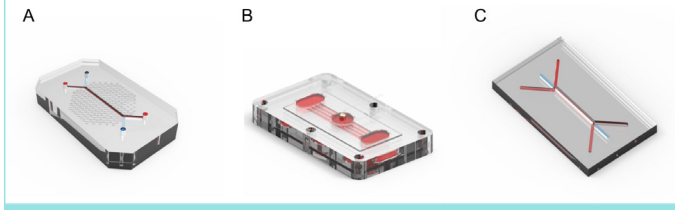


**Figure 1.** Prototype organ chip designs. **A)** Two-channel lung-on-a-chip microfluidic platform designating a top epithelial channel and a bottom microvascular endothelial channel **B)** Microfluidic blood-brain-barrier model consisting of a bottom perfusion layer with microchannels and bottom electrodes, a middle layer with reservoirs and neuronal chambers, and a top layer with top electrodes, **C)** Three-channel glomerulus-on-a-chip device consisting of middle channel with collagen stratification, right side channel representing the vascular space for podocytes and endothelial cells, and the left side channel depicting the urinary space where filtrate is collected.

(Adapted from Benam et al., 2016, Wang et al., 2017, Petrosyan et al., 2019).[19,20,24]

to produce rhythmic breathing movements and to create a 'breathing' lung-on-a-chip.[15,17] Alveolar chip was a step forward for assessing inflammation-induced intravascular thrombosis and toxicology of antithrombotic drugs.[18] Following the alveolus chip, small airway-on-a-chip was designed to recreate a differentiated, mucociliary bronchial epithelium exposed to air with an underlying microvascular endothelium which experiences fluid flow.[19] Many human intestine chip, 'gut-on-a chip' models have been established in which intestinal epithelial cells are cultured on polymeric scaffolds that allow crypt-villus architecture of human small intestine.[20] In further efforts, the combined effect of 3D structure and fluidic shear induced '3D gut chip' formation with absorptive permeability and enzymatic activity of the gut epithelium.[21] Efforts into modeling of human liver, a major site of drug metabolism and a target for drug-induced toxicity, have resulted in the assembly of a liver-chip consisting of human induced pluripotent stem cell (iPS)-derived hepatocytes in a perfusable platform.[22] The initial design of kidney-on-a-chip, on the other hand, contained two compartments: top channel mimicking the urinary lumen lined with renal tubular cells with fluid flow, and the bottom chamber mimicking the interstitial space.[23] A later report utilized a glomerulus-on-a-chip design with three channels using podocytes and glomerular endothelial cells representing the vascular space and the urinary space, and was proved to be a useful tool for screening therapeutic compounds.[24]

The use of biomimetic systems for the development of human skin equivalents have multiple applications including testing of pharmaceuticals and cosmetics, as well as studying the pathology of skin diseases, allergies and inflammation. The proposed models consist of three layers: epidermal, dermal and vascular components,[25] whereas more recently built full-thickness skin-on-chip devices exhibit robust epidermal and barrier function, and low skin permeability.[26] Engineering neural networks within a brain-on-a-chip platform is more challenging due to the complexity of brain tissue and multiple cell crosstalk, structural connections and cell-cell interactions representing important factors for brain function. However, progress in this area can drive breakthroughs in neurodegenerative therapies, neurodevelopmental studies and brain cancer treatments. In their study, Kilic et al.[27] generated a brain-on-chip model with pluripotent human cells differentiated into neuronal clusters interconnected with thick axonal bundles and interspersed with astrocytes, mimicking the brain parenchyma. Many microfluidic models of the blood-brain barrier (BBB) have also proposed to facilitate drug discovery targeting brain disorders, and are particularly important for understanding diseases such as Alzheimer's disease. These models usually composed of human brain microvascular endothelial cells (BMECs) interface with primary human brain astrocytes recapitulating the high level of barrier function,[28] as well as iPSC-derived neurons.[29] While the abovementioned organ chips are among the most advanced platforms, heart-on-a-chip, retina-on-a-chip, bone marrow-on-a-chip, spleen-on-a-chip, placenta-on-a-chip, as well as tumour- or cancer-on-a-chip are also being developed by researchers in the field.[12,30-34]

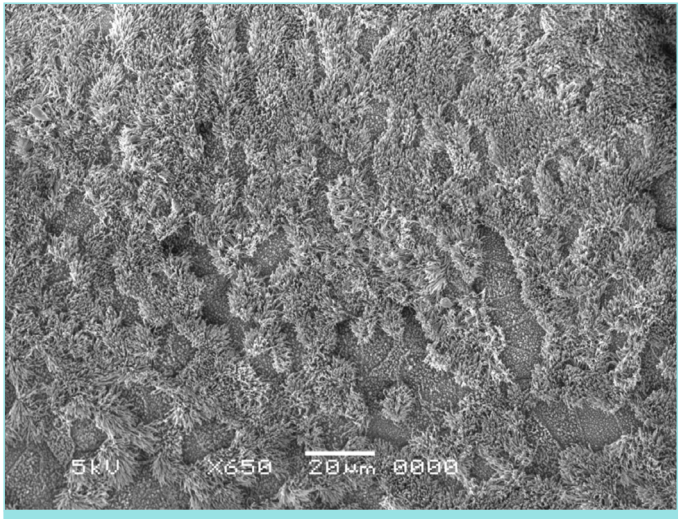


**Figure 2.** Ciliated airway epithelium present in a small airway-on-a-chip device imaged by scanning electron microscopy.

## Production Techniques of Microfluidic Devices

### Photolithography

Microfluidic prototyping mainly consists of two steps: creating of the master mold and replication into a polymeric microfluidic prototype. Master molds are often created using a complex and expensive procedure called photolithography. Photolithography is a core microfabrication technique preferably used to transfer microscale patterns to photosensitive materials by selective exposure to optical radiation.[35] During photolithographic processes, high-power ultraviolet (UV) light is projected through a photomask onto a photosensitive material (photoresist) layer to in order to fabricate patterns. A substrate such as a silicon wafer is covered with a photoresist, which is a highly viscous light-sensitive epoxy-based material. The thickness of the resist on the wafer is decided by spinning the wafer at a defined velocity via a spin-coating process, which determines the height of the subsequent microstructures. Following the photoresist uniformly covering the wafer at desired thickness, the photoresist is exposed to high-intensity UV-light. In order to create patterns in the photoresist, an opaque mask with transparent patterns is designed so that the UV-light passes through the transparent parts of the mask.[36] The result of the process is a substrate with defined structures, termed a master, which can mimic the micrometer range of sizes and ratio of *in vivo* human physiology. Photolithography processes are usually performed in a clean-room environment, which requires significant investment and maintenance costs. Alternatives to

**Table 1. Comparison of advantages and disadvantages of microfluidic chips and other existing *in vitro* culture models (modified from Yu et al., 2019)[49]**

| *In vitro* cell culture models | Advantages | Disadvantages |
|---|---|---|
| 2D cell culture (culture dish/flask, transwell membrane) | Well established protocols, easy to handle and analyze | Static condition, large media volume, lack of physiological and biochemical cues, variations in nutrient and waste concentrations, lack of immune cells |
| 3D cell culture (engineered scaffolds, spheroids, organoids) | Cell-cell and cell-ECM interactions, mimicking of 3D architecture of human tissue | Static condition, inefficient nutrient and waste transport |
| Microfluidic chip (organ-on-a-chip) | Constant flow, good transport via fluid flow, fine control over microenvironment, inclusion of microbiome and immune cell elements | Difficulty in standardization and scale up, requirement for pumps, tubing and connectors |

ECM: extracellular matrix, 2D: two-dimensional, 3D: three-dimensional.

photolithography including removal of the need for master molds entirely such as vinyl cutters, laser cutting, shrinking polymer, polyester-toner and paper-wax have been explored for creating master molds, however they lack the superior resolution of the photolithography technique.[37] Comparison of advantages and disadvantages of different microfabrication techniques are given in Table 2.

### Soft Lithography

Much of the work in the field of microfluidics has been done using soft lithography (SL) – a collection of techniques based on printing, molding and embossing with an elastomeric stamp, which can be viewed as a complementary extension of photolithography. SL is the most common method to fabricate components of organ-on-chips, among other techniques based on molding such as injection molding and its sister technology, hot embossing. It represents a prototyping approach of several types of both microscale and nanoscale structures, and devices on planar, curved, flexible and soft substrates at a low cost. SL involves the fabrication of elastomeric stamps, i.e. mechanically soft materials, using replica-molding technique. Polydimethylsiloxane (PDMS) is a polymer with an inorganic siloxane backbone and organic methyl groups attached to silicon, and is the most commonly used material for SL applications due to its unique properties including optical transparency, biocompatibility, mechanical flexibility, chemical inertness, low toxicity, gas permeability, versatile surface chemistry, durability and importantly, low cost.[38]

The components of the organs-on-chips, both the 'rigid' chip itself as well as the flexible porous membrane that supports the cells can be fabricated using SL. The fabrication of PDMS microfluidic devices via this method has two main steps: a photolithography process for the fabrication of the stamp and the molding. The principle of replica-molding involves liquid prepolymer of PDMS being casted against the bas-relief pattern of photoresist produced by photolithography to generate a PDMS substrate that replicates the 3D topography of the original master.[35] The uncured PDMS is deposited on the microstructured mould and cured. Upon removal from the mould, the PDMS contains negative copies of the microstructures of the mould. The microfluidic device is typically created by bonding the PDMS substrate having microchannel features with a blank PDMS slab. Similarly, porous PDMS membrane can be prepared by pushing the micropillars of a silicon master through an uncured PDMS film. The punctured film can be cured to create a porous PDMS membrane on which human cells can be seeded following surface

**Table 2. Advantages and disadvantages of microfluidic device fabrication techniques (adapted from Rodrigues et al., 2017 and Wu and Gu, 2011)[42, 50]**

| Methods | Advantages | Disadvantages |
|---|---|---|
| Photolithography | High (sub-micron) resolution, mass production, high wafer throughputs, ideal for microscale features | Requirement for a clean room facility, requirement for rigorous laboratory procedures and chemical post-treatment, expensive maintenance costs |
| Soft Lithography | Ability to fabricate 3D geometry, cost-effective, high resolution, control over surface chemistry, rapid prototyping | Pattern deformation and vulnerability to defects, low throughout, labor intensive, multi-step process |
| 3D Printing | High throughput fabrication, single step process, quick adjustment of device features, easy to replicate in different laboratories via sharing design files | Expensive, multiple treatment sessions, need for routine maintenance and calibration of 3D printer |

3D: three-dimensional.

activation and extracellular matrix (ECM) coating. Alternatively, porous membranes from commercial inserts can be used or filter membranes made of polycarbonate or polyethylene can be prepared by track etching. In track etching, electrons, heavy ions, X-ray irradiation or UV light is applied to a polymer film covered by a mask, passing through predefined openings of the mask and locally penetrating the polymer film. The production of porous polymer membranes via track etching gives control over pore size, density and share, and therefore is a preferred choice for the fabrication of organ chips.[39]

Upon microfabrication of organ-on-chip components, oxygen plasma treatment is typically applied by exposing the surface of the PDMS device components to oxygen plasma. This treatment changes surface chemistry by producing silanol terminations (SiOH) on the PDMS surface, after which the components are placed in contact to allow sealing. Plasma bonding allows a strong permanent bonding by which the properly sealed microchannels can be pumped with fluids at high pressure. The inlets and outlets of the microfluidic device are punched with a PDMS puncher in the size range of the connection tubing which will be used. Tygon (silicone, PCV, polyurethane, fluoropolymers, thermoplastic elastomers) and Teflon (polytetrafluoroethylene, PTFE) tubings are among the most frequently used material types in microfluidic setups that connect the device to a peristaltic or syringe pump for adjusting fluid flow.

### 3D Printing

Although photolithography and soft lithography techniques have been adopted for the fabrication of diverse organ-on-chips, they require multi-step processes and may be time consuming. More recently 3D printing and bioprinting have emerged as alternative methods owing to their ability to print multiple materials and cell types with good spatial resolution and reproducibility.[40] Stereolithography (SL) is a form of 3D printing that allows for the assembly-free production of 3D shapes in a single polymeric material from a photoresin precursor by a focused laser. In SL, a 3D object is built layer-by-layer using selective light exposure to photo-polymerize a precursor resin collected in a vat. Each layer is projected as an image obtained by digitally sectioning the 3D object into thin slices. Apart from SL, various other 3D-printing techniques have emerged such as multi-jet modeling and fused deposition (thermoplastic extrusion) modeling.[41]

### Polymers Used in Microfluidic Device Production

The selection of polymer which will be applied as a matrix in a microfluidic device depends on its compatibility with the required properties of the fabrication method. There are certain required characteristics of polymers such as good optical transparency, biocompatibility, high gas permeability, multiple bonding options, flexibility to complex geometries and low cost. The most popular polymers used in microfluidic device fabrication are poly(methyl methacrylate) (PMMA), poly(dimethylsiloxane) (PDMS), poly(ethyleneterephthalate glycol) (PETG), cyclic olefin copolymer (COC), poly(styrene) (PS) and poly(carbonate) (PC) and the comparison of their properties are given in Table 3.[42]

### Current Applications in Infectious Diseases

Organ-on chips have become popular tools in infectious diseases as they can be used to model organ-specific infections with various bacterial, viral and parasitic pathogens. While multiple features of an infection can be recapitulated on the chip e.g. receptor-driven adhesion to human cells, invasion, replication, intracellular survival and transepithelial migration, host responses to infection can also be evaluated by using readouts such as cytokine secretion, mucus secretion, neutrophil recruitment, integrity of cellular cytoskeletal architecture, barrier function, alterations in gene expression and protein expression levels.[43] Exploration of organ chip microfluidic technology holds a significant promise for the discovery and identification of novel drug targets, and for the preclinical evaluation of antibacterial, antiviral, antifungal and antiparasitic therapeutics in clinically relevant *in vitro* models. Most recent investigations of infectious disease research on organ-on-chip platforms are summarized below.

### Infections on Lung-on-a-chip

Albeit currently being far from replacing animal models, organ chips have been used to study the interaction of pathogenic microorganisms with human tissues and organs. In one of the

**Table 3. Comparison of the properties of the most commonly used polymers in fabrication of microfluidic devices (Adapted from Rodrigues et al., 2017)[42]**

| Polymer | Main characteristics |
|---|---|
| PMMA | Thermoplastic, transparent, UV resistant, low water absorption, good abrasion resistance |
| PDMS | Transparent elastomeric, biocompatible, high flexibility, high gas permeability, UV resistant, chemically inert, thermally stable |
| PETG | Transparent thermoplastic, chemical resistance |
| COC | Thermoplastic, high transparency, high heat resistance, low water absorption, high stiffness |
| PS | Thermoplastic, resistant to many chemicals, very good electrical properties |
| PC | Transparent thermoplastic, high heat resistance, high stiffness |

UV: Ultraviolet.

first reports, Benam et al.[19] have used a human lung small airway-on-a-chip lined with epithelial cells from individuals with chronic obstructive pulmonary disease, and successfully demonstrated clinical exacerbation by exposure to viral pathogens such as influenza virus, in addition to increased neutrophil recruitment and selective cytokine hypersecretion. In a similar human airway-chip, investigators modeled human-to-human transmission of influenza virus infection in continued presence of antiviral drugs that have led to the discovery of novel viral drug resistance mutations and identification of host therapeutic targets.[44]

### Infections on Gut-on-a-chip

Human gut-on-a-chip microdevices were also successfully applied to the study of intestinal bacterial infections and inflammation, and more importantly, the role of gut microbiome in disease by independently controlling multiple parameters on the chip. In their study, by comparing a mechanically active gut-on-a-chip to a mechanically-inactive device, Kim et al.[45] demonstrated that peristalsis-associated mechanical deformations contribute to bacterial overgrowth, a phenomenon observed in patients with inflammatory bowel disease. In their intestinal chip model, the authors also developed a chip with six commensal gut microbes, *Lactobacillus acidophilus, Lactobacillus plantarum, Lactobacillus paracasei, Bifidobacterium breve, Bifidobacterium longum*, and *Bifidobacterium infantis* and by doing so could also demonstrate that probiotic and antibiotic therapies can suppress villus injury by pathogenic bacteria such as enteroinvasive *E. coli* (EIEC).[45] Moreover, the colon chip was also applied to model damage in the human colonic epithelium induced by enterohemorrhagic *E. coli* (EHEC) infection. In this study, EHEC was observed to induce higher levels of epithelial injury when exposed to four human microbiome metabolites, and active human microbiome metabolites induced expression of flagellin associated with EHEC motility. This study itself was an example in which organ-chips provide an advantage over animal models, owing to the intrinsic species-specific differences that control the susceptibility of humans to pathogen.[9] Gut-on-a-chip platforms have also been useful for the analysis of enterovirus infection experiments that are difficult to perform in animals as they express different virus receptors to humans.[46]

### Infections on Liver-on-a-chip

Hepatitis B virus (HBV) infection today remains a major public health problem with limited preventative and therapeutic options mainly due to the lack of suitable *in vitro* models, which recapitulate all steps of the viral life cycle in liver hepatocytes, and the difficulty of modeling physiologically intact host cells for HBV replication. A microfluidic primary human hepatocyte-based liver-on-a-chip system, which is permissive to HBV infection and can be maintained for at least 40 days, was recently developed. This novel model allowed dissection of complex host-pathogen interactions in HBV infections, validation of viral infection biomarkers and treatment responses, thus provided a new preclinical platform to validate potential curative therapeutic interventions.[10]

### Infections on Placenta-on-a-chip

Placental inflammation, a known cause of preterm birth and neonatal mortality, has been a field in which extensive studies were limited by conventional cell and animal models due to the major variations in function and architecture of placenta. The establishment of placental barrier-on-a-chip device has provided a dynamic model of the fetal-maternal interfaces of human placenta. Acute inflammation by *E. coli* on the maternal side demonstrated complex responses including increased secretion of inflammatory cytokines by trophoblasts and adhesion of maternal macrophages following bacterial infection. These studies present a simple platform to study complex mechanisms underlying reproductive diseases.[33]

### Infections on Nervous System-on-a-chip

In alternative organ models, the technology enabled the analysis of neuron-to-cell spread and axonal transport by alpha-herpesviruses in microfluidic chambers in which peripheral nervous system neurons were cultured.[11] Similarly, a 3D printed nervous system-on-a-chip reconstituting glial cell-axon interface of the nervous system revealed that Schwann cells participate in axon-to-cell spread in pseudorabies virus infection.[47]

### Infections on Distal Tubule-on-a-chip

In a first-time study, Wang et al.[48] has built a distal tubule-on-a-chip to explore the pathogenesis of pseudorabies virus induced kidney disease, which demonstrated that the virus infection induced renal dysfunction in electrolyte regulation and disorder of $Na^+$ transporters due to disrupted tight junctions and intertwined microvilli in the reabsorption barrier.

### Infections on Spleen-on-a-chip

When parasitic infections are considered, a human splenon-on-a-chip has been microengineered which reproduces the physical and hydrodynamic properties of the smallest functional unit of the splenic red pulp, the splenon. By recapitulating the function of the spleen, which is to filter erythrocytes and malaria-infected cells, Rigat-Brugarolas et al.[12] have created a microscale platform to investigate potential drugs for malaria, the parasitic infection caused by *Plasmodium* parasites.

### Future Perspectives

Modeling infections in human-relevant systems is a necessity for accelerating the discovery of target-driven drugs and antimicrobials. Future applications of organ chips include real-time monitoring of infectious disease agent and human organ interactions for tackling some of the long-standing pathogens

such as HIV and ZIKV. These technologies will provide further insights into virus-host cell interactions and mechanisms associated with virulence and invasion, and hence will better aid in the design and development of safer and more potent drugs and therapeutics against HIV, ZIKV and other important human pathogens.

## CONCLUSION

Bioinspired organ-on-chips are still in their infancy of development, and yet are already providing unprecedented insights into a wide spectrum of disease pathologies and infectious disease mechanisms. The possibility of using patient-specific cells on chips is allowing us to design organ-on-chip models for a specific person to evaluate that person's unique reaction to an infectious agent or a drug treatment, and will facilitate a personalized treatment plan customized to the needs of an individual patient. While physiologically linking multiple organ chips to mimic the entire human body, human-on-a-chip, has taken its place in the literature, these systems do not yet exist.

Microfluidics technology has also attracted enormous interest from infectious disease researchers as well as attention from the pharmaceutical industry aiming at developing new antimicrobials to treat infectious diseases worldwide. Although research so far has enabled the discovery of novel pathogenic mechanisms and highlighted the importance of microbiome in infectious diseases, currently the microfluidic devices are far from replacing animal models in clinical testing in the near future.

## MAIN POINTS

- Organ-on-chips are engineered microfluidic cell culture devices that reconstitute the 3D microarchitecture and functions of living human organs.
- Organ-on-chips technology offers important advanced features over traditional 2D cell culture including mechanical forces, blood flow, immune cells and microbiome content.
- Organ chips offer advanced applications including clinical diagnostics, drug discovery, drug delivery, biomarker discovery, infectious disease research and disease modeling.
- The technology holds the promise of unraveling disease mechanisms of important human pathogens in the near future.

### ETHICS

**Peer-review:** Externally peer-reviewed.

## DISCLOSURES

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REVIEW

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# Advancements in Platelet-Rich Products: Obtaining Methods and Applications in Dentistry

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## Abstract

The concentrated autogenous platelet administration is one of the innovative and promising therapeutic approaches in medicine. In this sense, autologous biomaterials rich in platelets and leukocytes obtained from the patient's own blood are used. These biomaterials are very easy to apply and do not require any biochemical treatment. These products, which provide controlled release of various proteins and growth factors, are especially applied to accelerate wound healing in either soft or hard tissue. When platelets are activated, they form a network in the fibrin matrix; this activates the tissue healing mechanism and ensures the release of growth factors that stimulate regeneration. The physiological effects of platelets on wound healing have been investigated in the last 20 years and it has been stated that more successful treatments can be conducted with platelet-rich biomaterials especially in oral surgery. Several methods are used to obtain platelet-rich products. The differences between the methods may depend on the centrifugal speed and duration, the supernatants formed, their precipitates, and the added chemicals. These variations cause differences in fibrin network structures and tend to change the leukocyte and growth factor contents of platelets. Thus, a series of biomaterials with different structures and properties have been developed. This innovative review studies the obtainment methods, structural differences, contents, and applications of platelet-rich products in dentistry.

**Keywords:** Platelet-rich plasma, advanced platelet-rich fibrin, wound healing, injectable platelet-rich fibrin

## INTRODUCTION

Tissue regeneration is of paramount importance in dentistry, especially in the field of implantology, maxillofacial surgery, and periodontology. Tissue regeneration is a complex healing and tissue-repair process involving various biological events and strategies. For this purpose, bone grafts, biomaterials and growth factors, natural and synthetic substructures, and recently stem cells have been used.[1] In contemporary dentistry, there are manifold surgical procedures and dental biomaterials that are used for the reconstruction of maxillary and mandibular bone defects, and the augmentation of lost-tissues in the residual alveolar ridges.[2]

Autogenous platelet concentrates are innovative and promising therapeutic approaches in medicine. The use of platelet-rich products obtained using the patient's own blood appears to be a preferred treatment method in contemporary dentistry. These products (autologous biomaterials rich in platelets and leukocytes), which allow the controlled release of various proteins and growth factors, are applied to induce wound (either in soft or hard tissue) healing. Moreover, they are easy to apply and do not require any biochemical process.[3]

Platelets act as reservoirs for growth factors and cytokines that support bone and soft tissue regeneration in wound healing.

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Platelets, when active, form a network in the fibrin matrix and release growth factors that stimulate tissue-healing mechanism and thereby, regeneration. The physiological effects of platelets on wound healing have been investigated in the last 20 years and it has been stated that more successful treatments can be conducted especially in oral surgery.[2]

### Retrospective Overview of Platelet-Rich Products

The "platelet-rich plasma (PRP)" term was first used by Kingsley in 1954. He also underlined the importance of platelet concentrates on blood-clotting.[4] In 1986, Knighton et al.[5] reported that platelet structures were clinically effective in wound healing. They applied the product, namely, platelet-derived growth factor (PDGF), obtained by a two-step centrifugation system from 49 patients with non-healing chronic ulcers, and reported that the results were clinically acceptable. Dohan Ehrenfest et al.[6] used the PRP term for the substance that forms during the aggregation of platelets, but it was stated that the resultant substance obtained was similar to the fibrin gel. Marx et al.[7] began using the term PRP in their studies when they produced a biomaterial by using a device similar to the cell separator used in a transfusion. This bio-product is activated by bovine thrombin and its final form is also called fibrin gel.

Long-term results regarding the use of PRP indicated many limitations. Since the technique requires the use of bovine thrombin or calcium chloride ($CaCl_2$) in addition to clotting factors; they have greatly reduced the healing process during the regenerative phase. Furthermore, the entire protocol was not technically useful due to the presence of several separation phases, sometimes lasting more than 1-hour and inefficient for medical purposes. Because PRP is liquid, it was initially necessary as an agent to be combined with various other biomaterials, particularly bone grafting agents.[8] While the data obtained from the studies show that growth factor release occurs very early in the distribution phase in PRP; however, it is preferable to release growth factors for a long time during the whole regenerative phase, in contrast to the rapid regimen.[9]

All these limitations led to the emergence of the second platelet concentrate [platelet-rich fibrin (PRF)]. These concentrate benefits from the fact that a fibrin matrix can be obtained without anticoagulants, which contains all the set of growth factors trapped in the matrix and released slowly over time. Additionally, PRF (later renamed as leukocyte PRF or L-PRF) contains leukocytes that significantly contribute to wounding healing.[8] PRF was first used in 2001 by Choukroun et al.[10] It is especially used in oral and maxillofacial surgery, and currently considered as a new generation platelet concentrate. Moreover, it consists of an autologous fibrin matrix and is considered as a complete autologous biomaterial, making it easier to prepare and obtain any biochemical agent than PRP.[11] Recently, advanced platelet-rich fibrin (A-PRF) and injectable platelet-rich fibrin (i-PRF) systems have been developed and studied.[12,13]

### Platelet Concentrates

Platelets originate from cytoplasmic parts of megakaryocytes in the bone marrow. They are either oval- or round-shaped with a diameter of 2 nm. They are the smallest of the blood cells. It has components such as granules, microtubules, and mitochondria, but no nuclei. Platelet count in peripheral blood varies between 150,000–400,000/μL (1.5-4 x $10^8$/mL blood) in healthy individuals.[14]

Platelet concentrates are blood derivatives containing cytokines, growth factors, and autogenous platelets that play an important role in tissue regeneration by enabling angiogenesis, chemotaxis, extracellular matrix synthesis, and cell proliferation and differentiation. Platelets contain secretory granules that serve to fulfill their functions. There are three types of secretory granules. α-granules are more abundant than others and contain high levels of protein. These granules are rich in growth factors [vascular endothelial growth factor (VEGF), transforming growth factor-β1 (TGF-β1), platelet-based growth factor (PDGF), epidermal growth factor (EGF), hepatocyte growth factor (HGF), fibroblast growth factor (FGF), insulin growth factor (IGF) etc.] and cytokines. Growth factors in active platelets support recovery in soft and hard tissue. Although platelet concentrates used as a guide for tissue regeneration in surgery are referred to as PRP; they vary according to the way of preparation. These differences can be contributed to the centrifugation speed and time, the added chemicals, the resulting supernatants, and their precipitates. These variations cause differences in fibrin network structures, and leucocyte and growth factor content of platelets. For this reason, the use of the term PRP alone is not correct.[2]

There are different methods for obtaining platelet-rich products. These different methods also differentiate the content of platelet products. According to fibrin and leukocyte contents, platelet products can be examined in seven classes:[2,15] (i) pure leukocyte-rich plasma (P-PRP), (ii) leukocyte and platelet-rich plasma (L-PRP), (iii) pure platelet-rich fibrin (P-PRF), (iv) leukocyte and platelet-rich fibrin (L-PRF), (v) advanced platelet-rich fibrin (A-PRF), (vi) injectable platelet-rich fibrin (i-PRF), and (vii) concentrated growth factor (CGF).

### Platelet-Rich Plasma (PRP)

PRP is a rich source of growth factors and platelets and is found in low-volume plasma. It has been reported that PRP has shortened the recovery time in nerve tissue, hard tissue, and soft tissue, and it also has antimicrobial properties in support of the immune system with the help of its interleukins (IL) and leukocytes.[16]

The blood clot principally contains 5% platelets, 95% erythrocytes, and 1% leukocytes. PRP produced from the patient's own blood contains 95% platelets, 4% red blood, cells, and 1% leukocytes. The PRP can be added to the graft material or injected into the

lesion site. PRP is obtained in the presence of anticoagulants, and so as not to lose its applicability; the duration of manipulation should not exceed 8 h. PRP has a long storage life. However, it should be used quickly after it has been obtained because it maintains its effectiveness for only 7 days in the region where it is applied and secretes almost 95% of the growth factors in its content within 1 h.[17]

PRP has a sticky structure due to its high fibrin content. With the aid of this structure, it has been reported that it can act as a stabilizing agent by assisting the immobilization of bone graft or hemostatic agent by providing a clot formation in the defect area. Additionally, it is thought to can prevent the migration of epithelium to apical as it mimics a membrane with its biological adhesive property in guided tissue regeneration.[18]

### Content of PRP

PRP includes FGF, TGF-β, IGF, PDGF-like growth factors, and cell adhesion molecules such as vitronectin, fibrin, and fibronectin. Because of this content, PRP accelerates wound healing.[19]

### PRP Obtaining Method

The centrifuge device should be available for the application of all techniques. Although different systems are used to obtain PRP, the general procedure is similar. For this purpose, 8–10 ml of venous blood is taken first. Blood should be mixed with an anticoagulant agent to prevent blood clotting. This mixture is centrifuged at 2,400 rpm for 10 min. In this centrifugation process, the main aim is to collect the platelets, which are the desired blood fraction, in a region by allowing the shaped elements in the blood to aggregate to the bottom of the tube in accordance with their weights. At the end of the first centrifuge, the blood in the tube appears to be divided into two parts. While there is yellow plasma at the top, erythrocytes accumulate at the bottom because of their weight. Platelets accumulate in the lower part of the plasma close to erythrocytes. All of the plasma and erythrocytes in the tube (1–2 mm from the top), which is assumed to contain fresh platelets newly added to the circulation, are transferred to a second tube with the help of the cannulation technique. The plasma mixture with few erythrocytes is subjected to a second centrifugation at 3,600 rpm for 15 min to collect the platelet fraction at the bottom of the tube. The amount of supernatant obtained for 8 mL blood is approximately 0.6–0.7 mL and constitutes the PRP to be used for the surgical procedure.[20]

### PRP Used in Dentistry

There are manifold applications of PRP in dentistry: (i) immediately after peripheral nerve injuries;[21] (ii) into the extraction socket after impacted third molar surgery;[22] (iii) immediately after cyst enucleation;[23] (iv) in soft tissue injuries;[24] (v) to take advantage of regenerative properties in periodontal and prosthetic treatments;[25] and (vi) in alveolar cleft palate and oro-nasal fistula treatment.[26]

### Plasma Rich Growth Factor (PRGF)

Plasma rich growth factor (PRGF) is obtained from venous blood from the brachial vein of the patient. A modified PRP protocol that was described by Anitua et al.[27] is used to obtain PRGF. The difference between PRGF and PRP is that PRGF has been optimized to allow the longer-term release of growth factors. PRGF is obtained in a single step by using sodium citrate as an anticoagulant agent. PRGF has a three-dimensional fibrin structure. This structure can be injected into the tissue defect to preserve the regenerative area and create a structure in which cells can perform tissue healing. After activation, PRGF secretes proteins and growth factors continuously to accelerate soft tissue healing and bone regeneration. Rodella and Bonazza[2] have reported that the fibrils and cellular structure in PRGF can be used to close the extraction socket after tooth extraction and to accelerate soft tissue epithelialization.

### Fibrin

It is obtained by the activation of fibrinogen, which is found in the plasma. During homeostasis, fibrin, which is located in alpha granules and plasma of platelets, enables platelet aggregation. It is initially converted to a shape that resembles a biological adhesive that can stabilize platelet aggregation and thereby, form a protective wall during coagulation. In fact, fibrinogen is the final substrate for all coagulation reactions. As a soluble protein, fibrinogen is converted with thrombin into insoluble fibrin; while the polymerized fibrin gel forms the first healing matrix of the injured site. Fibrin is the natural guide for the realization of angiogenesis. It has been reported that angiogenesis is directly induced by the fibrin matrix.[28,29]

### Platelet-Rich Fibrin (PRF)

Due to the limitations of PRP arising from its anticoagulant content, further studies by Joseph Choukroun in the early 2000s focused on developing a second-generation platelet concentrate without the use of anticoagulant factors.[10] In this way, it was first observed that in a single centrifugation cycle at 2,700 rpm (750 g), a platelet concentration that did not carry clotting factors at the top of the centrifuge tubes was collected. This formulation is called PRF.[28-31]

PRF is a second-generation platelet product, which enables the formation of growth factors- and platelet-rich membranes. PRF (leukocyte-PRF or L-PRF) additionally contains leukocytes (WBC) within the fibrin matrix; it is involved in wound healing by enhancing immunity and secreting large amounts of growth factor.[32]

Regarding tissue engineering, it has long been noted that three components must improve tissue repair to maximize the regenerative potential of various bioactive structures: (i) a three-dimensional matrix capable of promoting tissue growth, (ii) locally amplified cells capable of affecting tissue growth, and (iii) bioactive growth factors capable of enhancing cell uptake and differentiation within the biomaterial surface. With respect to PRF, all three of these properties are met: (i) fibrin, as a scaffold, attracts and collects regenerative cells to the defect sites, including leukocytes, macrophages, neutrophils, and platelets; (ii) fibrin serves as a reservoir of growth factors that can be released over time between 10 and 14 days.[8]

In all known clinical applications, PRF increases neovascularization and accelerates the wound healing due to its ability to defend against the infectious environment in the oral cavity. There are three important factors in soft tissue management of PRF. It simultaneously supports angiogenesis, immunity, and tissue epithelial coverage.[8]

### Obtaining PRF

All clinicians can easily implement the protocol and do not need a special machine or any medical device. Venous blood is collected and centrifuged into 10 mL anticoagulant-free glass-coated plastic tubes. PRF is obtained after centrifugation at 2,700 rpm for 12 min or at 3,000 rpm for 10 min. Since there is no anticoagulant substance in the PRF, coagulation starts when blood is collected in the tube.[31] After centrifugation, three layers are formed; cell-free plasma at the top, erythrocytes at the base, and PRF clot in the middle. The PRF clot forms a three-dimensional complex structure with a robust fibrin matrix in which platelets and leukocytes are concentrated.[28,29]

### PRF Content

The PRF produced according to the standard protocol contains all components found in normal blood. These are mainly platelets, fibrin, platelet growth factors, cytokines, leukocytes, circulating stem cells, monocytes, T and B lymphocytes, and neutrophilic granulocytes.[12,33]

### Introducing the Low-Speed Concept

Recently, the most important factor for stimulation is the maintenance of a low and constant growth factor release to the environment, not the number of growth factors released. Since the use of PRF has seen a steady increase in work in regenerative medicine, there has been great interest in determining whether clinical conditions can be improved by optimizing centrifugation protocols to change the PRF matrix. This hypothesis stems from the fact that the cells in the original PRF matrix are surprisingly concentrated at the base of the PRF matrix. Therefore, centrifugation speeds may benefit from slower g-force to prevent cells from progressing downward. This hypothesis was reinforced with a study by Ghanaati et al.[12] who reported that a more optimal formulation of PRF containing a higher number of cells could be formed by reducing the centrifugation speed from 2,700 rpm (750 g) to 1,500 rpm, and leukocytes could be more evenly distributed throughout the PRF matrix. This new formulation of PRF was called the advanced PRF (A-PRF) and was considered a natural evolution of the original PRF. It has recently been found that leukocytes are pushed unnecessarily out of fibrin clots (to the bottom of centrifuge tubes). A recent study showed that both centrifugation speed and time can be reduced to further enhance growth factor release and cell performance in A-PRF.[34]

### Advanced PRF (A-PRF)

A-PRF is a new PRF protocol described by Choukroun.[34] In preparation, venous blood is drawn from the cephalic vein into 10 mL sterile vacuumed plain glass tubes that do not contain anticoagulants (Figures 1 and 2). These tubes are then centrifuged at 1,500 rpm (100 g) for 14 min to obtain A-PRF.[12] After this, the blood is divided into three layers. Platelet-poor plasma (PPP) is found at the top and is removed with a syringe. The remaining fibrin structure and erythrocytes are removed from the tube by tweezers. A-PRF clot is separated from erythrocytes.[12,31] These structures can be cut into small pieces and mixed with graft material or can be used to form membranes.[35]

A significant effect of leukocytes on vascularization and bone formation was proved by a study.[36] Furthermore, granulocytes play an additional role in vascularization and improve the function of monocytes, which were described by Soltan et al.[37] as "supercells for bone regeneration". Both cells are present in higher concentrations in A-PRF. Understanding the role of g-force on the loss of white cells during the spin cycle has guided new protocols to reduce rpm to maintain more white cells in the fibrin matrix. Furthermore, the insertion of a special glass tube inducing faster clotting has allowed a significant reduction

**Figure 1.** Collecting venous blood from cephalic vein into glass tube.

in the centrifugation time from 12–14 minutes to 8 min; this further reduced the number of lost leukocytes due to the high centrifugation speed and time. This new fibrin clot is rich in leukocytes. With a less dense fibrin matrix, it allows invasion and penetration of incoming cells to regenerate within the matrix in a rapid ongoing process.[12,38] The more recent formulation of PRF (A-PRF) increases the release of growth factors such as VEGF, PDGF-BB, PDGF-AB, PDGF-AA, TGF-β1, EGF, and IGF. Moreover, it has been shown that gingival fibroblasts in contact with A-PRF produce higher levels of collagen and significantly higher cell migration to A-PRF compared to PRP or PRF.[9,12] In another protocol called A-PRF +, the blood is centrifuged at 800 rpm for 8 min. In this way, it has been advocated that the release of growth factors will increase by decreasing the centrifugation time and speed.[38]

### PRF or A-PRF Used in Dentistry

There are many applications of PRF or A-PRF in dentistry: (i) along with graft material[37] (Figure 3); (ii) in implant surgery[37]; (iii) for the treatment of gingival recessions[39]; (iv) after tooth extraction[40]; (v) after the extraction of the impacted tooth[41] (Figure 4); (vi) after enucleation of the cyst;[31]; (vii) in sinus lift procedures;[37]; and (viii) as a membrane[42] (Figure 5).


**Figure 2.** 10 mL sterile vacuumed plain glass tube.

### Injectable PRF (i-PRF)

i-PRF is a new alternative for platelet aggregation that can be used in different fields of medicine and dentistry. Since i-PRF is autogenous, there is little cross-reactivity with platelets.[43] Studies have shown that i-PRF has no cytotoxic effect.[44] In comparison with PRP, i-PRF is a good alternative for bone regeneration.[45] It shows a good mix of bone grafts. No anticoagulant or other additive is needed to obtain it. It is

**Figure 3.** Combination of graft material with A-PRF.
A-PRF: advanced platelet-rich fibrin

expected that the use of i-PRF will increase gradually because of new studies.[13]

i-PRF was developed to achieve the goal of acting as a regenerative agent which can be delivered in a liquid formulation and obtained by rapidly collecting blood into a specific centrifuge tube with a shorter centrifugation time (3 min) at a very low speed (at 700 rpm). The objective is to centrifuge without anticoagulants and additives and maintain the ability to separate the two layers. This new formulation can be used for various procedures, including mixing with bone grafts to form a stable fibrin bone graft for improving graft stability (for 1–2 minutes). It can be recommended to combine with bone grafting materials to improve graft stability by preventing the migration of granules into the maxillary space during sinus lifting procedures. Subsequently, i-PRF can be used for various procedures alone, such as osteoarthritis, knee injections for treating temporomandibular joint disorders, and various procedures in facial aesthetics to naturally improve collagen synthesis. The i-PRF principle remains the same, with a greater proportion of leukocytes and blood plasma proteins due to the low-speed concept; known vascularization inducers are activated and this accelerates the speed at which wound healing can occur.[8]

In another technique, i-PRF is obtained from venous blood using 9 mL silica-coated (yellow-cap) tubes without any additional material. After the blood is drawn into the tube, the tube is centrifuged for 2 min at 3,300 rpm with the water-filled tube to ensure equilibrium so that i-PRF is obtained. Then, carefully, the tube is opened and it is ensured that these materials do not mix. Five milliliters of i-PRF is obtained from this drawn blood using a 20 mL syringe with 18 G needles.[13]

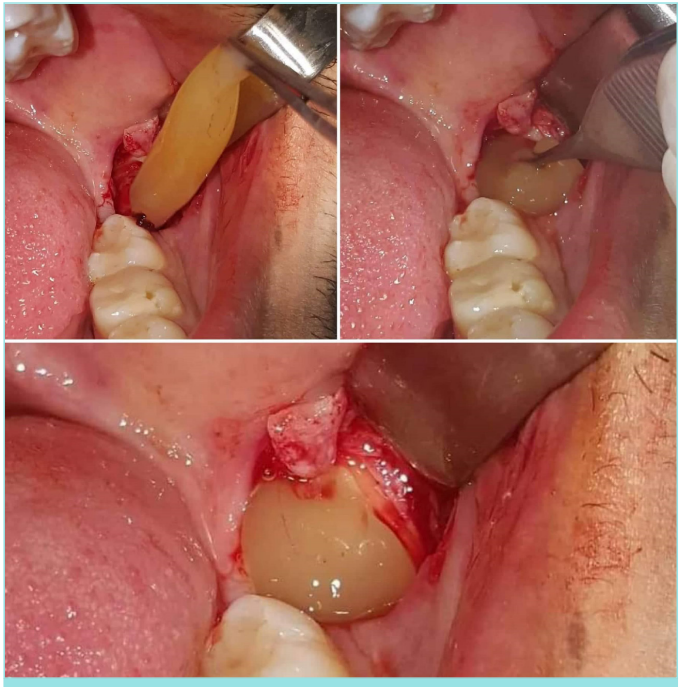

**Figure 4.** Implementation of A-PRF into extraction socket for decreasing pain and increasing healing rate.

A-PRF: advanced platelet-rich fibrin

### Concentrated Growth Factor (CGF)

Concentrated growth factor (CGF) is the fibrin structure rich in leukocytes and platelets, first used by Sacco in 2006.[46] CGF contains autologous osseo-inductive growth factors derived from platelets and fibrin matrix. As in PRF, CGF is obtained by a single-stage centrifugation method, but CGF requires a specially programmed centrifuge. For this purpose, plastic tubes without anticoagulants coated with red-cap silica particles are required

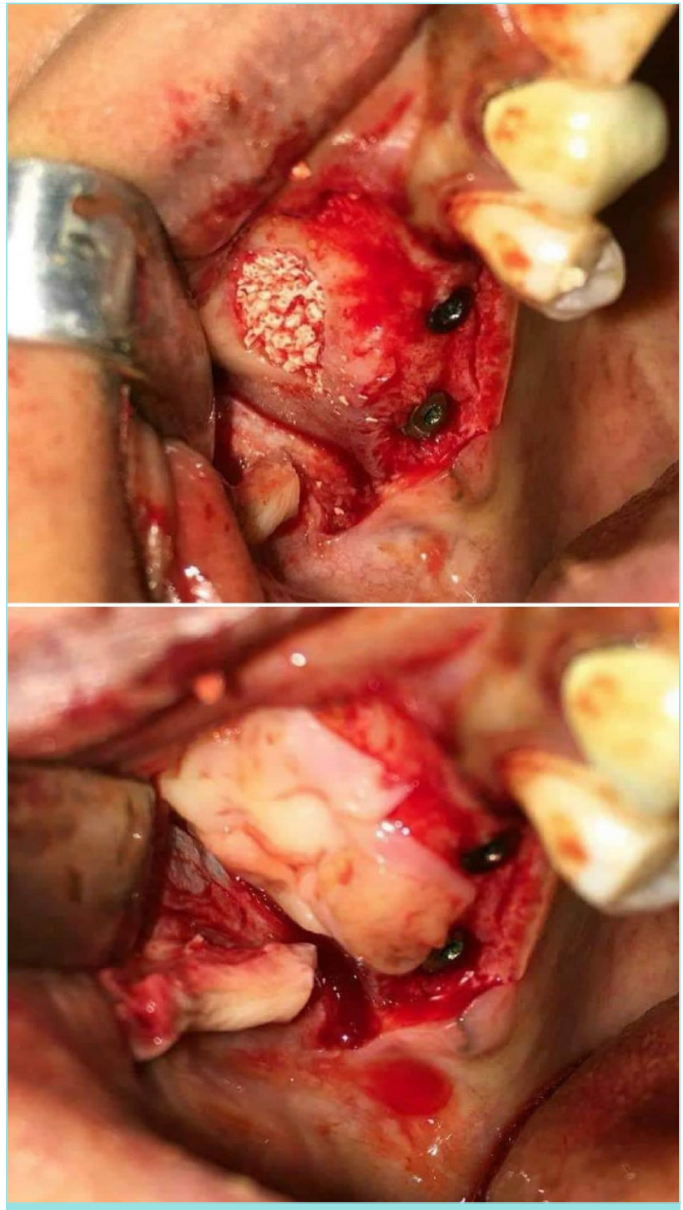

**Figure 5.** Implementation of A-PRF as a membrane during sinus lifting.

A-PRF: advanced platelet-rich fibrin

and there is no need to add exogenous substances in this process. The blood in the tubes is centrifuged at a low and controlled speed for 12 min at 2,400–2,700 rpm. The resulting clot is divided into three layers. The uppermost layer contains platelet-poor plasma, the middle layer includes the dense polymerized fibrin block containing fibrin and CGF, and the bottom layer contains erythrocytes. Two layers of these were discarded, and CGF collected in the buffy coat layer. This layer is a dense fibrin matrix rich in growth factors. PRF or CGF contains concentrated autologous growth factors. It does not contain any synthetic or biomaterial to obtain a gel form, so cross-contamination is minimal. However, unlike the first generation, its use in bone augmentation is limited because it cannot stabilize bone particles. This limitation is aimed to be prevented by obtaining sticky bone together with autologous fibrin adhesives.[2]

### Autologous Fibrin Glue (AFG)

Fibrin adhesives (in terms of hemostasis) were first introduced at the beginning of the last century. In 1940, Young and Medavar[47] mixed plasma fibrinogen with bovine bone and achieved a saturation of peripheral nerves in animal models by using the resulting biological adhesive material. For obtaining AFG, venous blood is collected in uncoated yellow tubes. AFG configuration time is between 2 and 12 minutes. A two-minute centrifuge is conducted to obtain a high amount of growth factor. Two different layers appear in the uncoated tube. AFG is seen in the upper layer and erythrocytes are seen in the lower layer. The AFG is removed with a syringe and mixed with the particulate bone to obtain a yellow sticky bone that is polymerizable in 5–10 minutes. Histological samples showed inflammatory cell infiltration on the 14$^{th}$ day and osteoblast and fibroblast activity as well as inflammatory cells at 2 months. However, although fibrin and factor VIII stimulate tissue repair and wound healing; the mechanism of fibrin glue is not clearly understood.[48] AFG can be used for the repair of sinus membrane perforation. Histologic examination showed continuous epithelial tissue extending to the perforation region in the AFG region. Under the epithelial layer, there was a decrease in serous glands. Where the collagen membrane is applied, dense fibrosis tissue and epithelial surface loss are observed. Lymphocyte-induced inflammatory infiltration is also present.[49] Although the AFG technique is effective; the isolation method does not give high platelet concentration and is challenging. Therefore, to obtain a sticky bone by using a method developed in 2010, CGF membrane and AFG should be prepared at the same time. Based on this, in 2015, Sohn et al.[48] performed augmentation with sticky bone on three cases and achieved successful results.

## CONCLUSION

Platelet-rich products can be used in tissue healing by accelerating the vascularization of tissues due to growth factors and cytokines. It is easy and quick to prepare during or before the operation, so it does not waste time and is suitable for clinical use. Thanks to the platelets they contain, these products reduce bleeding during and after the operation in the recipient and donor area. It has been shown that they can be used along with graft materials with respect to their regenerative and adhesive properties. Additionally, it is seen that PRF application is a method that can be integrated into dentistry. This method is cost-effective and easy to apply. Moreover, PRF is an autogenous biomaterial (no side effects) obtained from the patient's own blood. Even so, further studies are needed to better understand the action mechanism and to wide usage areas.

## MAIN POINTS

- Platelet concentrates are blood products that can be preferred in oral and maxillofacial surgery and periodontology branches because they increase healing by accelerating vascularization and reduce pain.

### ETHICS

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: M.G.C., Ö.Ö., Design: M.G.C., Ö.Ö., Supervision: M.G.C., Ö.Ö., Data Collection and/or Processing: M.G.C., Ö.Ö., Analysis and/or Interpretation: M.G.C., Ö.Ö., Literature Review: M.G.C., Ö.Ö., Writing: M.G.C., Ö.Ö., Critical Review: M.G.C., Ö.Ö.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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# Determination of Health Literacy Levels and Effecting Factors of Elderly Living in the Turkish Republic of Northern Cyprus/Dikmen Region

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## Abstract

**BACKGROUND/AIMS:** In this study, it was aimed to determine effect on some factors and the health literacy levels among elderly people, living at home in the Dikmen of the Turkish Republic of Northern Cyprus.

**MATERIALS AND METHODS:** The research was conducted during the home visit between April 2–May 30, 2018 as a cross-sectional type descriptive study. The sample consisted of the elderly people (n=134) who were determined using the simple random sampling method and agreed to participate in the study. The data were collected with the "Socio-Demographic Questionnaire" and "Adult Health Literacy Scale" developed by Sezer and Kadıoğlu (2014) after. SPSS 21.00 statistical program was used for data analyze.

**RESULTS:** 60.4% of the participants were women and the age average was 72.20±6.23. The total score mean taken from the scale was 10.51±4.15. 86.6% of the participants stated that they did not know the health screening times and 61.2% did not know the patient rights. A statistically significant relationship was found only between age ($x^2$=10.047; p=0.001) and educational status ($x^2$=9.536; p=0.023) according to score means.

**CONCLUSION:** In this study, it was observed that the health literacy levels of the elderly people were not sufficient, they had difficulties in using health services and their knowledge about chronic disease management was not good. It is recommended that nurses working with elderly individuals should first evaluate the health literacy status of the elderly, and organize nursing interventions and health education activities accordingly.

**Keywords:** Health literacy, elderly, public health nursing

## INTRODUCTION

Health literacy is defined by the World Health Organization (WHO) as "the cognitive and social skills of individuals about their access to health information, their ability to understand and use information, and their desire to maintain and improve their health".[1] Individuals with inadequate health literacy have higher rates of hospital costs, they use of preventive health services less, they have higher mortality[2] and morbidity rates, their chronic disease management is poor, they have prolonged hospitalization, their rates of unnecessary investigations and unnecessary emergency service usage are high. In the study show that limited health literacy is a frequent phenomenon in German adults aged 65 years and above. This was associated with financial deprivation (odds ratio: 3.05). Research on health literacy in old age and the role in health disparities is urgently needed.[3] Similar results are found in other countries, e.g.

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Canada, Ireland and Greece.[4-6] A recent European study shows that 58.1% of those aged 66 to 75 years report limited health literacy.[7] This is more common among elderly people, especially those who have poor health literacy.[8] But, while international studies identify older adults as an important target group for health literacy research and interventions a research gap exists concerning the detailed assessment of health literacy among different subpopulations of older adults and the associations between different levels of health literacy, demographic and socio-economic factors in those of old age.

In the world, Turkey and our country, due to the developments in science, technology, and living standards lifetime has prolonged, an increase has occurred in the elderly population.[9,10] The elderly population constitutes the world's population about 8%,[11] Turkey's 8.3%,[12] and the Turkish Republic of Northern Cyprus's (TRNC) 8.8%.[13] Increases in acute and chronic health problems are also observed with aging. In a study conducted in the Dikmen region of TRNC, at least one chronic disease was found in 87.4% of the elderly people. 75.6% of the elderly people have hypertension and diabetes was detected in 41.5% of them. Apart from hypertension and diabetes, heart-related diseases (24.5%), skeletal system diseases (13.8%), vertigo (11%), and other chronic diseases (26%) were detected.[14]

The capacity is the potential a person must do or accomplish something. Elderly people who need health information and services have to be health literacy skills. Generally, the elderly are individuals low formal education. Health literacy is also low due to low formal education levels.[3-5] But, Another study show that the risk of low health literacy was high (43.4%) in the well-educated cohort.[15] Therefore, they may have more difficulties in disease prevention and management.[2,9] Many studies have shown that elderly people have problems in the health literacy level with joining health protection activities (vaccination, having screening tests, etc.) and managing chronic diseases. In the study, overall, 66.3% of all respondents aged 65 years and above had limited health literacy. Limited health literacy was especially prevalent among respondents above 76 years of age (80.6%).[3]

If they can find information and met their needs and preferences and understand the choices, consequences. They can act and respond to the meaning and usefulness of the information and services.[16] Aging results in normal changes in cognition. Three specific changes occur reduced processing speed, greater tendency to be distracted, and reduced capacity to process and remember new information. So nine out of 10 adults struggle to understand and use health information when it is unfamiliar, complex or jargon-filled. Another problem is this age group is vision problems. About 2/3 of adults with vision problems are older than 65. Additionally, most of them loss hearing capability. Hearing problems affect one in three people older than 60 and half of the those older than 85.[6,17] Elderly people have problems in relaying their health messages to health workers and understanding the messages given by health workers correctly.[2] Health professions must repeat essential health information and focus on the important meaning of the information, that is, the gist. It is important that used plain language and communicate directions and advice that need to be followed. To make information easy to see and read, text should be printed with the highest possible contrast and 16 to 18 point size font or larger is best to use when developing materials for older adults. Elderly people with low vision may have difficulty finding the beginning of the next line when reading, so it is preferable for space between lines of text to be at least 25 percent of the point size. Health professions should consider providing audio information whenever necessary to reduce the number of hearing challenges (limit background noise, speak clearly with more volume, always talk face to face etc.[17]

In the literature, there is no study on the health literacy of elderly individuals throughout the TRNC. It is considered that this study will be a source of information for public health nurses and other health personnel working in the field.

In this study, it was aimed to determine effect on some factors and the health literacy levels among elderly people, living at home in the Dikmen of the Turkish Republic of Northern Cyprus.

## MATERIALS AND METHODS

**The type of Research:** The study was conducted as a cross-sectional type descriptive study the health literacy status of elderly individuals.

**Population-Sample:** The population of the study consisted of elderly people who reside in the central boundary of Dikmen Municipality (n=301) according to the results of the 2011 population census. The sample consisted of the elderly people (n=134) who were determined using simple random sampling method with a 95% confidence interval and $p<0.05$ significance level and agreed to participate in the study. In this study, participant' response rate is 44.5%.

**Data Collection:** Data were collected through the "Socio-Demographic Questionnaire" and the "Adult Health Literacy Scale".[18] The socio-demographic properties of the participants (birth year, gender, educational status, occupation, health status, drug use status) were obtained by researchers using a 12-item form developed in accordance with the literature. "Adult Health Literacy Scale" developed by Sezer and Kadıoğlu[18] was used for health literacy levels. This scale consists of 23 questions (22 multiple choice and one question for recognition of the location of organs in the body). In the scale, among the questions, 13 of the questions are yes/no type, four of them are filling the blank type, four of them are multiple choice type, two of them are

matching type. The questions are scored as follows: "yes/no" questions 1/0, the blank-filling questions are one for the correct responders and zero points for the wrong answer. For multiple choice questions, two and more correct answer markers are given a score of one point, those who do not know or who are pointing the right answer with "wrong" answer is given a score of zero points. For questions with the matching type, one is given to more than two correct matches and zero is given to others. Scores that can be taken from the scale vary between zero and 23. The increased score indicates that health literacy level is high. Data were collected between April 2–May 30, 2018 during the home visits by face-to-face interview method and each interview lasted about 30 min.

### Ethical Considerations

In order to apply the data collection forms, the "Institution Permit" from Dikmen Municipality and "Ethics Committee Approval" from Near East University's Ethics Committee (YDU/2018/56-548) were obtained as written consent, the content of the study was explained and verbal consent was obtained from the participants.

### Statistical Analysis

Data were analyzed using appropriate statistical methods in SPSS 21.00 statistical program. The percentage and frequency distributions of variables were examined in the study. Intergroup comparisons were made using One-Way ANOVA in parametric variables and Mann-Whitney U and Kruskal-Wallis tests in non-parametric variables. The results were evaluated at a 95% confidence interval and $p<0.05$ significance level. In the study of Sezer and Kadıoğlu[18], general Cronbach's Alpha value of the scale was 0.77; in this study, Cronbach's Alpha value was found to be 0.74.

## RESULTS

Table 1 presents the socio-demographic properties of elderly individuals who participated in the study. Accordingly, the average age of the participants was 72.20±6.23. It was determined that 60.4% of the participants were women, 45.5% were homemakers, 59% were graduated from primary school, and 77.6% had social security. 90.3% of the participants stated that their longest living place was a village and 63.4% stated that they perceived their economic status at a moderate level. While 34.3% of the elderly people defined their health status as "not bad", only 6.7% stated that the first place of the application was "community clinic". It was determined that 76.9% of the participants used drugs regularly and 73.1% of them had two and more than two diseases.

The score status of the participants taken from the scale is given in Table 2. The total score mean taken from the scale is 10.51±4.15 (min=0, max=19). According to some socio-demographic properties (age, gender, educational status, occupation, health status, social security, etc.) of the participants, scale score means were examined. A statistically significant difference was found only between age ($x^2$=10.047; p=0.001) and educational status ($x^2$=9.536; p=0.023) according to score means.

In Table 3, when the responses of the elderly people to the questions about preventive health services are examined, it is determined that 63.4% are not regularly weighed and 48.5% are not aware of the body mass index (BMI) values. 84.3% of elderly people do not know modern family planning methods and 86.6% of them do not know health screening times. However, 63.4% of elderly individuals have known the location of their body organs correctly.

Elderly participants were asked questions about their illnesses and treatments, it was detected that 58.2% did not know the symptoms of low blood pressure and 65.7% did not know the symptoms of high blood pressure. Of the participants, 64.9% did not know the "minimum body temperature" value, which indicates that a person has a "high" fever, and 55.2% do not know what should be done as a first intervention at home if his/her fever rises. Concerning the time of drug use, 50.7% of the elderly people know the "correct time" of a drug that should be taken every 12 h, while 51.5% of them do not know the "correct day" of the drug that should be taken every two days. 61.9% of elderly people have correct information about "taking drugs on an empty stomach" (Table 3).

About their use of health services and the communication with health personnel; 56.7% of the participants knew the service where they would apply if they had "burning, bloatedness, and indigestion in their stomach after eating" and 58.2% of them knew the service where they would apply if they had "complaints of burning and pain while urinating". However, 45.5% did not know the clinic's names with synonymous (internal diseases, etc.). It was determined that 61.2% of the elderly people did not know the rights of the patients and whether there is such a unit in the hospitals, and 67.9% of them had difficulty in applying to the health institution. However, 66.4% of them know how to get an appointment from the hospital. 82.8% stated that they had no difficulty in explaining their health problem to the doctor/nurse and 83.6% stated that he/she could ask questions to the doctor/nurse about his/her health status (Table 3).

In the questions of obtaining and understanding health information; 61.2% of the participants stated that they followed the health news on the radio or television, but 59.7% stated that they did not read the health-related news of the newspapers/magazines. It was also observed that 44.0% of elderly people had difficulty in reading and understanding health/disease related information brochures (Table 3).

## DISCUSSION

With the aging of the population, the increase in chronic diseases and complications, depending on the decrease in the time allocated to the patient and decrease in the quality of service, even if health systems were developed; has become obliged to be informed about their own health and diseases, to take part in decision processes and to take responsibility.[10]

Due to the low level of health literacy (HL), especially the elderly people apply to the health system late, cannot benefit from preventive care such as early diagnosis and treatment, and their hospitalization rates are increased.[19] In a study conducted in eight European Union (EU) countries, it was shown that approximately two people out of ten had insufficient levels of HL.[7] In the study conducted with adults in Korea, the level of HL was found to be statistically low in elderly people, the less educated people, the rural people, those who think that they have barriers to obtain health information and those who find their sources of information (brochures, books, journals) expensive. There was no relationship between marital status, monthly income, current and past health history, sufficient time and health status perception.[20]

In this study, the total score mean obtained from the health literacy scale was found to be moderate and it was found that this result was below the mean score of 'Adult Health Literacy Scale' used in the study.[18]

Today, many programs are being developed in many parts of the world to improve the health of society and prevent risky behavior. However, applied programs often do not produce positive results. The relationship between health behavior and HL has been shown in many studies.[21] When the variables related to health literacy were examined, it was seen that the health literacy levels of those with the worst economic status were insufficient and social status, education, and age followed this. The gender variable has the least effect on health literacy level.[7] In a study conducted in Japan, it was shown that there was a direct relationship between getting health-related information and positive health behavior applications in individuals with high levels of HL. These individuals can reach health information more easily and quickly and evaluate the information they obtain by comparing them with their available information. Moreover, they avoid risky behaviors and feel more effective in health promotion practices. However, the same study did not find a direct relationship between the level of HL and health status ($p>0.05$).[22]

According to a systematic study, if a change in health behavior is desired, concurrent intervention is also required in HL, this, a positive contribution can be made to the improvement of public health.[23,24] In defining strategies in the provision of education and health services, it is important to identify risk groups with low HL levels and to determine factors associated with HL level.[8]

In this study, some socio-demographic properties and scale score means of the elderly people were compared and no statistically significant relationship was found between the other variables except age and educational status ($p<0.05$) Age is an associated and unchanging factor in health literacy.[20]

In this study, the average age of the participants was $72.20\pm6.23$. According to WHO, the 64–75 age group is called "the young old".[23] This age segment; although it positively affects the results of the current study, in the literature, health literacy decreases at later ages.[3,6,18] In this context, it is considered that the participants are in the "risky group in terms of their future lives.

According to the study definition developed by the HLS-EU Consortium, health literacy is associated with general literacy.[7] In this study, one in ten elderly people is illiterate, and the findings are consistent with the literature. It was found that there is a moderate, positive and significant relationship between health literacy of elderly and successful aging.[16] If health literacy is high, the elderly will have healthy aging success.[3]

Individuals need to comply with primary protection measures for the protection and improvement of their health. Protecting health is always cheaper than treatment. Özaydın et al.[25] reported that 72.3% of elderly people did not know how to calculate the BMI. In this study, it was determined that more than half of the elderly people did not regularly weigh and 48.5% did not know the BMI values. Today, elderly people face both obesity and malnutrition problems. It is evaluated that regular weighing of elderly people, measurement of BMI, waist and hip ratios can be used as an objective and cost-effective criterion for increasing early diagnosis and elderly awareness. In Bozkurt and Demirci[26] study, 93.5% of the participants stated that they had difficulties deciding which health screening they needed. In the same study, it was reported that among the subjects in which the elderly people felt most inadequate were "adult vaccines and periodic examinations".[26] In this study, most of the elderly people stated that they did not know the health screening times.

Another important issue is that at the secondary protection level, people can recognize changes in their health status; they can take simple measures by knowing the symptoms and complications of the disease. In the study, it was determined that more than half of the participants did not know the symptoms of low blood pressure, the symptoms of high blood pressure. In addition, they did not know the "minimum body temperature" value, which indicates that a person has a "high" fever, and what to do as a first intervention at home if his/her fever rises. In the study by Demirbağ and Timur[27], 61.1% of the elderly people did not have information about their drugs and 85.5% did not use their drugs regularly. Among the reasons for the non-regular use of drugs by elderly people, one in five (21.2%) was unable to adjust their medication hours. In this study, more than half

| Table 1. The socio-demographic properties of elderly people (n=134) | | | |
|---|---|---|---|
| **Socio-demographic properties** | | **Number (n)** | **Percentage (%)** |
| **Age** | 72.20±6.2 | | |
| **Gender** | Female | 81 | 60.4 |
| | Male | 53 | 30.6 |
| **Marital status** | Married | 102 | 76.1 |
| | Single | 32 | 23.9 |
| **Occupation** | Retired | 56 | 41.8 |
| | Housewife | 61 | 45.5 |
| | Other (farmer, driver) | 17 | 12.7 |
| **Education** | Not literate | 13 | 9.7 |
| | Primary school | 79 | 59.0 |
| | Secondary school | 13 | 9.7 |
| | High school | 17 | 12.7 |
| | University | 12 | 8.9 |
| **Social security** | No | 30 | 22.4 |
| | Yes | 104 | 77.6 |
| **Longest living place** | Village | 121 | 90.3 |
| | City center | 13 | 9.7 |
| **Economic status** | Good | 10 | 7.5 |
| | Moderate | 85 | 63.4 |
| | Bad | 39 | 29.1 |
| **Health status** | Pretty good | 28 | 20.9 |
| | Good | 45 | 33.6 |
| | Not bad | 46 | 34.3 |
| | Bad | 15 | 11.2 |
| **Application place** | Community clinic | 9 | 6.7 |
| | State | 90 | 67.2 |
| | Private | 33 | 24.6 |
| **Drug use** | Yes | 103 | 76.9 |
| | No | 31 | 23.1 |

n: number.

of the participants answered the timing correctly for a drug to be taken on an empty stomach. However, almost half of the elderly people did not know the "correct time" of a drug that should be taken every 12 h, and the "right day" of a drug to be taken every two days. Additionally, associated with the level of health literacy, it was seen that almost one of three elderly did not control the expiration date of drugs, read the prospectus because they had visual problems.[27]

The complex structure of health services and providing services by different units by separating services from each force service users.[28] In this study, more than half of the participants were aware of the units they could go about their health problems and had difficulty knowing the two-name clinics. In this study, the participants know how to get an appointment from the hospital. In the study by Bozkurt and Demirci[26], the usage of health services was found to be 63.5%. In the study by Özaydın et al.[25], it was determined that 56% of the participants did not use the "hospital appointment system".

In this study; the participants have information about the hospital appointment system. However, only a few of them have information about primary healthcare services or they are users. This result can be explained as a reflection of general health policies, it can be said that therapeutic health services are mostly known by the participants. But, most participants stated that they did not have any difficulty explaining their health problem to the doctor/nurse. And, they could ask

**Table 2. Total score of the scale and Cronbach's Alpha Value (n=134)**

| Scale total score mean | Min-max score of the scale | Min-max score of this study | Cronbach's Alpha Value of scale | Cronbach's Alpha Value of this study |
|---|---|---|---|---|
| 10.51±4.154 | 0–23 | 0–19 | 0.77 | 0.74 |

Min: minimum, Max: maximum, n: number.

**Table 3. Scale items recognition status of elderly individuals (n=134)**

| Service area | Scale items | Recognizant/yes | | Miscognizant/no | |
|---|---|---|---|---|---|
| | | (n) | (%) | (n) | (%) |
| Preventive health services | Regular weighing | 49 | 36.6 | 85 | **63.4** |
| | BMI value | 69 | **51.5** | 65 | 48.5 |
| | Application time of screening test | 18 | 13.4 | 116 | **86.6** |
| | Family planning modern methods | 21 | 15.7 | 113 | **84.3** |
| | Place of the organs | 85 | **63.4** | 49 | 36.6 |
| Treatment services | Symptoms of the drop in the blood pressure | 56 | 41.8 | 78 | **58.2** |
| | Symptoms of the rise in the blood pressure | 46 | 34.3 | 88 | **65.7** |
| | Minimum value of the fever | 47 | 35.1 | 87 | **64.9** |
| | Intervention at home in case of fever | 60 | 44.8 | 74 | **55.2** |
| | Correct dose taking time | 68 | **50.7** | 66 | 49.3 |
| | Correct dose taking day | 65 | 48.5 | 69 | **51.5** |
| | Correct dose taking time on an empty stomach | 83 | **61.9** | 51 | 38.1 |
| Application to health care institutions and using the service | Consulted clinic during epigastric burning | 76 | **56.7** | 58 | 43.3 |
| | Consulted clinic during urinary burning | 78 | **58.2** | 56 | 41.8 |
| | Synonyms of the clinics | 73 | **54.5** | 61 | 45.5 |
| | Patient rights | 52 | 38.8 | 82 | **61.2** |
| | Difficulty in during the application to health institution | 43 | 32.1 | 91 | 67.9 |
| | Getting an appointment from the hospital | 89 | **66.4** | 45 | 33.6 |
| | Difficulty in explaining the health problem to doctor/nurse | 23 | 17.2 | 111 | **82.8** |
| | Ability to ask questions to doctor/nurse about health status | 112 | **83.6** | 22 | 16.4 |
| Health literacy | Following the health news | 82 | **61.2** | 52 | 38.8 |
| | Following the health newspaper/magazine | 54 | 40.3 | 80 | **59.7** |
| | Difficulty in reading and understanding health-related brochures | 59 | 44.0 | 75 | **56.0** |

Sifnificant values are shown in bold.

BMI: Body Mass Index, n: number.

questions about their health status. the results of this study were evaluated as positive. By 2030, noncommunicable diseases are projected to account for more than one-half of the disease burden in low-income countries and more than three-fourths in middle-income countries. Among the elderly population, noncommunicable diseases already account for more than 87% of the burden in low-, middle-, and high-income countries. Long-term-care systems enable older people, who experience significant declines in capacity, to receive the care and support of others consistent with their basic rights, fundamental freedoms and human dignity.[28] While using health services, if the elderly people make an appointment with the right unit and good communication with health personnel will prevent disruptions in health services and save time and money. It also keeps their diseases under control and prevent complications.

The increase in the level of health literacy will primarily affect the health of the individual. However, its main effect is its impact on the development of community health related to HL. In Turkey Health Literacy Survey, it was stated that the primary sources of information on individuals about health-disease are television and internet.[25] Similarly, in this study, it was determined that more than half of the participants followed the health news in visual or

auditory media and did not read newspapers or magazines. The overall low literacy level of the study group supports this finding.

In this study, another important finding in this study was that 44.0% of the participants had difficulty in reading and understanding health/disease information brochures. Nutbeam[29] (1998) defined health literacy as basic/functional health literacy (sufficient general reading and writing skills), interactive health literacy (taking part in daily life with cognitive and social skills, gaining knowledge, making sense of different communication types), and critical health literacy (more advanced skills that can critically analyze health-related information and express its ability to make health decisions).[29] In order to make effective decisions about protecting, developing and maintaining health through all these complex processes, health professionals must evaluate the health literacy levels of the elderly as whole (accessing information, assessing information, analyzing risks and gains, calculating drug doses, understanding test results, etc.).

The 20th century, considered the longest century, has been one of the biggest factors affecting the internal migration movements and thus the social structure on the island of Cyprus. In this process, there are important time periods that can be considered breaking points. On the island; Between 1900 and 1950, population movements were observed, but mixed villages lived together. Between 1950 and 1963, the internal migration movement created by social conflict stands out. The internal dynamics of the social separation and the ghettoization process between 1963 and 1975 had serious effects. In 1975, the population exchange was held between the parties. In the following years, TRNC has received foreign migration and this has caused social, economic and political impacts on society. Migration is generally considered to impact public health and in particular on health literacy.[30,31] However, further studies are needed to obtain precise results.

### Limitations of the Study

Firstly, research data were obtained from the elderly people living in only one region of the TRNC (Dikmen Municipality boundaries), the results cannot be generalized to all elderly. Secondly, this study was a cross-sectional survey design. To assess the association between health literacy and in community dwelling elderly will need to further studies.

## CONCLUSION

In this study, it was found that the health literacy of elderly individuals is not sufficient, there was only a statistically significant relationship between education and age variables and health literacy score mean ($p<0.05$).

It was seen that the knowledge of elderly people about recognition of BMI, regular weighing, and participation in screening programs was not sufficient in the context of health protection services; they did not know the abnormalities for the signs and findings of diseases in the scope of therapeutic health services; and they confused correct time and day to take drugs. they followed health-disease information more in audiovisual media and they could not read and understand the health news and brochures in newspapers and magazines at a sufficient level. However, it was determined that they knew where to apply when they had some health problems, they used hospital appointment systems, and they could easily explain their health status to the doctor/nurse and ask questions.

It is recommended that nurses working with elderly people should evaluate health literacy status of elderly people at first, nursing interventions and health education activities should be carried out together with programs that improve the level of HL and consider the level of HL. In addition to public health nurses should pay more attention to the impact of health literacy on elderly health. Moreover, to enhance the effects of health promotion interventions, they should aim at raising HL levels of their target population groups.

Interventions to improve health system access among persons with low health literacy are probably inexpensive compared with larger, structural changes to the health system, and thus ought to be considered part of an overall strategy to reduce disparities.

## MAIN POINTS

- The level of health information and health literacy are low of the elderly.
- Health literacy of the elderly is associated with their education level.
- The level of health literacy should be taken into account when making nursing interventions.

## ETHICS

**Ethics Committee Approval:** Ethics committee approval was received for this study from Near East University Ethics Commitee (no: YDU/2018/56-548, date: 10.04.2018).

**Informed Consent:** Available.

**Peer-review:** Externally-peer reviewed.

### Authorship Contributions

Concept: H.B., D.N., M.A., E.Ü.S., Design: H.B., D.N., M.A., E.Ü.S., Supervision: Ü.S. Data Collection and/or Processing: D.N., M.A., Analysis and/or Interpretation: H.B., Literature Review: H.B., D.N., M.A., E.Ü.S., Writing: H.B., D.N., M.A., E.Ü.S., Critical Review: H.B., D.N., M.A., E.Ü.S.

**DISCLOSURES**

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# The Prevalence of Intimate Partner Violence Among Women in North Cyprus and Related Risk Factors and Psychological Symptoms

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## Abstract

**BACKGROUND/AIMS:** Intimate partner violence (IPV) is the most common type of violence applied to women and it causes significant health problems. The aim of this study is to show the prevalence of IPV against women in North Cyprus (NC), and to investigate related risk factors and psychological symptoms with the ultimate objective of forming data for future preventative studies.

**MATERIALS AND METHODS:** The present study included 497 female participants from North Cyprus who were all older than 18 years of age. The Women Abuse Screening Tool (WAST) was used to assess intimate partner violence against women and the Symptom Checklist Revised form (SCL-90-R) was used to assess the psychological symptoms.

**RESULTS:** The prevalence of IPV was found to be 14.3%. Women who were younger than 35, who were separated or divorced, who had secondary education or literate, and who were employed, were exposed to IPV more frequently. However, partners' age and educational level did not demonstrate significant associations with the women's IPV scores. Women exposed to IPV had significantly higher scores for all subscales of SCL-90-R, except for somatization.

**CONCLUSION:** This study revealed the extent of IPV against women in the TRNC and its negative consequences on women's health. Prevention programs should be planned to increase public awareness and to implement precautionary measures.

**Keywords:** Women, intimate partner violence, risk factors, psychological symptoms, Northern Cyprus, prevalence

## INTRODUCTION

Cyprus is an island located in the Mediterranean. Since the war in 1974, a cease fire has been in operation, with the island separated into north and south regions by a buffer zone under the control of the United Nations. The northern part of the island is predominantly inhabited by Turkish Cypriots, who speak the Turkish language and are largely Muslim. The southern region is populated by Greek Cypriots, who are mainly Orthodox. The Greek section of the island is governed by the Cyprus Republic, which is a member of the European Union, while the northern section is not a part of the EU acquiscommunautaire.[1]

Intimate Partner Violence (IPV) is a self-reported experience involving sexual or/and physical violence once or more action of by a partner who previous or current against women over the age of 15 years. IPV is a significant global health problem. However, it has been observed that people prefer not to talk openly about this and they frequently prefer to treat it as a private issue. IPV can be experienced not only in formal partner relationships

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such as marriage but also in informal partner relationships such as flirtatious (dating) relationships and unmarried sexual relationships.[2,3] IPV has different subtypes such as economic, social, physical, sexual, and psychological.

The rate of IPV changes within a wide range at different culture as there are many different risk factors that can be effective. Secondary education and formal marriage are found to be protective factors. However, young age, alcohol abuse, cohabitation, approval of spousal abuse, having sexual partners outside, growing up with domestic violence, and experiencing or observing other forms of violence in adulthood, a history of childhood abuse increase risks of IPV.[4-8] There are varied causes and effects of different forms of violence on women. Numerus studies have shown that for experiencing violence the major risk factor is being a woman and particularly being a pregnant woman.[9]

Victims of IPV suffer from various psychological and behavioural problems. Mental and psychological problems after violence were also examined. Some researchers reported higher chronic stress, depression, anxiety, sleep disorder (insomnia; hypersomnia), suicidal tendency, post-traumatic stress disorder (PTSD) and chronic mental problems. Additionally, these women feel less self-confidence and less social trust. Additionally, this violence can lead to substance abuse, especially triggering alcohol dependence.[10]

This research aims to investigate the IPV prevalence against women in Turkish Republic North Cyprus (TRNC), as well as the related risk factors and psychological symptoms. It is hypothesized that some demographic features like an increase the risk of IPV and women exposed to IPV is more likely to show psychological symptoms as a consequence.

## MATERIALS AND METHODS

### Participants

The sample of the research includes 497 female participants older than 18 years. In order to provide a representative sample, strafed random sampling was applied. The study was conducted as a household survey study. The data of the previous census was used and the sample was formed at the same proportions as the population according to the geographical regions (from every city Kyrenia, Morphou, Famagusta, İskele and Nicosia), age (18–25, 26–35, 36–45, 46–55, 56 and above) and urban and rural areas. Participants were all residents of Northern Cyprus and speak Turkish.

### Instruments

### Socio-demographic variables

At the first part of the questionnaire socio-demographic characteristics of the participants were investigated. Questions about the participants' family of origin like where they live (whether in NC or not), how often they meet, if they get financial and emotional support from them were asked.

### The Symptom Checklist-90-Revised (SCL-90-R)

SCL-90-R is a widely used instrument developed by Leonard R. Derogatisto evaluate common psychiatric symptomatology. It has 90-items and it is a self-report inventory. It has subscales evaluating somatization, obsessive-compulsive disorder, depression, anxiety, phobic anxiety, hostility, interpersonal sensitivity, paranoid ideation, and psychoticism. There are also Global Severity Index, Positive Symptom Distress Index, and Positive Symptom Total. Items are graded on a five-point Likert style ranging from "not at all" (0) to "extremely" (4). Dağ[11] conducted the Turkish adaptation of the scale, Cronbach's alpha was found as 0.97.

### Women Abuse Screening Tool (WAST)

WAST, which was developed by Brown and his collegues, has eight-items with 3 possible answers, ranging from a lot (1) to nothing (3). Possible responses to the first and second items are as 'no tension/difficulty' or 'NA tension/difficulty'. Items 3 through to 8 rate the frequency of the situations described in each item, as 'never', 'sometimes' and 'often. The scores of WAST and the Abuse Risk Inventory have a high correlation (r=0.96). Original form of WAST has a high internal consistency (Chronbach's alpha: 0.95). The Cronbach's alpha for the Turkish version was found 0.81 and revealed to have two factors, which are emotional abuse (questions 1,2,3,5,7,) and physical abuse (questions 4,6,8).[12]

The first two WAST questions are used as a screening tool and are called WAST-short. In this study WAST-short results were used to allocate participants into two groups as abused or non-abused. The most negative choice for these two questions was scored 1 and the other choices as 0; participants with a total score of 1 and higher were categorized within the abused subgroup.

The total score was computed as the sum of eight items (ranging between 8–24); subscores for physical abuse (questions 4,6), sexual abuse (question 8), and emotional abuse (questions 3,5,7) were computed as the sum of the related questions.

### Questions Investigating Abuse in Previous Generations

Two questions were added in WAST about the familial abuse history of the participants. The participants were asked if their father abused their mother and at the second question if their father-in-law abused their mother-in-law.

### Data Collection

Cross-sectional research design was used in this research. Thirty survey workers and a field supervisor collected the data. The

researchers were given education about the administration of survey before data collected phase. The starting points in the urban areas were the streets randomly determined by the researchers and the starting point for rural areas were the centre of the village. Survey workers cover squares, i.e., they began at the lowest numbered house on the right-hand side of a street and visited every third house. At their first turn, they turned right and continued contacting households on the right-hand side of the street until they completed the square. Then, they crossed to the next square and continued in the same manner. This uniformity of 'pacing' eliminates interviewer bias. The questionnaires were applied face-to-face to the participants by the survey workers. If there was more than one candidate at the house who was eligible for the research, the woman whose birthday was last was included in the sample. In order to minimize interviewer bias, each survey worker only conducted twenty interviews.

The survey workers gave informed consent form before applying the survey form. The data was collected in 2014.

### Ethical Considerations

The study was approved by the Social and Science Institute Ethics Board at the Near East University of NC and was conducted according to the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Written informed consent from all participants was also obtained.

### Statistical Analysis

The data obtained in the study were analyzed by a computer using Statistical Package for Social Science (SPSS) 21 software package program. Descriptive statistical methods were used in the study and chi-square statistical method was used in abuse-non abuse comparison of socio-demographic characteristics. Additionally, WAST total and its subscales for physical, psychological and sexual abuse and SCL-90 were compared between the groups through t-test analysis. Logistic regression analysis was used to determine the relationship between risk factors such as, age, marital status, education and employment (independent variables) and abused (dependent variables).

## RESULTS

The distribution of participants of demographic characteristics the is given at Table 1. The mean age of the participants was 37.80±14.31 (18–82). The participants were divided into two groups (abused and non-abused) according to the WAST-short scores as defined in the materials and methods. We observed that the participants reported to have been exposed to IPV were more under 35 years old, who divorced and separated, employed and literate and secondary school graduate (Table 2).

When the mean scores of the WAST total and its subscales for physical, psychological and sexual abuse were compared between the groups through t-test analysis, a significant difference was found. The abused group had significantly lower mean scores than the non-abused group, indicating a higher frequency of abuse ($p<0.001$) (Table 3). When the mean scores of the WAST-Factor 1 (Emotional Abuse; questions 1,2,3,5,7) and WAST- Factor 2 (Physically Abuse; questions 4,6,8) for the two groups were compared with t-test analysis, a significant difference was found. The abused group had significantly lower mean scores than the non-abused group, indicating a higher frequency of verbal abuse ($p\leq0.001$). When the mean scores of theSCL-90 subscales for the abused and non-abused women were compared with t-test analysis for all subscales of SCL-90, other that somatization subscale the abused group had significantly higher mean scores than the non-abused group ($p<0.05$) (Table 4).

Odds ratio analysis showed that IPV was experienced more among participants who are under 35 years old, non-cohabiting, whose education level is secondary school and higher and who are employed (Table 5).

## DISCUSSION

This study demonstrates that the rate of IPV against women in the TRNC is 14.3%. At a study in Spain where WAST scale was used IPV rate was found as 18%.[10] Another research in USA among 1,152 women participants aged 18–65 years revealed that 53.6% of the participants had ever suffered from IPV.[13] The reports show that the most common type of VAW is IPV that affects about 30% of women and is the cause of 38% of murders involving women in the world.[2,3]

In this study, women who are younger than 35 declared to suffer from IPV more often than the others. According to the special report of the US Bureau of Justice about 671,110 violent crimes that women have been subjected to by their current or previous partners younger women reported more IPV.[14,15] WHO report shows that even at the ages 15–19 if the women have a partner, the rate of IPV is high. The result of this study with respect to age is parallel with other countries.[2]

In this study, 348 (70.3%) of the participants were from TRNC, 28.7% (142) from Turkey, 1.0% (5) from other nationalities and 1.0% (5) did not answer the question of their nationality. The rate of IPV did not differ between the participants from Turkey and the TRNC. This finding is similar to the results of another domestic violence study conducted in TRNC.[16] The rates of IPV would be expected to be higher among women from Turkey in this study as VAW is generally shown to be higher among immigrants in literature related to economic problems and weak social support system. This unexpected result might be related to a limitation of this study as it was not asked how long the participants from other places have been living in TRNC. Some might be living for many years in TRNC and have established a good standard of life.[17]

**Table 1. Demographics of non-abused and abused in North Cyprus**

| Demographic variables | Non-abused | | Abused | | Total | | | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | $x^2$ | p-value |
| **Age** | | | | | | | | |
| 18–25 | 102 | 82.3 | 22 | 17.7 | 124 | 100 | 9.704 | 0.046* |
| 26–35 | 99 | 82.5 | 21 | 17.5* | 120 | 100 | | |
| 36–45 | 92 | 86.8 | 14 | 13.2 | 106 | 100 | | |
| 46–55 | 61 | 84.7 | 11 | 15.3 | 72 | 100 | | |
| 56 and above | 67 | 97.1 | 2 | 2.9 | 69 | 100 | | |
| **Country of birth** | | | | | | | | |
| Cyprus | 293 | 85.7 | | 14.3 | 342 | 100 | | |
| Turkey | 121 | 85.2 | | 14.8 | 142 | 100 | | |
| **Marital status** | | | | | | | | |
| Married | 258 | 90.8 | 26 | 9.2 | 284 | 100 | | |
| Separated | 2 | 33.3 | 4 | 66.7* | 6 | 100 | | |
| Divorce | 10 | 45.5 | 12 | 54.5* | 22 | 100 | | |
| Widowed | 22 | 81.5 | 5 | 18.5 | 27 | 100 | | |
| Engaged | 30 | 93.8 | 2 | 6.3 | 32 | 100 | | |
| In a relationship | 58 | 85.3 | 10 | 14.7 | 68 | 100 | | |
| Not in a relationship | 41 | 78.8 | 11 | 21.2 | 52 | 100 | | |
| **Education** | | | | | | | | |
| Illiterate | 13 | 86.7 | 2 | 13.3 | 15 | 100 | | |
| Literate | 3 | 75 | 1 | 25* | 4 | 100 | | |
| Elementary school | 81 | 94.2 | 5 | 5.8 | 86 | 100 | | |
| Secondary school | 32 | 72.7 | 12 | 27.3* | 44 | 100 | | |
| High school | 141 | 84.4 | 26 | 15.6 | 167 | 100 | | |
| University | 150 | 86.2 | 24 | 13.8 | 174 | 100 | | |
| **Employment** | | | | | | | | |
| Employed | 166 | 79.8 | 42 | 20.2* | 208 | 100 | | |
| Unemployed | 255 | 90 | 28 | 9.9 | 283 | 100 | | |

*Statistically significant at the $p<0.05$.

This study indicates marital status as an important factor effecting IPV rate. Women divorced or separated reported to have suffered from IPV more than in other relationships. Literature from other countries supports this finding. A study conducted in the USA showed that being divorced or separated rather than other relationship status is related to higher IPV among 1,152 female participants aged 18 to 65 years.[13] Also, US Bureau of Justice at their report in 1999 show that about 671,110 crimes, which about violent, indicated that separated women suffer from to IPV more often.[14] In a study of violence against women in North America covering 100,000 respondents, it was shown that respondents who were living separated from their partners suffer IPV three times more than the divorced and 25 times more than the married women. A research report from Mozambique on 1,442 women also shows that divorce and separation are factors related with sustained IPV.[18]

In this study IPV rate did not differ with the age or education level of the partner of the participants. A study conducted among 333 Spanish women showed similar results to this study[10] whereas other research in Philippines include 2,050 participants showed that not partner's level of education but partner's age being lower than forty years old significantly increased IPV.[19-21]

The participants of this research who were literate or graduates of secondary school reported to have suffer from IPV more than the ones graduated from elementary school, high school or

| Table 2. Women Abuse Tool (WAST) item responses (in percentages) and overall test score | | | |
|---|---|---|---|
| **WAST item** | **Non-abused (n=420)** | **Abused (n=70)** | **Total (n=490)** |
| **In general, how would like to describe your relationship?** | | | |
| A lot of tension | 0 | 72.9* | 10.4 |
| Some tension | 46.8 | 21.4 | 43.2 |
| No Tension | 53.2 | 5.7 | 46.2 |
| **Do you and your partner work out arguments with?** | | | |
| Great difficulty | 0 | 72.9* | 10.4 |
| Some difficulty | 51.8 | 18.6 | 47.0 |
| No difficulty | 48.2 | 8.6 | 42.6 |
| **Do arguments ever result in you feeling down or bad about yourself?** | | | |
| Often | 2.4 | 41.4 | 8.0 |
| Sometimes | 36.4 | 42.9* | 37.3 |
| Never | 61.2 | 15.7 | 54.7 |
| **Do arguments ever result in you hitting, kicking, or pushing?** | | | |
| Often | 0 | 14.3 | 2.0 |
| Sometimes | 3.3 | 24.3 | 6.3 |
| Never | 96.7 | 61.4* | 91.6 |
| **Do you ever feel frightened by what your partner says or does?** | | | |
| Often | 0.7 | 20.0 | 3.5 |
| Sometimes | 15.7 | 35.7 | 18.5 |
| Never | 83.6 | 44.3* | 78.0 |
| **Has your partner ever abused you physically?** | | | |
| Often | 0 | 11.4 | 1.6 |
| Sometimes | 3.8 | 24.3 | 6.7 |
| Never | 96.2 | 64.3* | 91.6 |
| **Has your partner ever abused you emotionally?** | | | |
| Often | 2.9 | 31.4 | 6.9 |
| Sometimes | 23.5 | 40.0* | 25.9 |
| Never | 73.6 | 28.6 | 67.2 |
| **Has your partner ever abused you sexually?** | | | |
| Often | 0.2 | 5.7 | 1.0 |
| Sometimes | 2.1 | 18.6 | 4.5 |
| Never | 97.6 | 75.7* | 94.5 |
| **To your knowledge, did your father abuse your mother?** | | | |
| Yes | 12.1 | 24.3 | 13.8 |
| No | 73.6 | 52.9* | 70.7 |
| I do not know | 14.3 | 22.9 | 15.5 |
| **To your knowledge, did your father abuse your mother?** | | | |
| Yes | 0.2 | 31.4 | 13.2 |
| No | 51.8 | 27.1 | 48.3 |
| I do not know | 38.0 | 41.4* | 38.5 |

*Statistically significant at the $p<0.05$, n: Number.

**Table 3. Comparison of WAST subscores between abused and non-abused participants**

| | Abused | Non-abused | tdfp |
|---|---|---|---|
| WAST-Total | 16.34±3.50 (n=70) | 22.04±1.75 (n=420) | -13.348<br>74.817<br>0.000* |
| WAST-Physical | 5.00±1.35 (n=70) | 5.92±0.31 (n=421) | -5.724<br>70,257<br>0.000* |
| WAST-Psychological | 5.95±1.74 (n=70) | 8.12±1.06 (n=420) | -10.063<br>77.757<br>0.000* |
| WAST-Sexual | 2.70±0.57 (n=70) | 2.97±0.17 (n=421) | -3.965<br>71.124<br>0.000* |
| WAST-Factor 1 | 8.64±2.16 (n=70) | 13.13±1.62 (n=420) | -16.591<br>82.488<br>0.000* |
| WAST-Factor 2 | 7.70±1.71 (n=70) | 8.90±0.38 (n=421) | -5.846<br>70.176<br>0.000* |

*p<0.00, WAST: women abuse tool, n: number.

university, or who were illiterate. Another study in Nigeria among 373 women also found that graduates of secondary school suffer from IPV more than women from other levels of education.[22] Also, some studies showed no influence of education level on IPV like the study in Malawi among 8,291 participants.[23] In the TRNC literacy rate is high and this study represents a limited sample size of illiterate participants.

Employment enables economic independence and is expected to protect women from IPV, but studies show contradicting results. In this study and in some other studies employed women report having been victim of IPV more often than unemployed women.[6,22]

This research shows that there was no significant association between IPV and monthly income. Similarly, some researchers found no relationship between monthly income and partner violence.[24] However, some studies show that women with economic disadvantages are at higher risk of partner abuse than women with economic advantages.[25,26]

This study showed no relationship between IPV and child number and people number in the household. In some studies, increased number of children is correlated with increased rate of IPV.[22] Some other research show that no significant association between IPV and the number of people in the household.[10]

In this study, the relationship with the family of origin, how often they visit each other, perceived emotional or financial support from the family of origin were assessed but these variables did not correlate with rate of IPV. A research conducted that women who do not receive social, financial or emotional support from

**Table 4. Comparison of SCL-90 subscores between abused and non-abused participants**

| | Abused | Non-abused | tdfp |
|---|---|---|---|
| SOM | 0.94±0.82 (n=70) | 0.76±0.63 (n=417) | 1.742<br>83.221<br>0.085 |
| OC | 1.23±0.75 (n=70) | 0.91±0.60 (n=419) | 3.268<br>84.457<br>0.002* |
| INS | 1.05±0.87 (n=70) | 0.77±0.67 (n=416) | 2.543<br>83.370<br>0.013* |
| DEP | 1.17±0.84 (n=70) | 0.83±0.67 (n=419) | 3.243<br>84.456<br>0.002* |
| ANX | 0.81±0.73 (n=70) | 0.59±0.61 (n=417) | 2.336<br>85.807<br>0.022* |
| HOS | 1.12±0.95 (n=70) | 0.66±0.66 (n=421) | 3.898<br>80.715<br>0.000** |
| PHO | 0.57±0.67 (n=70) | 0.36±0.51 (n=419) | 2.407<br>82.983<br>0.018* |
| PAR | 1.24±0.75 (n=70) | 0.93±0.69 (n=421) | 3.371<br>489<br>0.001* |
| PSY | 0.61±0.65 (n=69) | 0.38±0.49 (n=416) | 2.862<br>81.644<br>0.005* |
| Additional items | 1.08±0.76 (n=70) | 0.86±0.63 (n=415) | 2.292<br>85.884<br>0.024* |
| GSI | 0.97±0.66 (n=69) | 0.71±0.52 (n=397) | 3.155<br>83.282<br>0.002* |
| PST | 43.01±22.27 (n=69) | 35.85±20.11 (n=397) | 2.684<br>464<br>0.008* |
| PSDI | 1.93±0.55 (n=69) | 1.69±0.47 (n=397) | 3.831<br>464<br>0.000** |

*p≤0.05 **p<0.001, SCL-90: Symptom Checklist Revised form, SOM: somatization, OC: obsessive-compulsive, INS: interpersonal sensibility, DEP: depression, ANX: anxiety, HOS: hostility, PHO: phobic-anxiety, PAR: paranoid ideation, PSY: psychoticism, GSI: global severity index, PST: positive symptom total, PSDI: positive symptom distress index, n: number.

**Table 5. Odds ratio of the risk factors**

| Demographic variable | Abused/non-abused women | |
|---|---|---|
| | Odds ratio | %95 CI |
| Age (35 and under/over 35) | 1.61 | (1.03–2.52)* |
| Marital status (non-cohabiting/ married) | 2.67 | (1.58–4.51)* |
| Education (secondary-school and over/below) | 2.32 | (1.07-5.02)* |
| Employment (employed/ un-employed) | 2.04 | (1.31– 3.18)* |

*p≤0.05 significance levels, CI: confidence interval.

their family or friends were at a higher risk of victimization.[24,27-30] Çakıcı et al.[17] showed qualitative research that in TRNC in some areas, family VAW seems to be normalized. The neighbours do not react to such incidents and even the attitude of the police is to calm the situation and to return the couple to their homes without any legal procedure.[31]

In this study, the abused/non-abused group was formed according to WAST Short. The findings reveal that there was a significant associated in every item of WAST between these two groups. Furthermore, there was a significant difference in the subscales of WAST between abused and non-abused women. This supports WAST-short as a good screening tool for IPV.

In this study women exposed to IPV reported both their mothers and partner's mothers to be abused by their partners more often. Turkish culture has strong family bonds and people are inclined to model their behaviour on their family members, particularly their father and mother.[17] IPV practiced between parents may become a role model for resolving conflicts for their children.[31]

## CONCLUSION

This study showed that women suffer from IPV had higher scores for psychiatric symptoms. It can be included that IPV is a source of stress and psychopathology. There are researches that also show significant relationship between SCL-90 and IPV[32] and which report significant relationship between physical and psychological symptoms and with IPV for both men or women victims.[13,33] The groups in this study did not differ for somatization score. However, Zacarias et al.[34] was conducted in Maputo City, Mozambique among 1,442 women participants, somatization was significantly more prevalent among women suffer from IPV. Depression, anxiety, health problems, such as injury, chronic pain, gastrointestinal problems, post-traumatic stress disorder are related to partner violence in different studies.[15]

In this study IPV status was self-reported and this may result with over or under reporting related to recall bias and social desirability bias. Another limitation of this study is, women who do not speak Turkish could not be involved in this study. Future studies, should choose the sample in psychiatry hospital and should focus on not only IPV but also violence against women from other family members.

## MAIN POINTS

- This study demonstrates that the rate of IPV against women in the TRNC is 14.3%.
- Women who were younger than 35, who were separated or divorced, who had secondary education or literate, and who were employed, were exposed to IPV more frequently.
- Partners' age and educational level did not demonstrate significant associations with the women's IPV scores.
- Women exposed to IPV had significantly higher scores for all subscales of SCL-90-R, except for somatization.
- This study revealed the extent of IPV against women in the TRNC and its negative consequences on women's health. Prevention programs should be planned to increase public awareness and to implement precautionary measures.

### ETHICS

**Ethics Committee Approval:** The study was approved by the Social and Science Institute Ethical Board at the Near East University Ethics Commitee (decision no:99, date: 09.01.2014).

**Informed Consent:** Written informed consent from all participants was also obtained.

**Peer-review:** Externally-peer reviewed.

#### Authorship Contributions

Concept: M.K., E.T., Design: M.K., E.T., Supervision: E.T., Data Collection and/or Processing: M.K., Analysis and Interpretation: M.K., E.T., Literature Search: M.K., Writing: M.K., Critical Review: E.T.

### DISCLOSURES

**Financial Disclosure:** The author declared that this study had received no financial support.

**Conflict of Interest:** The authors declare no conflict of interest.

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# A University Hospital Healthcare Personnel's Knowledge Levels About Adult Basic Life Support: A Descriptive Study

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## Abstract

**BACKGROUND/AIMS:** This study was carried out to determine the knowledge level of adult basic life support (BLS) of nurses, paramedics and emergency medical technicians (EMT) who are working in a university hospital and its affiliated dispensaries in North Cyprus.

**MATERIALS AND METHODS:** This descriptive study included 137 nurses, paramedics and emergency medical technicians from 212 university and hospital dispensaries in North Cyprus, who agreed to participate. The data of the study were collected between 20 April–30 May 2017 by using personal information forms which consist of 9 questions about the socio-demographic characteristics and 14 questions about their knowledge of adult BLS to determine employees' features. The results were statistically evaluated and interpreted.

**RESULTS:** It was found that 37.23% of the health personnel were between the ages of 25–27, 82.48% were women, 72.99% were bachelors, and 35.77% were employed in inpatient services. 83.94% of the participants received in-service BLS training, 67.88% of them done BLS implementation, and 51.09% found themselves adequate for the BLS implementation. In the information form, the time of initiation of BLS in cardiac arrest (88.32%) question highly answered correct. It was determined that the average score is 62.04±16.11 out of 100 were taken from the BLS information form by participants as well as, the lowest score was 7.14 and the highest score was 92.86.

**CONCLUSION:** It is believed that: 'adding BLS theoretical and applied courses to vocational training programs, and supporting the training with in-service and orientation programs in business life' will increase the BLS abilities of health personnel to the desired level.

**Keywords:** Basic life support, nurse, paramedic, emergency medicine technician, knowledge level

## INTRODUCTION

Cardiac arrest can develop at anytime and anywhere. In such cases, the lack of theoretical and practical knowledge of basic life support (BLS) may have tragic consequences. Knowing, applying and developing BLS skills to prevent undesired outcomes increases the chances of survival in cardiac arrest.[1] As is stated in the 1998 European Resuscitation Council Guidelines, the continuous of education is as essential as following scientific developments.[2]

The practices in the international guidelines for BLS are organized on two different grounds, depending on whether the rescuer is a healthcare professional or not, and are updated every five years.[3] Healthcare professionals with different working areas and responsibilities should not be expected to have the same level of

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current knowledge. Accordingly, when evaluated in terms of the medical duties of healthcare professional, significant problems can include the amount of BLS information they know and whether their knowledge on subject is continually updated.[4]

Various studies on BLS are available in the literature. In the study by Örsal et al.[5], the mean score of nurses' BLS knowledge level was determined as 6.37 (out of 17). According to the results of the study by Kara et al.[6], the correct response rate of nurses to questions about BLS was between 2.9% and 72.5%. The mean of the scores for BLS knowledge was determined as 4.85 (out of 10). In the study by Irfan et al.[7], nurses were determined to the group with lowest BLS knowledge scores (38.4%). In the study by Shrestha et al.[8], the average score levels for BLS knowledge of healthcare professionals were determined to be sufficient.

The current study evaluates healthcare professionals' BLS knowledge levels according to the departments in which they worked and the need to repeat training based on statistical evaluation of the obtained knowledge scores. Despite the importance of the subject, no study on BLS in Northern Cyprus has been found in the literature.

## MATERIALS AND METHODS

This study is descriptive. The universe of the study consisted of nurses, paramedics and emergency medicine technicians who were working at a university hospital and the hospital's dispensaries in North Cyprus and voluntarily agreed to participate (n=137).

The data of the research were collected through a data collection form used with the permission of the real owner.[9] The data collection form consists of two parts. In the first part of the form, there are nine introductory questions about the socio-demographic characteristics of healthcare professionals and BLS. In the second part of the form, 14 questions assess the BLS knowledge levels of healthcare professionals. Each question in the second part has four options and one correct answer. Healthcare professionals marked an option they thought was correct. Oral information was provided to each participant for the implementation of the research. The correct answer to each item was multiplied by 100/14=7.14 to evaluate the total score from 14 items in the BLS information form out of 100. The range of points that can be obtained from the scale varies from 0 to 100. High and low scores obtained from the scale shows that the level of knowledge about BLS is high or low, respectively.

Approval was obtained from Near East University Ethics Committee (2017/403) for conducting the study, and written consent was obtained from the real owner of data collection form and the healthcare professionals who agreed to participate in the study.

### Statistical Analysis

Statistical Package for Social Sciences (SPSS, version 18.0) program was used to analyse the data. The analysis of the identifying characteristics of the healthcare professionals was determined by frequency distributions. The compliance of the information points with a normal distribution was determined by calculating the Kolmogorov-Smirnov and Shapiro-Wilk tests, QQ plot, and skewness-kurtosis values. The homogeneity of the variances was examined by Levene test. Independent samples t-test, one-way ANOVA, Kruskal-Wallis, Mann-Whitney U tests were used to compare the data. The results of the study were evaluated at 95% confidence interval and a significance level $p<0.05$.

## RESULTS

The descriptive statistics of the healthcare professionals are shown in Table 1. According to this, 37.23% of the healthcare professional were between the ages of 25–27, 84.48% were women and 72.99% were undergraduates. It was determined that 35.77% of the healthcare professional worked in the in-patient department, 83.94% had received BLS training before, 67.88% had experienced BLS and 51.09% believed that they were sufficient in BLS (Table 1).

According to the results, time of starting to apply BLS in cardiac arrest (88.32%), the position that the patient should be placed in during implementation (83.21%), the rate of chest pressure/artificial respiration rate in adults (82.48%), and the place where the pulse should be taken to evaluate the circulation in adults (81.02%) were mostly answered correctly. Chest pressure (64.96%), the processes of respiration (60.58%), and time to evaluate respiration (56.93%) were answered incorrectly by more than half of the participants (Table 2).

It was determined that the average score achieved by the participants for the BLS information form was 62.04±16.11, while the lowest score was 7.14, and the highest score was 92.86. Accordingly, the average BLS knowledge score of healthcare professionals who were working in the emergency department was 69.05±14.70 (highest), while it was 65.71±15.17 for those working in the intensive care unit, 61.52±13.03 for professional in the in-patient department, 50.65±8.11 (lowest) in the operating room, and in the out-patient clinic, it was 57.97±22.97. A statistically significant difference was found between the worked departments in which the healthcare professionals worked and the average scores they received ($p<0.05$). The knowledge scores of the healthcare professionals who were working in the emergency department are found to be higher than the other participants. Also, the knowledge scores of the healthcare professionals in the intensive care unit were higher than those in the operating room and the out-patient clinic (Table 3).

The average score of healthcare professionals who had performed BLS was determined as 63.98±15.62, while the score for those who had nor performed BLS was 57.95±16.54. A statistically significant difference was found between the knowledge point averages of the healthcare professionals who did and did not implement BLS ($p<0.05$) (Table 4).

When the independent sample t-test results of the healthcare professionals were analysed to compare the knowledge about BLS, it was found that the average score of healthcare professionals who believed that they were sufficiently knowledgeable about BLS was 66.53±14.26 and for those thought they were insufficiently knowledgeable, it was 57.36±16.68 ($p<0.05$). The knowledge scores of the participants who perceived themselves to be sufficient in terms of BLS were significantly higher than those who found themselves insufficient (Table 5).

**Table 1. Distribution of the participants' socio-demographic characteristics and BLS training (n=137)**

| Identifier features | Number (n) | Percent (%) |
|---|---|---|
| **Age group** | | |
| 24 years and under | 48 | 35.04 |
| 25–27 years | 51 | 37.23 |
| 28 years and older | 38 | 27.74 |
| **Gender** | | |
| Female | 113 | 82.48 |
| Male | 24 | 17.52 |
| **Education** | | |
| Health vocational high school | 9 | 6.57 |
| Associate degree | 18 | 13.14 |
| Undergraduate | 100 | 72.99 |
| Master's degree | 10 | 7.30 |
| **Worked department** | | |
| In-patient department | 49 | 35.77 |
| Intensive care unit | 30 | 21.90 |
| Out-patient clinic | 26 | 18.98 |
| Emergency department | 21 | 15.33 |
| Operation room | 11 | 8.03 |
| **Having in-service BLS training** | | |
| Yes | 115 | 83.94 |
| No | 22 | 16.06 |
| **BLS implementation experience** | | |
| Yes | 93 | 67.88 |
| No | 44 | 32.12 |
| **Finding him/herself sufficient in BLS** | | |
| Yes | 70 | 51.09 |
| No | 67 | 48.91 |
| **Total** | 137 | 100.00 |

BLS: basic life support, n: number.

## DISCUSSION

According to the answers from the participants, the mean score of BLS was found to be 62.04, and it statistically evaluated at the intermediate level. In the literature on this subject, the level of knowledge of the BLS of healthcare professionals are generally reported to be moderate to low. In the study by Ateşli[9] in North Cyprus in 2011 on the BLS knowledge level of nurses who worked in state hospital, the participants' knowledge level was evaluated at an intermediate level. In the study of Sabir, which evaluated the nursing faculty students' BLS knowledge, the experience of 93.5% of the participants was found to be at the intermediate level.[10] In a similar study by Nambiar et al.[11], on 461 healthcare professionals, the overall average was low. Various factors could be behind these results. The most important of these is the fact that the healthcare professional do not participate in current BLS training unless it is mandatory during and after vocational training. Among other reasons, the healthcare professional may not receive BLS training periodically in their professional lives or do not ensure continuity, do not want to spend extra time on in-service training due to oppressive working conditions, or trainer does not have up-to-date information.[11] The higher the quality and consistency of the BLS training, the more successful resuscitation will be. The willingness of the healthcare professional toward this topic would help them increase their level of education.

According to the results obtained from our research, the rate of healthcare professionals who had previously applied BLS was 67.88%. In spite of this high rate, only 51.09% of the participants were found to be sufficient. In the study of Ateşli[9], it was concluded that; 51.63% of the healthcare professional considered themselves partially sufficient in the context of BLS.In a study by Pillow et al.[12], with fourth-grade medical students, 36.8% of the students concluded that the avoided resuscitation because their perceptions of inadequacy regarding cardiopulmonary resuscitation (CPR). In the study of Valarmathi and Parajulee[13], the rate of correct responses of 175 participants was determined as 57.14%. The main reason at this stage is the awareness of healthcare professional regarding how much knowledge they have. The obtained results were consistent with the literature and reveal the importance of continuing education and repetitive training for staff who do not believe they are adequate. Increasing the theoretical and practical training will increase the likelihood of survival.

When the correct response rates in the questionnaire were used to determine the knowledge level of BLS of the participants evaluated, the correct response rates of the questions about the time to initiate BLS (88.32%), the position to be given to the patient (83.21%), the rate of chest pressure and artificial respiration (82.48%), and the evaluation of circulation (81.02%) were right. The correct response rate was considerably low for

**Table 2. Distribution of health personnel information questions according to correct/incorrect responses (n=137)**

| BLS Information Questions | Correct | | Incorrect | |
|---|---|---|---|---|
| | n | % | n | % |
| Time to start BLS in case of cardiac arrest | 121 | 88.32 | 16 | 11.68 |
| The right position was given to the patient for the BLS implementation | 114 | 83.21 | 23 | 16.79 |
| The rate of chest pressure/artificial respiration rate in adults | 113 | 82.48 | 24 | 17.52 |
| The place to take a pulse to evaluate the circulation in adults | 111 | 81.02 | 26 | 18.98 |
| Proving the airway clearance of the unconscious patient without head/neck trauma | 97 | 70.80 | 40 | 29.20 |
| The processes that have to be done when the patient's circulation has stopped | 87 | 63.50 | 50 | 36.50 |
| The checks that need to be done before starting BLS | 83 | 60.58 | 54 | 39.42 |
| Definition of cardiopulmonary arrest | 82 | 59.85 | 55 | 40.15 |
| Ideal location for chest compression | 79 | 57.66 | 58 | 42.34 |
| The number of compressions applied per minute in chest pressure | 78 | 56.93 | 59 | 43.07 |
| How chest pressure has to be applied to adults | 64 | 46.72 | 73 | 53.28 |
| The time to evaluate the respiration of the patient | 59 | 43.07 | 78 | 56.93 |
| The processes that need to be done in the absence of respiration | 54 | 39.42 | 83 | 60.58 |
| The depth of the chest pressure in adults | 48 | 35.04 | 89 | 64.96 |

BLS: basic life support, n: number.

**Table 3. Comparison of BLS information points according to the department in which the health personnel worked (n=137)**

| Worked department | n | Mean | s | Mean Rank | $X^2$ | p-value | Variance |
|---|---|---|---|---|---|---|---|
| Emergency department | 21 | 69.05 | 14.70 | 87.05 | | | 1–3 |
| Intensive care units | 30 | 65.71 | 15.17 | 79.30 | | | 1–4 |
| Operation rooms | 11 | 50.65 | 8.11 | 35.36 | | | 1–5 |
| In-patient departments | 49 | 61.72 | 13.03 | 65.36 | 15.43 | 0.00* | 2–3 |
| Out-patients clinic | 26 | 57.97 | 22.07 | 63.63 | | | 2–5 |

*p<0.05, BLS: basic life support, n: number.

questions related to the period of assessment of the respiratory rate (43.7%), the processes to be applied in the absence of respiration (39.42%), and the depth of chest pressure in adults (35.4%) (Table 2).

A similar questionnaire was used in the study by Chandrasekaran et al.[14], in which 1.054 people, 74 including various healthcare professionals, were asked to provide information about their BLS knowledge. The questions relate to time to start implementing BLS (89%), the position to be given to the patient during the implementation (74%), the depth of chest pressure in adults (67%), and the chest pressure/artificial respiration rate (34%) were answered incorrectly by the participants.[14] In Sabir's[10] study, he specified the significant difference between the levels of knowledge of BLS before and after training. Similar results were obtained in the study by Nambiar et al.[11], in which it was determined that the questions that generally evaluated the knowledge of the participants were not answered correctly by the participants. In Kaya et al.[15], study, the proportion of respondents who knew heart pressure and artificial respiration rate correctly was 21.5% and 90.9%. Successful implementation of the BLS depends on the training of the rescuer with up-to-date information. In particular, it is necessary for the healthcare professional to handle the application as a whole and know each stage correctly. Generally, the questions that were answered correctly in our study were found to be compatible with the literature.

Concerning the participants' knowledge about BLS, it was found that the knowledge scores of the participants who found themselves to be sufficient in terms of BLS were higher than those who believed they were insufficient. These results are considered statistically significant ($p<0.05$). The knowledge scores of the participants who perceived themselves sufficient in terms of BLS were significantly higher than those who found themselves insufficient (Table 5). In a multicentre study by Akritia et al.[16], it was concluded that there was a correlation between the participants' self-sufficiency and high knowledge scores.

In the study conducted by Ateşli[9] in 2011, it was determined that the knowledge and implementation score averages of healthcare professional in the 35-year-old age had statistically

**Table 4. Comparison of BLS information points of health personnel according to, BLS implementation status (n=137)**

| BLS implementation | n | Mean | s | t | p-value |
|---|---|---|---|---|---|
| Yes | 93 | 63.98 | 15.62 | 2.07 | 0.04* |
| No | 44 | 57.95 | 16.54 | | |

*p<0.05, BLS: basic life support, n: number.

**Table 5. Comparison of BLS information points of health personnel according to they find sufficient themselves about BLS (n=137)**

| Finding sufficient | n | Mean | s | t | p-value |
|---|---|---|---|---|---|
| Yes | 70 | 66.53 | 14.26 | 3.47 | 0.00* |
| No | 67 | 57.36 | 16.68 | | |

*p<0.05, BLS: basic life support, n: number.

significant differences, and were lower than the other groups.[9] In the study by Kara et al.[6], in 2015, no correlation was found between the ages of the professional who participated in the study and the average point score of BLS. According to the study by Valamathi and Parajulee[13] in 2011, no correlation was found between the age of healthcare professional and the BLS information scores. It is normal for newly-graduated healthcare professional (24 years and below) to have high scores for BLS knowledge due to reasons such as recently completing their education and participating in-service training organized in the business environment in their new occupation. The reason for the decrease seen in the 25 and older age group could be that they were not following the innovations related to BLS and were not participating in the training, which may have let to them forget information due to the lack of cases in which their knowledge and application skills could be improved.

## CONCLUSION

The following suggestions can be made in line with these results:

Theoretical and practical courses should be added to associate degree, undergraduate, and post-graduate programs to increase the healthcare professionals' BLS skills to the desired level.

The same classes or training should be supported through in-service and orientation programs in business life.

The continuity of on-the-job training related to the BLS, increasing participation should be ensured, while the healthcare professional should regularly attend relevant events such as seminars, conferences and congresses.

BLS training should be divided into groups and organized into different groups.

From healthcare professionals to normal citizens, if BLS information is increased throughout society, this is the basis of a successful emergency health system. Thus, the survival rate will be increased in emergencies. Hence, it is responsibility of institutions to provide vocational training and healthcare services to teach first aid to healthcare professionals and the wider community.

## MAIN POINTS

- Cardiopulmonary resuscitation practices are life-saving when done correctly and effectively.
- It is of great importance that professionals working in the field of health know the basic life support steps completely and accurately.
- Thanks to the guides and trainings that are developed and updated every five years, the level of knowledge can be increased.

### ETHICS

**Ethics Committee Approval:** Approval was obtained from Near East University Ethics Committee (2017/403) for conducting the study.

**Informed Consent:** Written consent was obtained from the real owner of data collection form and the healthcare professionals who agreed to participate in the study.

**Peer-review:** Externally-peer reviewed.

#### Authorship Contributions

Concept: U.K., S.A., Design: U.K., S.A., Supervision: U.K., S.A., Data Collection and/or Processing: U.K., S.A., Analysis and/or Interpretation: U.K., S.A., Literature Search: U.K., S.A., Writing: U.K., S.A., Critical Review: U.K., S.A.

### DISCLOSURES

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# Investigating Relationships Between Pain, Comfort, Anxiety and Depression in Surgical Patients

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## Abstract

**BACKGROUND/AIMS:** The aim was the investigate the relationships between levels of pain, comfort, anxiety and depression in patients undergoing surgery.

**MATERIALS AND METHODS:** This study is of descriptive analytic design. The universe of the study consisted of the patients in the surgical wards of two hospitals in western Turkey who had undergone surgery. The study sample comprised 245 patients. The Shapiro-Wilk normality test was used to assess normal distribution. Number, percentage, t-test, ANOVA and correlation analysis were used to evaluate the data of the study.

**RESULTS:** The patients' mean pain and comfort score was 3.46±1.71, 4.27±0.59. The mean score for anxiety was 10.64±3.59 and the mean depression score was 8.51±2.90. A weak, negative correlation was found between the patients' anxiety and comfort levels, while there was a weak but positive correlation between their anxiety and pain levels. A weak and negative correlation was found between comfort and pain levels.

**CONCLUSION:** The result of the study was the finding that the patients' levels of pain were low and their comfort levels were good. It was determined that the tendency of patients to anxiety and depression was mild. Providing effective pain control will positively contribute to the patient's anxiety, depression and comfort during the postoperative period. Preoperative music therapy and postoperative back massage can be recommended.

**Keywords:** Pain, comfort, anxiety, depression, postoperative

## INTRODUCTION

The aim of surgery is to free patients from defects and deformities, ensure the continuation of organ functions, reduce mortality rates, eliminate pain and raise the level of quality of life. However, surgical interventions bring about psychological, physical and social traumas that create a stress response in the patient.[1] Because of this, depending on the degree to which an individual feels threatened, surgery can lead to problems such as anxiety and depression.[2] This creates a potential for complications, increases the intensity of the pain perceived by the patient and extends the period of stay in the hospital.[3] Postoperative pain is related to the mediators secreted from the incision site. The intensity of pain however varies depending upon the patient, the surgical intervention, the equipment used, the position of the patient, and the effectiveness of pain control.[4,5] It has been found that most patients experience moderate to severe pain postoperatively.[3,6,7] In one study, 86% of patients who underwent surgery experienced post-operative pain, and 75% of those who reported pain defined the severity

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as moderate to post-operative period.[8] On the first postoperative day, it was reported that pain scores were highest after obstetric and orthopedic/traumatic procedures, but high scores after common small surgical procedures such as appendectomy, cholecystectomy, hemorrhoidectomy, tonsillectomy, and some laparoscopic procedures.[3] Insufficient pain control causes delayed mobilization and increases morbidity and mortality in the event of complications.[9,10] Furthermore, postoperative pain is known to be an important parameter that reduces the patient's level of comfort.[11-13] Kolcaba[14] defines comfort as a concept that has physical, sociocultural, psychospiritual and environmental dimensions. Health is the state at which all of these dimensions are in alignment and nurses try to make an effort to improve these aspects of well-being.

Nurses provide aim to provide a holistic and humanistic approach to identifying and treating an individual's present and potential problems in terms of the person's physiological and psychosocial needs. In surgical patients, effective pain control and maintaining comfort is one of the most important responsibilities of the surgical nurse.[7,15] Many different approaches are used for pain control, pharmacological and nonpharmacological. While drugs are used to treat the somatic dimension of pain, non-pharmacological methods aim to treat the affective, cognitive, behavioral and sociocultural dimension of pain.[16,17] Nonpharmacological interventions are effective not only in pain control, but also in relieving anxiety and increasing the comfort of the patient. These interventions are relaxation techniques, taking attention in another direction, music, imagination, massage, positioning, transcutaneous electrical nerve stimulation (TENS), etc. Additionally, therapeutic touch and chat are also effective interventions.[9,16,18]

Studies have indicated that music therapy is effective in reducing pain and anxiety.[19,20] It was determined that listening to the music preferred by the patient in the preoperative period reduces the anxiety of the patient and regulates the hemodynamic parameters. It was also found to increase patient satisfaction in the postoperative period.[21] In the study by Demir and Saritas[22], it was found that back massage applied to patients after liver transplantation had a positive effect on life findings. Additionally, the pain scores of the patients who were massaged were determined to be lower and their comfort levels were higher.

There are different studies examining the pain of patients undergoing surgical intervention in the nursing literature, the use of analgesics in pain control and the role of the nurse,[4,15], the relationship of pain with anxiety, satisfaction, comfort and activity.[3,5,12] However, no study investigating the relationship between pain, comfort, anxiety and depression has been found in all surgical clinics. This is an investigation into the relationships between levels of pain, comfort, anxiety and depression in patients undergoing surgical interventions.

### Research Questions

What are the levels of pain, comfort, anxiety and depression of patients undergoing surgery?

Is there a relationship between pain, comfort, the tendency of anxiety and the tendency of depression of patients undergoing surgery?

## MATERIALS AND METHODS

### Design

The study is of descriptive analytic design.

### Sample and Setting

The universe of the study consisted of the patients who had undergone surgery and were hospitalized in the surgical wards of two hospitals in western Turkey. The study sample comprised 245 patients of the ages 18 and over, who were at least in their second postoperative day and were time- and place-oriented. Individuals who were being provided mechanical ventilation support or had hearing loss was not included in the study.

### Sample Size

A power analysis at a confidence interval of 0.05 and 90% power was performed in the light of the literature and it was found that the sample size would have to consist of at least 230 individuals [Power Analysis and Sample Size (PASS) software]. Against the possibility that there would be data loss, the study was conducted with 245 individuals who comprised the sample.

### Instruments

The data for the study were collected with a Patient Information Form, the Brief Pain Inventory, the Perianesthesia Comfort Questionnaire, and the Hospital Anxiety Depression Scale.

**Patient Information Form:** This form consisted of 10 questions on the individual's age, gender, education, diagnosis, surgery, the clinic where the individual was hospitalized, the patient's previous experience with hospitalization and surgery, and of notations on how many days the patient had been in the hospital and how days had passed after surgery.

**Brief Pain Inventory (BPI):** Cleeland and Ryan[23] developed this inventory. Dicle et al.[24] carried out the validity and reliability study of the Turkish version of the inventory. The BPI contains four questions on the intensity of pain and seven questions on the effect of the pain on various functions (general activity, emotional state, walking, interpersonal communications, sleep, taking pleasure out of life). Each item is assessed on the basis of 0–10 points. Cronbach's alpha coefficient for pain intensity was found to be 0.79; the effect of pain on the various functions was 0.80. It has been reported that BPI is a valid and reliable instrument that can be used to assess postoperative pain

intensity.[24] The Cronbach Alpha coefficients for pain intensity for this study were 0.82, the effect of pain on the various functions were 0.85.

**Perianesthesia Comfort Questionnaire (PCQ):** Kolcaba and Wilson[25] developed and Üstündağ and Aslan[26] carried out the validity and reliability study of the Turkish version of the questionnaire. The instrument contains 24 items that query the individual's self-concept and feelings reflecting thought processes before and after the surgical intervention. Each statement in the instrument receives a response on a Likert-type scale ranging from 1–6. The highest possible score on the scale is 144, the lowest is 24. Lower scores indicate that comfort is at a poor level, higher scores that comfort is at a good level. Üstündağ and Aslan[26] conducted the Turkish validity and reliability study and found a Cronbach's alpha coefficient of 0.83. In this study, the Cronbach alpha value was found to be 0.84.

**Hospital Anxiety and Depression Scale (HADS):** Zigmond and Snaith[27] developed this scale. Aydemir et al.[28] adapted to Turkish and its validity and reliability were tested. Anxiety and depression are the headings of its subscales. The aim of the scale is not to make a diagnosis but to quickly screen individuals with physical illness to identify risk groups in terms of anxiety and depression. The scale can also be used in the assessment of changes in the emotional state of a patient. The scale is made up of 14 items, seven of which explore the symptoms of depression and seven the symptoms of anxiety. The responses are assessed in Likert form and are scored on a scale of 0–3. The lowest possible score an individual can receive from both subscales is 0; the highest is 21. The cut-off points on the Turkish version of the scale is 10 for the anxiety subscale (HADS-A) and seven on the depression subscale (HADS-D). Accordingly, individuals scoring above these points are accepted as being at risk.[28] The Cronbach Alpha coefficients for this study were 0.83, for anxiety and 0.87 for depression.

### Data Collection

The authors collected the data for the study through face-to-face interviews with consenting participants in their rooms after their surgery. Data from each individual were collected in approximately 15–20 minutes.

### Statistical Analysis

Data analysis was performed electronically using the Statistical Package for the Social Sciences (SPSS) for Windows 22.0 (SPSS IBM Corp.; Armonk, NY, USA). Calculations were made at a 95% level of confidence. The Shapiro-Wilk normality test was used to assess normal distribution. Numbers, percentages, the t-test, ANOVA and correlation analysis were employed. The level of statistical significance was set at $p<0.05$.

### Ethics Statement

Ethics committee approval for the study was obtained from the Ethics Committee of Pamukkale University (decision no: 2017/50265, date: 01.08.2017) and from the institution where the study was conducted. The participants in the study were informed about the research and their written consent was taken.

## RESULTS

The mean age of the study participants was 54.77±17.49 years. The mean number of their postoperative days was 3.46±1.59 and the mean duration of their hospitalization was 6.31±4.70 days. Of the patients, 46.5% (n=114) were female; 69.2% (n=145) had an elementary school education. Of the participants, 24.9% (n=61) were patients in the general surgery department. The patients who had a previous history of hospitalization represented 77.2% (n=190); 66.3% (n=163) had a history of prior surgery (Table 1).

The patients' mean pain score was 3.46±1.71; their mean comfort score was 4.27±0.59. The mean score for anxiety was 10.64±3.59 and that for depression was 8.51±2.90. It was found that 65.7% (n=161) of the participants tended toward anxiety; 38.4% (n=94) tended toward depression. While the participants' worst pain in the last 24 h was at a level of 4.62±2.48, the least level of pain stood at 2.18±1.76. The area of life which was most affected by their pain in the last 24 h was routine work (in and outside of the house), the ability to walk, and their level of general activity. The mean percentage of pain relief the participants had pain therapy in the last 24 h was 60.20±23.45 percent and the analgesics most resorted to in the departments was nonsteroidal anti-inflammatory drugs and opioid drugs were among the drugs least administered. A statistically significant difference was found between gender and the mean scores anxiety and of pain and the subscales of the pain scale (general activity, emotional state, ability to walk and routine working level) ($p<0.05$) (Table 2).

A statistically significant difference was observed in the comparison between the departments and the pain and comfort mean scores ($p<0.05$). The highest level of pain was felt in the orthopedics department; the lowest level of pain was in the cardiothoracic department. When the departments and comfort levels were compared, the lowest level of comfort was found in the Otorhinolaryngology-Ophthalmology department while the highest level of comfort was in the cardiothoracic department. In the comparison of the departments and tendencies toward anxiety and depression, it was found that the patients in the cardiothoracic surgery department displayed the lowest scores in anxiety and the highest scores in depression. The department where the tendency toward anxiety was the highest was the

| Table 1. Distribution by participants' sociodemographic and descriptive features (n=245) | | |
|---|---|---|
| **Variables** | | |
| **Age** | **54.77±17.49** | |
| **Postoperative hospitalization (days)** | **3.46±1.59** | |
| **Duration of hospitalization (days)** | **6.31±4.70** | |
| | **Number (n)** | **Percentage (%)** |
| **Gender** | | |
| Female | 114 | 46.5 |
| Male | 131 | 53.5 |
| **Education** | | |
| Literate | 47 | 19.2 |
| Elementary school | 145 | 69.2 |
| High school | 34 | 13.9 |
| University | 19 | 7.8 |
| **Department** | | |
| General surgery | 61 | 24.9 |
| Orthopedics and traumatology | 60 | 24.5 |
| Cardiothoracic surgery | 48 | 19.6 |
| Neurosurgery | 21 | 8.6 |
| Otorhinolaryngology-ophthalmology | 17 | 6.9 |
| Urology | 38 | 15.5 |
| **Surgical history** | | |
| Yes | 163 | 66.5 |
| No | 82 | 33.5 |
| **Hospitalization history** | | |
| Yes | 190 | 77.2 |
| No | 55 | 22.8 |
| n: number. | | |

urology department. The department with the lowest tendency toward depression scores was the general surgery department ($p>0.05$) (Table 2).

There was a negative and weak correlation between the patients' ages and their tendency toward depression ($p<0.005$, $r=-0.238$). A positive and weak correlation was found between the patients' duration of hospitalization and their tendency toward depression ($p<0.001$, $r=0.238$). There was a negative and weak correlation between the postoperative hospitalization and pain ($p<0.005$, $r=-0.190$), a positive and weak correlation between postoperative hospitalization and the tendency toward anxiety ($p<0.05$, $r=0.141$), and a positive and weak correlation between postoperative hospitalization and the tendency toward depression ($p<0.05$, $r=0.160$) (Table 3).

A weak, negative correlation was found between the patients' anxiety and comfort levels ($p<0.001$, $r=-0.241$), while there was a weak but positive correlation between their anxiety and pain levels ($p<0.001$, $r=0.324$). Furthermore, a weak and negative correlation was found between comfort and pain levels ($p<0.001$, $r=-0.269$).

## DISCUSSION

The result of the study was the finding that the patients' levels of pain were low and their comfort levels were good. It was determined that the tendency of patients to anxiety and depression was mild. Insufficient post-operative pain control reduces the comfort and satisfaction of patients.[5] This can result in patients' tendency to anxiety and depression. We observed that the patients had tendencies toward both anxiety and depression. The stay in the hospital, chronic illnesses, and factors such as the inability to fulfill one's roles can lead surgical patients into anxiety and depression.[29] This is because surgical interventions are traumas that have a biological, psychological and social impact on the individual; they disrupt the integrity of the body, make individuals dependent and encompass the fear of the unknown.[2] In our study, the anxiety levels of the female patients were higher than the males and difference was statistically significant ($p<0.05$). This suggests that female patients are more affected because of interruptions in their gender-related roles brought about by the surgical process. Simultaneously, changes in perceptions of body image caused by surgical interventions may be another factor that raises anxiety levels among female patients.

**Table 2. Comparison of patients' pain, comfort, anxiety and depression levels according to variables**

| Variables | Pain* | Comfort | Anxiety | Depression |
|---|---|---|---|---|
| X ± SD | 3.46±1.71 | 4.27±0.59 | 10.64±3.59 | 8.51±2.90 |
| **Gender** | | | | |
| Female | 3.80±1.77 | 4.24±0.57 | 11.14±3.76 | 8.80±2.75 |
| Male | 3.17±1.61 | 4.29±0.62 | 10.22±3.39 | 8.25±3.01 |
| p-value | **0.004** | 0.502 | **0.046** | 0.139 |
| t | -2.916 | 0.672 | -1.994 | -1.474 |
| **Surgical history** | | | | |
| Yes | 3.61±1.80 | 4.28±0.56 | 10.78±3.64 | 8.53±2.74 |
| No | 3.18±1.48 | 4.25±0.66 | 10.37±3.50 | 8.47±3.21 |
| p-value | **0.048** | 0.701 | 0.398 | 0.883 |
| t | 1.987 | 0.385 | 0.847 | 0.147 |
| **Hospitalization history** | | | | |
| Yes | 3.50±1.76 | 4.23±0.58 | 10.84±3.55 | 8.62±2.77 |
| No | 3.37±1.55 | 4.39±0.64 | 9.92±3.71 | 8.05±3.71 |
| p-value | 0.602 | 0.120 | 0.097 | 0.203 |
| t | 0.583 | -1.573 | 1.666 | 1.276 |
| **Departments** | | | | |
| General surgery | 3.32±0.22 | 4.41±0.06 | 10.62±3.92 | 7.86±3.09 |
| Orthopedics | 4.13±0.20 | 4.16±0.07 | 11.06±3.39 | 8.43±2.87 |
| Cardiothoracic surgery | 3.06±0.24 | 4.46±0.08 | 9.58±3.49 | 9.14±2.45 |
| Neurosurgery | 3.09±0.19 | 3.89±0.12 | 9.85±2.39 | 8.66±2.70 |
| Otorhinolaryngology-ophthalmology | 3.58±0.42 | 3.97±0.13 | 11.05±4.17 | 8.52±3.42 |
| Urology | 3.31±0.31 | 4.32±0.11 | 11.63±3.52 | 8.78±3.00 |
| p-value | **0.018** | **0.000** | 0.103 | 0.336 |
| F | 2.793 | 4.959 | 1.855 | 1.147 |

*Average pain in the last 24 hours, SD: standard deviation.

Significant values are shown in bold.

An effective assessment and correct management of postoperative pain is important in preventing complications and increasing comfort levels.[13] Our study indicated that the mean pain score of the patents in the last 24 h was at a low level. Studies in the literature report different results for the pain levels of surgical patients as there are many influencing factors.[6,7,13] It has been found that most patients experience moderate to severe pain postoperatively.[3,6,7] We found in our study that pain levels of women were significantly higher than men and that individuals with a surgical history had significantly higher pain levels than those that did not ($p<0.05$). Acar et al.[4] too have reported that women's pain levels are higher than men's. There is no clear distinction in the literature about the reasons for the differences in the perception of pain by men and women. However, it has been asserted that the higher level of complaints of pain among women compared to men is related to satisfaction.[30] Gender roles can also affect reactions toward pain,[31] and normal hormone fluctuations in women, it is reported, can increase sensitivity toward pain.[32] If effective pain control is achieved, it is suggested, the individual's tolerance of future pain increases.[33] It was found in our study that levels of pain varied depending upon the department and that the pain levels of patients in the orthopedics department were significantly higher than in the other clinics ($p<0.05$). Çavdar and Akyüz[18] too have reported high levels of pain among patients after orthopedics, cardiothoracic and upper gastrointestinal surgery. In a study by Murray and Retief[34], it was reported that the incidence of pain in those undergoing abdominal and lower extremity surgery is high. A study by Savcı and Bilik[35] with orthopedic patients reveals that postoperatively the participants had experienced the severest pain they had ever felt and that they had difficulty moving because of their pain. In our study as well, the areas in which patients felt the most pain in the last 24 h were in the ability to walk and their general levels of activity. It was determined that the majority of the patients recovered from pain with pain treatment. It was found that the medications most used for pain control are nonsteroidal anti-inflammatory analgesics (NSAIs) and weak opioid analgesics. Other studies have reported the postoperative use of mostly NSAIs for pain control at a considerably low rate (13%), with a minimum dose

**Table 3. Correlation of patients' pain, comfort, anxiety and depression levels according to age, duration of hospitalization, postoperative hospitalization**

| Variables | Pain* | Comfort | Anxiety | Depression |
|---|---|---|---|---|
| **Age** | | | | |
| p-value | 0.151 | 0.085 | 0.881 | **0.002** |
| r | -0.092 | -0.110 | 0.010 | -0.236 |
| **Duration of hospitalization** | | | | |
| p-value | 0.010 | 0.162 | 0.168 | **0.000** |
| r | -0.152 | -0.901 | -0.088 | 0.238 |
| **Postoperative hospitalization** | | | | |
| p-value | **0.003** | 0.406 | **0.028** | **0.012** |
| r | -0.190 | 0.053 | 0.141 | 0.160 |

*Average pain in the last 24 hours.

Significant values are shown in bold.

of opioids. The use of a multimodal method was recorded as only 13%.[6,36] It was reported in another study as well that while NSAIs were preferred for treating slight pain, the opioid group of drugs were used in moderate to severe pain.[37] Considering the most recent evidence, the combined administration of analgesics with a central and peripheral effect is recommended. In this context, it is reported further that a multimodal pain management approach specific to the surgical procedure would be appropriate in improving postoperative healing.[38] Although there have been developments in the physiology and control of pain, it is reported that sufficient levels of postoperative pain control have not been achieved. Uncontrolled postoperative pain can lead to sleep problems and physical dysfunction, adversely affecting the recovery of the patient. It may in fact delay discharge from the hospital and functional healing.[9,10] Postoperative pain management requires a multidisciplinary team approach and encompasses defining and treating the pain as well as undertaking interventions for care.[15]

A patient's experiencing pain, being in the hospital and undergoing a surgical procedure are factors that have an adverse impact on comfort.[11,13] In our study, we found that the mean comfort score of our participants was at a good level. Good levels of comfort have also been reported in studies that have assessed the comfort levels of patients undergoing various types of surgery.[5,39] The most important factor impacting patients' expectations in their postoperative care is effective pain control, which in turn has a positive effect on their perception of comfort. In our study, we found that males had a higher level of comfort than females but the difference was not statistically significant ($p>0.05$). Similar results have been indicated in the literature.[26,39] The reason for the lower comfort level of female patients may stem from the higher levels of pain they were found to be experiencing.

It was observed in our study that there was no significant difference between the participants' comfort mean scores and their surgical histories ($p<0.05$). On the other hand, patients who did have previous surgical experiences were found to have higher comfort levels. Some studies have indicated positive, some have reported negative effects of surgical experience on comfort.[26,39] This suggests that individuals that have had a positive experience with surgery will tend to better manage their surgical procedure and this will therefore have a positive impact on their perceived levels of comfort. The fact that we found a negative and significant correlation between the patient's age and the tendency toward depression may be associated with the individual's coping skills. However, a positive relationship was found between the patients' duration of hospitalization and their tendency toward depression. This result may have stemmed from the failure to quickly achieve the independence of the patient, which is one of the most important outcomes expected from healthcare. Additionally, a negative, significant correlation was found between the postoperative hospitalization and pain and a positive, significant correlation between anxiety and the tendency toward depression (Table 3). Our study furthermore indicated a negative correlation between comfort and pain levels. Studies reveal inverse correlations between the severity of pain and comfort levels.[39] Findings indicating that pain is the most important parameter reducing comfort in the physical sense are supported by the results of our own study.[11] It has also been found however that anxiety is a factor that increases feelings of pain while pain in turn increases anxiety. It has been asserted that individuals who are emotionally healthy feel moderate-severe pain to a lesser extent than emotionally unhealthy individuals. It has been reported that when there is anxiety, the increase in the secretion of endorphins also affects the perception of pain.[18] In our study as well, we found a significant correlation between pain and anxiety. There was a negative, significant correlation between anxiety and comfort. In a study by Ören[2] in which the factors influencing levels of comfort and anxiety among patients who had undergone surgery were assessed, the author reported a negative and significant correlation between

comfort and anxiety. It has also been reported that anxiety is also an important factor that reduces a patient's psychospiritual comfort following surgery.[11,25]

### Limitations of the Study

This study has some limitations. The study sample comprised from two state hospital and was nonrandom; therefore, the findings are not generalizable to all patients.

## CONCLUSION

As a result, it has been determined that the pain levels of patients undergoing surgical interventions are at good levels because of the approach to pain control developed in recent years. Although patients still display slight levels of anxiety and a tendency toward depression, comfort levels have been found to be good. The patient's surgical history, age and gender affect these parameters. In the nursing care given to surgical patients, the patient should be approached with a holistic outlook and all factors adversely affecting the patient's comfort (pain, anxiety, environmental conditions, etc.) should be well managed to support the healing period. The type of surgical procedure the patient has previously undergone and particularly the patient's individual qualities should be considered in pain management. It is important that in line with evidence-based practices, the right analgesics are administered and the level of pain is assessed at appropriate intervals with a valid assessment tool. We believe that achieving pain control will make a positive contribution to the state of a patient's anxiety, depression and comfort while nursing care.

## MAIN POINTS

- Pain levels of patients undergoing surgical interventions are at good levels because of the approach to pain control.
- Although patients still display slight levels of anxiety and a tendency toward depression, comfort levels have been found to be good.
- A weak, negative correlation was found between the patients' anxiety and comfort levels while there was a weak but positive correlation between their anxiety and pain levels.
- A weak and negative correlation was found between comfort and pain levels.

### ETHICS

**Ethics Committee Approval:** Ethics committee approval was obtained with the decision dated 2017 August 01, and the protocol number of GO 2017/50265 of the Pamukkale University Non-Invasive Clinical Researches Assessment Commission to conduct the research (decision no: 2017/50265, date: 01.08.2017).

**Informed Consent:** The participants in the study were informed about the research and their written consent was taken.

**Peer-review:** Externally-peer reviewed.

### Authorship Contributions

Concept: K.K., A.S., Design: K.K., A.S., Supervision: K.K., Data Collection and/or Processing: A.S., K.K., F.K.H., Analysis and/or Interpretation: A.S., K.K., F.K.H., Literature Search: A.S., K.K., F.K.H., Writing: K.K., A.S., Critical Review: K.K., A.S.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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ORIGINAL ARTICLE

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# A Retrospective Evaluation of Suicidal and Accidental Drug Intoxication in Intensive Care Unit

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## Abstract

**BACKGROUND/AIMS:** We reviewed the demographic characteristics, causes, and prognosis of intoxication cases admitted to the intensive care unit over 3 years.

**MATERIALS AND METHODS:** The records of patients treated for intoxication in medical and surgical intensive care unit in January 2015–December 2017 were retrospectively reviewed. Age, gender, intoxicating drug, length of intensive care unit stay, need for mechanical ventilation, need for hemofiltration, and prognosis were evaluated.

**RESULTS:** A total of 3,252 patients were admitted to the intensive care unit during the study period, 202 (6.21%) of whom for intoxication. One hundred fifteen (56.9%) were females and 87 (43.1%) were males. Mean age was 32.8±13.5 years. Suicidal intent was determined in 146 (72.3%) of the cases, while 56 (27.7%) were considered accidental intoxication. The rate of intoxication with suicidal intent was 81.7% (n=71) among females, significantly higher than the rate among males. Need for mechanical ventilation was greater among those with accidental intoxication (32.1%, n=20) compared to those with suicidal intent (13.6%, n=18). The mortality rate was significantly higher among patients who required mechanical ventilation and hemofiltration ($p<0.001$ for both). While the combined drug intoxication was most common (27.7%, n=56), the antidepressants were the most common observed agents alone.

**CONCLUSION:** Although suicidal intoxication has low mortality and fair prognosis, intoxication cases still occupy a significant portion of intensive care beds.

**Keywords:** Intoxication, suicidal, drug

## INTRODUCTION

Alcohol or drug intoxication is defined by the World Health Organization as major disturbances in consciousness and vital functions because of intentional or accidental exposure to an excessive dose of a psychoactive substance.[1] Acute intoxication is among the most common causes of medical emergencies and places a substantial burden on the health system. A large proportion of the acute intoxication cases presenting to emergency departments are admitted to the intensive care unit (ICU).[2,3] In Turkey, intoxication cases comprise 0.7%–2.4% of the total number of patients presenting to emergency departments.[4,5] Intoxication cases also account for a small percentage of hospital mortalities (2.1%).[6]

In this study, we retrospectively examined the demographic characteristics, causes, and prognosis of intoxication cases admitted to ICU over a period of 3 years.

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## MATERIALS AND METHODS

The records of patients treated in the training and research hospital department of medical and surgical ICU in the years 2015–2017 were retrospectively reviewed (ethics committee approval number: 2018/0109, date: 10/04/2018). Patients admitted for drug intoxication were evaluated in terms of age, gender, intoxicating drug, comorbidities, length of ICU stay, need for mechanical ventilation, need for hemofiltration, and prognosis.

### Statistical Analysis

Statistical analyses were done using Statistical Package for the Social Sciences (SPSS) software version 20.0 (SPSS Inc., Chicago, IL, USA). The data were expressed as mean ± standard deviation or number (n) and percentage (%). Comparisons of numerical data between the two groups were done using Student's t-test, and categorical data were compared using the Pearson chi-square test. $P<0.05$ was considered statistically significant.

## RESULTS

A total of 3,252 patients were admitted to our ICU between the dates January 1, 2015 and January 1, 2018. Of these, 202 patients (6.21%) were admitted for intoxication; 115 were females (56.9%) and 87 were males (43.1%). Mean age was 32.8±13.5 years for all patients with intoxication, 33.9±15.5 years for the females and 31.2±10.0 years for the males. The rate of intoxication with suicidal intent was 81.7% (n=71) among females, significantly higher than the rate among males (59.8%, n=52) (p=0.001). Mean length of ICU stay was 2.4±1.4 (1–8) days and showed no difference based on gender. Gender was not significant associated with need for mechanical ventilation or hemofiltration or with outcomes (p=0.133, p=0.432 , p=0.701). General and gender-specific clinical characteristics of the patients and comparisons between the genders are presented in Table 1.

The majority (67.3%) of the patients were followed for 1 or 2 days, while the remaining patients were followed for 3 days or longer. A total of 38 (18.8%) patients required mechanical ventilation, and 18 (8.9%) underwent hemofiltration. The mortality rate was significantly higher among patients who required mechanical ventilation and hemofiltration (p<0.001 for both, Table 2).

Suicidal intent was determined in 146 (72.3%) of the cases, while 56 (27.7%) were considered accidental intoxication. Need for mechanical ventilation was significantly greater among those with accidental intoxication (32.1%) compared to those with suicidal intent (13.6%) (p=0.003). Intent/reason for intoxication was not significantly associated with any other parameters (Table 3). This intoxication was the second suicide attempt for 2 (1.3%) of the patients with suicidal intent, and was the first attempt for the others. Combined drug intoxication was most common (27.7%), with antidepressants being the most common single cause.

## DISCUSSION

With increasing numbers of cases worldwide, intoxication has become a major socioeconomic health problem. Intoxication cases are often admitted to emergency departments and require intensive treatment and follow-up. The National Poison Center of Turkey recommends that these patients be followed under ICU.

Our study includes patients with intoxication admitted to the ICU over a period of 3 years. Admissions due to intoxication accounted for 6.21% of all cases admitted to intensive care. In the literature, this rate varies between 4 and 20% for ICUs in Turkey.[2,7,8] Yaylaci et al.[9] reported that intoxication accounted for 8.9% of all cases admitted to the ICU.

The mean age of these patients varies between 25.2±9.9 and 35.5±16.7 years according to other Turkish publications; in our study the mean age was 32.8±13.5 years. Nearly all previous studies have indicated a preponderance of females among cases of intoxication.[4,7-9] Our analysis supported the literature, with women comprising 56.9% of our cases.

In our study, we observed that most of the intoxication were attempts to die by committing suicide, with suicidal intent significantly more common among women than men (81.7% vs. 59.8%). This is consistent with several other studies reporting higher rates of suicidal intoxication among women, at rates ranging from 60% to 77%.[10-13]

Average length of ICU stay due to intoxication varies between 2.7±1.2 and 3.7±2.05 days in the literature. In our study, mean ICU stays were 2.5±1.5 days for suicidal patients and 2.2±0.9 days for patients with accidental intoxication. Mechanical ventilation and hemofiltration were required more frequently by patients admitted for accidental intoxication than those with suicidal intent. Dağlı et al.[14] reported in their retrospective study of 87 patients that only two patients required mechanical ventilation and similarly, Totoz et al.[15] reported that eight of 66 patients needed mechanical ventilation and two underwent hemofiltration. In another study including 65 drug overdose cases, Orsini et al.[16] stated that 77% of the patients required mechanical ventilation. Brandenburg et al.[6] evaluated 7,331 patients in 81 ICUs in the Netherlands and determined an 18.9% rate of mechanical ventilation. Sorge et al.[17] reported rates of 27% for mechanical ventilation and 13.6% for hemodialysis. In this study, rates of mechanical ventilation and hemofiltration were 13.6% and 7.5% among patients admitted for intoxication with suicidal intent versus 32% and 12.5% for those with accidental intoxication, respectively.

Mortality rates were 7.5% for patients with suicidal intent and 14.3% for patients with accidental intoxication. Mortality rates reported in the literature are in the 0.1%–11% range in Turkey

**Table 1. General and gender-specific clinical data and gender-based comparisons**

| Parameter | | | Total (n=202) | Female (n=115) | Male (n=87) | p-value |
|---|---|---|---|---|---|---|
| Age (years) | | | 32.8±13.5 | 33.9±15.5 | 31.2±10.0 | 0.162 |
| Intent | Suicidal | | 146 (72.3%) | 94 (81.7%) | 52 (59.8%) | 0.001 |
| | Accidental | | 56 (27.7%) | 21 (18.3%) | 35 (40.2%) | |
| ICU stay (days) | | | 2.4±1.4 | 2.5±1.5 | 2.2±1.3 | 0.284 |
| Mechanical ventilation | | Yes | 38 (18.8%) | 22 (19.1%) | 16 (18.4%) | 0.133 |
| | | No | 164 (81.2%) | 93 (80.9%) | 71 (81.6%) | |
| Hemofiltration | | Yes | 18 (8.9%) | 11 (9.6%) | 7 (8.8%) | 0.432 |
| | | No | 184 (91.1%) | 104 (90.4) | 80 (91.2) | |
| Outcome | Discharge<br>Referral<br>Death | | 153 (75.7%)<br>30 (14.9%)<br>19 (9.4%) | 85 (73.9%)<br>19 (16.5%)<br>11 (9.6%) | 68 (78.2%)<br>11 (12.7%)<br>8 (9.1%) | 0.701 |

ICU: intensive care unit, n: number.

**Table 2. Comparison of mortality rates among patients who did and did not require mechanical ventilation and hemofiltration**

| | Mechanical ventilation | | | Hemofiltration | | |
|---|---|---|---|---|---|---|
| | Yes | No | p-value | Yes | No | p-value |
| Discharge | 19 (50%) | 134 (100%) | <0.001 | 0 (0%) | 153 (97.4%) | <0.001 |
| Death | 19 (50%) | 0 (0%) | | 15 (100%) | 4 (2.6%) | |
| Total | 38 (100%) | 134 (100%) | | 15 (100%) | 157 (100%) | |

**Table 3. Comparison of parameters between patients with accidental intoxication and intoxication with suicidal intent**

| Parameter | | Suicidal intent (n=146) | Accidental (n=56) | p-value |
|---|---|---|---|---|
| Age (years) | | 32.9±14.5 | 32.5±10.3 | 0.502 |
| ICU stay (days) | | 2.5±1.5 | 2.2±0.9 | 0.224 |
| Mechanical ventilation | Yes | 20 (13.6%) | 18 (32.1%) | 0.003 |
| | No | 126 (86.4%) | 38 (67.9%) | |
| Hemofiltration (yes/no) | Yes | 11 (7.5%) | 7 (12.5%) | 0.623 |
| | No | 135 (92.5%) | 49 (87.5%) | |
| Outcome | Discharge<br>Referral<br>Death | 111 (76.0%)<br>24 (16.5%)<br>11 (7.5%) | 42 (75%)<br>6 (10.7%)<br>8 (14.3%) | 0.851 |

ICU: intensive care unit, n: number.

and 2.8%–27% globally.[18-20] The rates in our study were higher than the average mortality rates for Turkey but comparable to global data.

Antidepressants predominate among intoxicating agents worldwide, and the situation is no different in Turkey. This is mainly because antidepressants are sold without prescription and most patients who attempt suicide by intoxication are using these medications to treat an underlying depressive mood disorder. Özayar et al.[11] reported that antidepressants were the most common intoxication agents, followed by analgesic anti-inflammatory medicines. In contrast, Dağlı et al.[14] found

that analgesics were more common than antidepressants. Özhasekener et al.[18] also determined intoxication by antidepressants as the most common, whereas Duran et al.[21] found psychoactive drugs to be the common cause. Consistent with the literature, the cases of intoxication in our study most commonly resulted from multiple drug intake, and antidepressant drugs were the most common single agents.

Intoxication is an important health and socioeconomic problem. Its incidence is steadily increasing worldwide. Treatment of these patients is particularly important because most are young and healthy, and full recovery is possible with early response and proper treatment. However, mortality and morbidity are high if the response is delayed. Therefore, individuals with intoxication must be diagnosed immediately upon admission to the emergency department and proper treatment should be initiated without delay. The drug and poison information center in Turkey operates expressly for this purpose; accessible 24 hours a day by phone, the center provides fast and easy access to information about the toxic and fatal doses, clinical symptoms after exposure, treatment, and antidotes for all drugs and poisonous substances. Our hospital also actively receives support from the poison information center; every intoxication case admitted to the emergency department is reported to the center, which provides treatment and follow-up suggestions. After the first response in the emergency department, patients with indications for critical care are admitted to the ICU for treatment. After treatment, psychiatric consultation is provided for patients admitted for suicidal intoxication, and patients are transferred to an institution with a psychiatry inpatient unit if needed.

## CONCLUSION

Intoxication is a health problem that mostly affects the young and healthy population, commonly results in admission to emergency departments and requires costly treatment in the ICU. The incidence of suicidal intoxication is rising. Most patients recover after a short follow-up period. However, for some patient's intoxication can be life-threatening and require advanced treatments.

## MAIN POINTS

- Intoxication is a frequent health problem that mostly affect young population. It increases the fullness ratio and treatment cost in ICU.
- For some patients' intoxication can be life-threatening and require advanced treatments.
- However, most of the patients recover after a short follow-up period.
- For short follow-up period, there must be an intermediate ICU at all hospitals.

## ETHICS

**Ethics Committee Approval:** This study was approved by Göztepe Training and Research Hospital Ethics Committee (approval number: 2018/0109, date: 10/04/2018).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally-peer reviewed.

### Authorship Contributions

Concept: B.Ş., İ.Ö., Design: B.Ş., İ.Ö., Supervision: B.Ş., İ.Ö., Data Collection and/or Processing: B.Ş., İ.Ö., Analysis and/or Interpretation: B.Ş., İ.Ö., Literature Search: B.Ş., İ.Ö., Writing: B.Ş., İ.Ö., Critical Review: B.Ş., İ.Ö.

## DISCLOSURES

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# Attitudes Towards the Elderly Among Medical Students and Related Factors

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## Abstract

**BACKGROUND/AIMS:** this study aimed to determine the attitudes towards elderly people and related factors among medical students.

**MATERIALS AND METHODS:** The population of this cross-sectional study consisted of 385 students in the fourth, fifth and sixth classes studying at a medical school. The questionnaire consisted of sociodemographic characteristics, the Kogan's Attitude Toward Old People Scale and the Beck Hopelessness Scale. For the analysis of the data, difference between two means, variance test, Mann-Whitney U test and Spearman Correlation Analysis was used. For statistical significance, $p<0.05$ was accepted.

**RESULTS:** The study was conducted with 324 people, the mean age was 23.3±1.4 years, 34.6% was in fourth, 32.7% was in fifth, 32.7% was in the sixth year and 55.7% was female. The mean attitude score toward the elderly was 100.7±14.4. The median value of KOGAN was higher in women than in men ($p=0.004$). There was a negative correlation ($r=-0.251$, $p<0.001$) between KOGAN and the hopelessness scores. KOGAN score of those who had a history of living with an elderly individual in a period of their life was 102.4±13.4, while it was 99.9±14.8 for others. It was 102.1±13.0 for those with a history of caring for a bed-dependent elderly person, and 100.7±14.4 for others ($p>0.05$).

**CONCLUSION:** Applications to be made to integrate medical students and elderly people and intensification of elderly care education will be effective in developing positive attitude among young people.

**Keywords:** Elderly, medical student, attitude, hopelessness

## INTRODUCTION

Aging means a person becoming dependent on others in physical, psychological, social and economic senses.[1] The elderly population is increasing both in countries around the world and in our country. It is predicted that in 2060 the elderly population will comprise 22.6% of the total population in Turkey, while it will reach 25.6% in 2080.[2] With the extension in life expectancies and increasing elderly population, elder health is encountered as a significant public health problem.

Diseases requiring attendance at health services and monitoring are observed more commonly in elderly individuals.[3] In the Turkish Incidence of Chronic Disease and Risk Factor Study, 74.1% of the population over the age of 65 in our country and 85.2% of the population over the age of 75 years were identified to have a health problem of any sort.[4] With the increase in the elderly population, the contact between elderly individuals and health workers has increased. Elderly individuals may be seen as a load by health workers due to lengthened hospital stays and difficult patient follow-up.[5] World Health Organization

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data show widespread negative attitudes toward the elderly.[6] Additionally, people may develop prejudices against aging with thoughts that it will limit freedom and the difficulties that will be experienced.[7,8] Due to all these reasons negative attitudes may be displayed toward elderly people within the health system. However, elderly individuals expect health workers to display different and positive attitudes.[9] There are many studies evaluating the attitudes of health workers and medical faculty students toward the elderly. These studies identified many factors like class, gender, living with elderly individuals and receiving geriatric training affected attitudes toward the elderly.[7,10-12]

Medical faculty studies will undertake significant duties within the health services for society in the future. Within an aging society, most groups served will comprise elderly people. With the increase in healthcare quality offered to the elderly; it is necessary to identify current attitudes toward the elderly. This study was completed with the aim of identifying attitudes toward the elderly and factors affecting this situation among students in different classes attending Çanakkale Onsekiz Mart University Faculty of Medicine. In the long term, as stated in the Pre-Graduation Medical Training National Core Education Program, in line with biopsychosocial and cultural perspectives,[13] the target is to organize new training strategies ensuring the possibility of training doctors with the development of positive attitudes toward the elderly.

## MATERIALS AND METHODS

### Type and Population of the Research

This study is cross-sectional type epidemiologic research. The population of the study comprised the fourth-, fifth- and sixth-year students receiving education in Çanakkale Onsekiz Mart University Faculty of Medicine in the 2018–2019 spring semester education-teaching period. In the 2018–2019 spring semester, there were 135 fourth year, 127 fifth year and 123 sixth year students attending Çanakkale Onsekiz Mart University Faculty of Medicine (on 05.03.2019). The aim was to reach the whole population in this study without any sample selection. During the study, 112 fourth year, 106 fifth year and 106 sixth year students, for 324 students (84.2% of the whole population), were reached. A total of 55 students could not be reached during the study period and six students did not agree to complete the questionnaire.

### Study Design

This research was completed from 1–15 April 2019 in Çanakkale Onsekiz Mart University Faculty of Medicine. With this aim, permission was granted by Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (decision no: 2019–07, date: 27.03.2019). The research data were obtained using a questionnaire. The questionnaire included 14 questions related to sociodemographic characteristics, 26 Likert-type questions for the Kogan's Attitude Toward Old People Scale (KOPS) and 20 questions for the Beck Hopelessness Scale (BHS). The fourth-, fifth- and sixth-year students from Çanakkale Onsekiz Mart University Faculty of Medicine completed the questionnaire in 15–20 minutes under observation without stating their name-surname, seated in a manner to prevent communication with each other. Fourth- and fifth-year students completed the questionnaire in classrooms in the faculty of medicine, while sixth-year students completed the questionnaire in the clinic-working area where they were employed. Participants accepting voluntary participation in the study were given information about the aim and method of the study by the researcher and provided verbal and written consent.

### Scales Used in the Research

**Kogan's Attitude Toward Old People Scale:** This was developed by Nathan Kogan in 1961. It is a 6-point Likert scale created with the aim of measuring attitudes of individuals toward the elderly. The scale contains 17 positive and 17 negative statements. Odd number questions are negative, while even number questions are positive. Negative statements are given points as 'definitely disagree 6, disagree 5, somewhat disagree 4, somewhat agree 3, agree 2, definitely agree: 1'. Positive statements are given points as 'definitely disagree 1, disagree 2, somewhat disagree 3, somewhat agree 4, agree 5, definitely agree: 6'. The scale has a point range from 34 to 204, with high points indicating positive attitude and low points indicating negative attitude.[14] Validity-reliability studies by Kılıç and Adibelli[15] in 2011 removed six items from the scale due to low correlation content and reduced the scale to 13 positive and 13 negative statements in 26 items. The point interval for the scale is 26–156. Increased total points show the individual has positive attitude toward the elderly.[15] In this study, the 26-item scale obtained after validity-reliability studies were used.

**Beck Hopelessness Scale:** This is a 20-item scale aiming to determine the expectations about the future and pessimism levels of an individual. The scale requests the person to mark 'correct' for statements that apply to them or 'incorrect' for statements that do not apply to them. The point interval for the scale is 0–20. The increase in total points shows increased hopelessness in the individual.[16] The validity-reliability studies for the scale were conducted by many researchers like Seber et al.[17] and Durak and Palabıyıkoğlu[18].

### Statistical Analysis

Data in the study were analyzed with the SPSS 20.0 statistical program software. Data are presented using number, percentage, mean, standard deviation, median, minimum and maximum values. According to the results of normal distribution tests, the parametric tests of significance of difference between two

means and variance analysis (ANOVA) tests were used and the nonparametric test of the Mann-Whitney U test was used. For the analysis of correlations of data, the Spearman correlation analysis was used in accordance with the results of the test of fit to the normal distribution. When correlation coefficients are evaluated, r=0–0.24 was weak correlation, r=0.25–0.49 was moderate, r=0.50–0.74 was strong and r=0.75–1.0 was compelling correlation. Situations with $p<0.05$ were accepted as statistically significant.

## RESULTS

The study included 324 people. The mean age of the study group was 23.3±1.4 years (median: 23, minimum-maximum: 21–29). Of participants, 34.6% were in fourth years, 32.7% were in fifth year and 32.7% were in sixth year. Among the participants, 55.7% were female, 99% were single, 64.1% had at least three people in their family, 62.7% had lived longest in provincial centers, 63.9% had a maternal education level of high school or above, and 76.8% had a paternal education level of high school or above. In terms of aging, 16.4% were unafraid of aging, 24.5% were undecided about aging and 59.1% were afraid of aging. Within the study group 10.8% had history of caring for an individual aged 65 years or older who was partly or fully bedridden. For participants, 92.6% had both parents living, and of 91.7% had parents who were living together. Of participants 33.3% had experience of living with an individual aged 65 years or older and of 43.5% lived with grandmother and grandfather, 43.5% lived with only grandmother and 12.1% lived with only grandfather. Of those with experience living with anyone aged 65 years or older, the mean duration living with the elderly person was 8.5±7 years (median: 5, minimum-maximum: 1–25) (Table 1).

Within the study group the KOPS mean points were 100.7±14.4 (median: 101, minimum-maximum: 38–156), with mean BHS points of 5.2±4.6 (median: 4, minimum-maximum: 0–19). When the BHS subdimensions are examined, mean points for the subdimension of feelings related to the future were 1.2±1.5 (median: 1, minimum-maximum: 0–5), with mean points for the loss of motivation 1.6±1.8 (median: 1, minimum-maximum: 0–8) and mean points for expectations related to the future of 1.8±1.5 (median: 2, Minimum-maximum: 0–5) (Table 2).

When sociodemographic characteristics are compared with the KOPS, there was a statistically significant difference identified for the gender variable with KOPS ($p=0.004$). For females the KOPS median value was higher compared to males. There were no statistically significant differences identified between other sociodemographic variables and the KOPS ($p>0.05$) (Table 3).

The KOPS was identified to have negative moderate correlation with the BHS total points ($r=-0.251$, $p<0.001$), negative moderate correlation with the BHS 'feelings about the future' subdimension ($r=-0.295$, $p<0.001$), negative weak correlation with the 'loss of motivation' subdimension ($r=-0.240$, $p<0.001$) and negative weak correlation with the 'expectations about the future' subdimension ($r=-0.173$, $p=0.002$). There was no statistically significant correlation determined between the KOPS and age variables ($r=0.874$, $p=0.322$) (Table 4).

## DISCUSSION

There are many studies about determining the status of attitudes toward the elderly among health workers. In validity-reliability studies by Kılıç and Adibelli[15] conducted with nurses, the KOPS mean points were identified as 97.8. In our study, the scale used in this validity-reliability study was used, and the results obtained appear to be similar. The occurrence of similar results may be explained by nurses and doctors sharing the same working environment and being in close contact with the elderly during their training. Another study of 137 nonmedical students in Konya determined mean KOPS points as 106.7.[19] In all societies the desire is that the attitude points toward the elderly be high. Additionally, considering the disease load, workers in the health sector will be in greater contact with the elderly. It is thought-provoking that health workers and students received lower points for attitudes toward the elderly than those in non-health sectors. The reason for this may be that stressful situations occurring during training and because of work difficulties affect attitudes toward the elderly or that training in the health sector about elder health is not sufficient.

Studies have identified different attitudes toward the elderly with the gender variable. Salman et al.[20] identified that male students displayed more positive attitudes toward the elderly than female students, while some studies have determined the female gender is associated with more positive attitudes toward the elderly.[11] Additionally, studies identified no correlation between the gender variable and attitudes toward the elderly.[19,20] Elbi et al.[10] in a study of 406 medical students in Manisa in 2015 identified more positive attitudes toward the elderly in females compared to males using the University of California Los Angeles (UCLA) attitude toward the elderly scale, while according to Kogan's Attitude Toward Old People Scale there were no attitude differences determined between the genders. In our study group, female gender was identified to have more positive attitudes toward the elderly. In Turkish society, when there is an elderly person in the family, the individual who cares for them most is generally female. A study in Turkey in 2005 identified that 39.5% of people caring for the elderly were daughters-in law, while 26.9% were daughters.[21] In our study, the more positive attitude identified in females may be explained by women in our society having greater contact with the elderly.

In the literature, there are studies showing there are more positive attitudes toward the elderly as class level increases.[22,23] Additionally, some studies of nursing and medical faculty

| Table 1. General features of the study group | |
|---|---|
| **Variables** | **n (%)** |
| **Gender (n=323)** | |
| Female | 180 (55.7) |
| Male | 143 (44.3) |
| **Marital status (n=324)** | |
| Single | 321 (99.1) |
| Married | 3 (0.9) |
| **Class (n=324)** | |
| Four | 112 (34.6) |
| Five | 106 (32.7) |
| Six | 106 (32.7) |
| **Number of individuals in family (n=323)** | |
| ≤3 | 116 (35.9) |
| >3 | 207 (64.1) |
| **Parents alive or not (n=324)** | |
| Both living | 300 (92.6) |
| Both dead | 0 (0.0) |
| Mother alive, father dead | 21 (6.5) |
| Father alive, mother dead | 3 (0.9) |
| **Parents living together (n=300)*** | |
| Living together | 275 (91.7) |
| Living separately | 25 (8.3) |
| **Maternal educational level (n=324)** | |
| Up to high school | 117 (36.1) |
| High school and above | 207 (63.9) |
| **Paternal educational level (n=323)** | |
| Up to high school | 75 (23.2) |
| High school and above | 248 (76.8) |
| **Location of longest habitation (n=324)** | |
| Province | 203 (62.7) |
| County/village/town/burg | 121 (37.3) |
| **Have lived in the same house as those over 65 years to date (n=324)** | |
| Yes | 108 (33.3) |
| No | 216 (66.7) |
| **Elderly people they have lived with to date (n=108)**** | |
| Grandmother-grandfather | 47 (43.5) |
| Only grandmother | 47 (43.5) |
| Only grandfather | 13 (12.1) |
| Uncle | 1 (0.9) |
| **Thoughts about aging (n=323)** | |
| Not scared | 53 (16.4) |
| Undecided | 79 (24.5) |
| A little afraid/afraid/very afraid | 191 (59.1) |

| Table 1. Continued | |
|---|---|
| **Have cared for person aged 65 years and older who was partly or fully bedbound (n=323)** | |
| Yes | 35 (10.8) |
| No | 288 (89.2) |
| n: number, %: column percentage, *: responses of participants with both parents surviving were included in calculations **: responses of participants with experience living with elderly people aged 65 years and older were included in calculations. | |

students determined the first year students had more positive attitudes toward the elderly.[10,24] In our study, though the difference was not statistically significant, sixth-year students appeared to have higher mean KOPS points compared to fourth- and fifth-year students. In our country, clinical training comes to the fore in the fourth, fifth and sixth year of medical faculty education; however, especially in the sixth year students have more interaction with patients in terms of developing doctor information and skills and effective use of their learned knowledge and skills. The occurrence of this situation may be associated with sixth-year students having slightly more interaction with elderly individuals in clinics compared to the other classes.

Ayaz Alkaya and Birimoğlu Okuyan[7] in a study determined the mean KOPS points of students at the life history of elderly individuals, caring for elderly individuals and communicating with elderly individuals every day were higher. In the literature, there are studies, which did not identify any correlation between living with elderly individuals and attitudes toward the elderly.[25,26] In our study, though the difference was not statistically significant, those living with an elderly individual in any period and those caring for an elderly person who was partly or fully bedridden were identified to have higher mean KOPS points. Considering these data, it was concluded that students who had interacted with the elderly displayed a more positive attitude toward the elderly.

In our study, when parents being alive was compared with the KOPS, those with either a mother or father who had died were determined to have slightly higher mean points. We can interpret this situation as young individuals missing their mother or father from a period of their life attempting to reduce this by displaying more positive attitudes to elderly individuals. Similarly, the group with parental education levels of high school or above were identified to have KOPS mean points that were a little higher. If we consider that the development of positive attitudes begins in the family, as family education level increases more positive attitudes may be transferred to the child.

When the literature is investigated, no research was encountered investigating the correlation between hopelessness levels of medical faculty students and attitudes toward the elderly. In our study, there was a negative moderate correlation between hopelessness and attitudes to the elderly and it was concluded that as hopelessness levels reduced, positive attitudes toward the elderly increased. Hopelessness may reduce empathy toward the elderly population. As a result, as the empathy toward the elderly reduces, positive attitudes toward the elderly may reduce.

### Limitations of the Study

This study was completed with students of a medical faculty in the clinical period; it is difficult to generalize or make interpretations for all work areas within the health system in line with the results obtained from this study. As well as being a rare study investigating the correlation between hopelessness and attitudes toward the elderly, multicentric studies with broader scope encompassing students from more than one faculty will show this correlation more clearly. Additionally, qualitative studies to be conducted about this topic will allow the possibility to investigate this correlation in detail. The results obtained in our study will be a source of guidance for future studies.

## CONCLUSION

In our study, students in the medical faculty in the clinical period were identified to have positive attitudes toward the elderly. Those living with elderly individuals in any period of their lives and those caring for partly or fully bedridden elderly individuals

| Table 2. Points for Kogan's Attitude Toward Old People and Beck Hopelessness Scale for the study group | | |
|---|---|---|
| **Variables** | **Mean ± SD** | **Median (min-max)** |
| Kogan's Attitude Toward Old People Scale (n=324) | 100.7±14.4 | 101.0 (38.0–156.0) |
| Beck Hopelessness Scale (n=322) | 5.2±4.6 | 4.0 (0.0–19.0) |
| **Subdimensions of Beck Hopelessness Scale** | | |
| Feelings about the future (n=322) | 1.2±1.5 | 1.0 (0.0–5.0) |
| Loss of motivation (n=322) | 1.6±1.8 | 1.0 (0.0–8.0) |
| Expectations about the future (n=322) | 1.8±1.5 | 2.0 (0.0–5.0) |
| n: number, SD: standard deviation, Min: minimum, Max: maximum. | | |

**Table 3. Comparison of sociodemographic characteristics with Kogan's Attitude Toward Old People Scale**

| Sociodemographic characteristics | Kogan's Attitude Toward Old People Scale | | p-value |
|---|---|---|---|
| | Mean ± SD | Median (min-max) | |
| **Gender** | | | |
| Female | 102.7±14.2 | 103.0 (66.0–150.0) | **0.004** |
| Male | 98.2±14.2 | 98.0 (38.0–156.0) | |
| **Class** | | | |
| Four | 100.4±14.6 | 102.0 (38.0–150.0) | 0.081[b] |
| Five | 98.8±14.6 | 98.0 (59.0–156.0) | |
| Six | 103.1±13.8 | 101.0 (66.0–145.0) | |
| **Number of individuals in family** | | | |
| ≤3 | 99.7±12.9 | 100.0 (66.0–145.0) | 0.349[a] |
| >3 | 101.3±15.2 | 101.0 (38.0–156.0) | |
| **Parents alive or not** | | | |
| Both alive | 100.6±14.6 | 100.0 (38.0–156.0) | 0.748[a] |
| Mother or father dead | 101.6±10.7 | 103.0 (80.0–117.0) | |
| **Parents living together*** | | | |
| Living together | 100.6±15.0 | 101.0 (38.0–156.0) | 0.999[a] |
| Living separately | 100.6±9.5 | 100.0 (85.0–119.0) | |
| **Maternal educational level (n=324)** | | | |
| Up to high school | 99.0±12.4 | 98.0 (66.0–128.0) | 0.103[a] |
| High school and above | 101.7±15.3 | 102.0 (38.0–156.0) | |
| **Paternal educational level (n=323)** | | | |
| Up to high school | 98.8±13.6 | 98.0 (66.0–130.0) | 0.186[a] |
| High school and above | 101.3±14.6 | 101.0 (38.0–156.0) | |
| **Location of longest habitation** | | | |
| Province | 100.9±15.1 | 101.0 (38.0–156.0) | 0.575 |
| County/village/town/burg | 100.4±13.1 | 100.0 (66.0–132.0) | |
| **Have lived in the same house as those over 65 years to date** | | | |
| Yes | 102.4±13.4 | 102.0 (66.0–156.0) | 0.132[a] |
| No | 99.9±14.8 | 99.5 (38.0–150.0) | |
| **Thoughts about aging** | | | |
| Not scared | 98.3±15.1 | 98.0 (64.0–156.0) | 0.123[b] |
| Undecided | 103.3±13.5 | 102.0 (75.0–150.0) | |
| A little afraid/afraid/very afraid | 100.5±14.1 | 101.0 (38.0–145.0) | |
| **Have cared for person aged 65 years and older who was partly or fully bedbound** | | | |
| Yes | 102.1±13.0 | 104.0 (73.0–126.0) | 0.568[a] |
| No | 100.7±14.4 | 100.5 (38.0–156.0) | |

Significant values are shown in bold.

SD: standard deviation, Min: minimum, Max: maximum, *: responses of participants with both parents surviving were included in calculations, p: Mann-Whitney U test, [a]: Significance of difference between two means test, [b]: Variance analysis (ANOVA) test, marital status not included in statistical analysis due to distribution of the sociodemographic variable.

were determined to have higher points for attitude toward the elderly. In the medical school education in our university, elderly health problems are explained with theoretical and practical applications with their social aspects in public health education. In clinical sciences, trainings are provided for diseases specific to old age. However, applications with the aim of integration

**Table 4. Correlation of Kogan's Attitude Toward Old People Scale with Beck Hopelessness Scale and age variable**

| | Kogan's Attitude Toward Old People Scale | |
|---|---|---|
| | r | p-value |
| **Variables** | | |
| **Beck Hopelessness Scale** | -0.251 | **<0.001** |
| **Subdimensions of Beck Hopelessness Scale** | | |
| Feelings about the future | -0.295 | **<0.001** |
| Loss of motivation | -0.240 | **<0.001** |
| Expectations about the future | -0.173 | **0.002** |
| **Age** | 0.874 | 0.322 |

Significant values are shown in bold.

r: Spearman correlation coefficient, p: statistical significance level.

between elderly people and medical faculty students and increasing the intensity of training related to elder care during education in medical faculties may contribute to the support of trainings and developing positive attitudes.

## MAIN POINTS

- When the literature is examined, this study is the only study that examines the relationship between attitudes toward the elderly and hopelessness. In the study, a negative correlation was found between hopelessness and attitudes toward the elderly.
- The median value of attitude toward the elderly is higher in women than in men. This situation is statistically significant.
- The average of attitude score toward the elderly is higher in those who live with the elderly in one period of their life compared to the others. However, there was no statistically significant difference.
- The average of attitude score toward the elderly is higher in those who have a history of caring for the elderly dependent on the bed. However, no statistically significant difference was found.

## ETHICS

**Ethics Committee Approval:** This study was approved by Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (decision no: 2019-07, date: 27.03.2019)

**Informed Consent:** Participants accepting voluntary participation in the study were given information about the aim and method of the study by the researcher and provided verbal and written consent.

**Peer-review:** Externally peer-reviewed

### Authorship Contributions

Concept: Ö.Ö., E.E., B.Y., Design: Ö.Ö., E.E., B.Y., Data Collection and/or Processing: Ö.Ö., E.E., B.Y., Analysis and/or Interpretation: Ö.Ö., E.E., B.Y., Literature Search: Ö.Ö., E.E., B.Y., Writing: Ö.Ö., E.E., B.Y., S.O., C.B., Critical Review: S.O., C.B.

## DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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# Are We Satisfied with the Umbilical Cord Clamps?

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## Abstract

**BACKGROUND/AIMS:** To determine the opinions of mothers and healthcare workers about the currently used umbilical cord clamps.

**MATERIALS AND METHODS:** In this study, 150 mothers with 0–1-month-old infants who were admitted to the university hospital were interviewed. In the survey conducted with health workers, no sample selection was made, and all midwives, nurses, and doctors (n=55) work in the field of obstetrics and pediatrics were interviewed. The surveys were prepared via literature review and taking obstetrics and pediatrics expert opinions. Satisfaction, problems, and views about the currently used umbilical cord clamps were included in the survey applied to mothers. In the survey conducted with health workers, the thoughts about the clamp and problems they had while clamping the umbilical cord were included.

**RESULTS:** When mothers' views on clamp dimensions were examined, 64.7% stated that the clamp was bigger than necessary. Among the problems related to the clamp, 53.3% of mothers were afraid of the accidental clamp slippage while taking off the baby clothes; 66.7% of the mothers stated that they would prefer a different design clamp. 54.5% of healthcare workers indicated that they had problems with clamp (slipping from hand when inserting, difficulty in locking). 74.5% responded positively about the need for a different design clamp.

**CONCLUSION:** Our observations and the results obtained from the surveys agree with the fact that parents and health personnel frequently raise doubts and problems about the traditional umbilical clamps. It may be recommended to repeat the research in different institutions by increasing the sample size and conducting research for a novel umbilical clamp design.

**Keywords:** Umbilical cord clamp, midwifery, newborn, birth

## INTRODUCTION

The umbilical cord is an essential structure with an average length of 50–60 cm and a thickness of 1–2 cm and it serves as a vital connection between the placenta and the fetus.[1] After the birth, the umbilical cord is cut after being clamped 1–2 cm above the abdominal wall under sterile conditions. The cord begins to dry immediately after birth and falls completely dry in 10–14 days.[2] The techniques used for the umbilical cord care after birth are clamping, tying with a string or ribbon, candle melting, and waiting without cutting the cord (lotus birth). The underlying logic in the cord ligation is to compress the umbilical vessels and to prevent possible bleeding until the umbilical cord dries and falls off. The history of the clamps produced for this purpose dates back to the early 60s. The conventional clamps consist of two legs  a fine-toothed clamping surface approximately 6 cm long and 4.5 cm thick (Figures 1, 2 and 3).[3-5] The most frequently observed problems by the healthcare professionals are difficulties in locking the clamp and slippage of the clamp from the hand. Some families are worried about the size and shape of the umbilical clamp, which may harm the baby. However, we could not find a study evaluating the satisfaction of healthcare workers and families with the traditional clamps in the published literature. Our study determined the opinions

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of mothers and healthcare workers about the umbilical cord clamps currently used.

## MATERIALS AND METHODS

This study was conducted in a university hospital within the period between February and July 2018. When calculating the study population and sample, we determined that the number of births in the hospital was between 350 and 400, so it was estimated that 136 samples (95% confidence interval and 5% error margin) were needed to perform the study with 90% power. The study population consists of 150 mothers with newborn babies who admitted to university hospital pediatrics and obstetrics outpatient clinics for routine control. In the survey carried out with the health personnel, we did not perform a sample selection because the number of health personnel working in the hospital was limited. All midwives, nurses, and doctors (n=55) working in pediatrics and obstetrics inpatient and outpatient clinics, delivery and operating rooms of the university hospital constituted the study population. Surveys were developed by the researchers after taking expert opinions in pediatrics and obstetrics (6 faculty members, two midwives, one nurse, one doctor). In the survey applied to mothers, we included socio-demographic data, satisfaction, opinions about the umbilical clamp and the problems encountered in the period until complete drying and fall of the umbilical cord. In the survey prepared for health professionals; socio-demographic characteristics, challenges encountered during the use of the current umbilical clamps (clamp slippage, locking, leaking problems) were investigated.

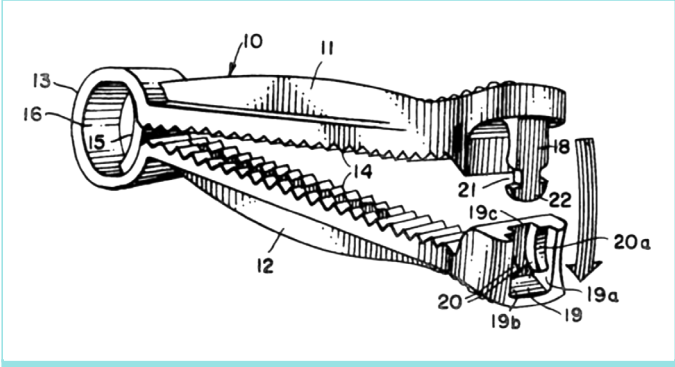


**Figure 1.** Umbilical cord clamp drawing patented by Nolan J.L in 1980 (Nolan, J.L, 1980).

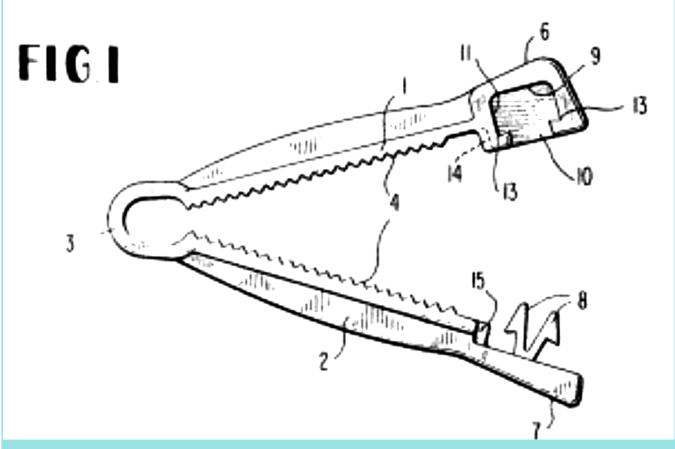


**Figure 2.** Drawing of umbilical cord clamp patented by Laugherty in 1974 (Laugherty L, 1974).

The necessary permissions for conducting the study were obtained from the Ethics Committee of Near East University (YDU/2018/55-520). The aim of the study was explained both verbally and written, and an informed consent form was obtained from the participants.

### Statistical Analysis

Data was analyzed by SPSS 21.0 (Statistical Package for Social Sciences, v. 21.0 Armonk, NY, USA). The frequency and percentage values were used to define the socio-demographic characteristics of families and health workers, and chi-square analysis was used to make comparison between groups. Mann-Whitney U and Kruskal-Wallis tests were used to compare the satisfaction scores of healthcare workers. Post hoc tests were performed for further analysis.

## RESULTS

### Findings of the Research with Mothers

The mean age of the mothers participating in our study was 31.6±5.2 (min-max: 20–44), and 44% of the mothers received undergraduate education. 70% of mothers were employed, and 90% lived in an urban area. 54% of the mothers had their first pregnancy, and 62% had their first baby, and all births occurred in the hospital. All infants' umbilical cord clamps were clamped with umbilical cord clamps.

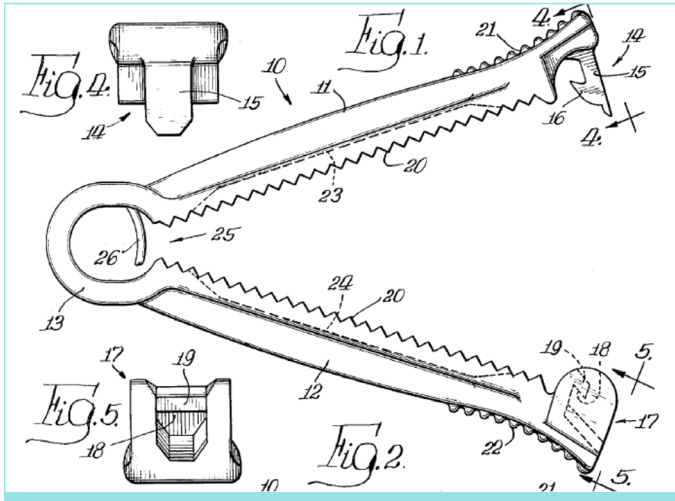


**Figure 3.** Umbilical cord clamp drawing patented in 1966 by J.D Schneider (Schneider JD, 1966).

When asked whether mothers were satisfied with the traditional clamp dimensions, 55.3% answered "No." 64.7% of the mothers stated that the clamps were larger than necessary and 53.3% of mothers experienced fears during the dressing and taking off baby's clothes. However, 36.6% of the mothers stated that they had no problems with the clamp. When the measures taken by mothers not to harm the baby's cord were examined, 35.3% reported that a cloth was wrapped around the cord to prevent harm to the baby's skin from the cornered edges of the clamp (Table 1).

Regarding the shape and size of the currently used clamps; 66.7% stated that there is a need for a different shape, 49.3% reported that they wanted the clamp to be smaller, 11.3% wanted it in oval form, and 10.6% wanted it to be produced from a softer material (Table 2).

There was a statistically significant difference between the mothers' satisfaction with the traditional clamp according to their place of residence and the number of children. 85.5% of the mothers living in the urban area (p=0.043) and 53% of the mothers with single children (p=0.030) were less satisfied with the traditional clamp than the other group (Table 3).

The mothers who tended to wrap a cloth around the cord and clamp to avoid pricking the baby's belly had high school education (p=0.001), moderate-income level (p=0.043), were living in the urban area (p=0.047), had one child (p=0.003) and were employed (p=0.045 (Table 4).

We found that mothers in the 18–23 age group experienced more problems with the clamps (p=0.021). Also, employed mothers reported more issues with the traditional clamps (p=0.029). The mothers who lived in the urban area experienced more problems with the conventional clamp than the mothers living in rural areas (p=0.026) (Table 5).

### Findings of the Research with Healthcare Professionals

The mean age of the healthcare workers was 31.4±6.1 (range: 20–59). In terms of occupational distribution, 61.8% were nurses, 25.5% were doctors, and 12.7% were midwives. While 56.4% of the health personnel had undergraduate education, the ratio of personnel with graduate education was 40%. Approximately half of the health personnel have been working for more than five years. The distribution of the working period of healthcare workers in neonatology area was as follows; 45.5% have worked for 1–5 years, 40.0% have worked for 6–11 years, and 14.5% have worked for 12 years or more.

65.5% of the respondents stated that they were not satisfied with the current umbilical cord clamp. When asked if they had any problems with the conventional clamp, 54.5% indicated that they had difficulty locking and 60% reported that clamp tend to slip from their hand while using. Also, 76.4% of the respondents stated that they observed various degrees of family anxiety until the umbilical cord dried up and fell off and 67.3% noticed that the families wrapped a fabric around the cord and clamp. 74.5% of the healthcare workers thought that they needed a different design clamp.

No statistically significant difference was found between the age, education level, occupation, total working years, and satisfaction of health workers with traditional clamp (p>0.05). A statistically significant difference was found between the duration of work and the satisfaction with the traditional clamp among personnel working in the area of neonatology. the clamp satisfaction rates of the staff whose working period is 12 years or older decreased significantly (p=0.025).

## DISCUSSION

The observations of the researchers indicate that mothers and healthcare personnel complain about some problems arising from the umbilical cord clamps and try taking some precautions during the use of the conventional clamp. The literature review conducted to determine the issues related to the use of the current umbilical clamps by mothers and health personnel, yielded no result in this area.

Because of the satisfaction surveys of the traditional umbilical cord clamp applied to the mothers, we noticed that most of the mothers perceive the umbilical clamps as big, and more than half of the them encountered problems while dressing the baby. One-third of the mothers were worried about the traditional clamp pricking the baby's belly or cause skin irritation (Table 6). In a study conducted by Jain et al.[6], it was found that breastfeeding positions were negatively affected as the mothers were worried that the clamp would prick the baby's skin.

When asked about possible design clamp ideas, two-thirds of the mothers reported that they needed a different design and nearly half of the mothers indicated that they wanted a smaller clamp. We think that the aesthetic aspect of the clamp design, which dates back to the 1960s, was not paid enough attention as it functions flawlessly. Considering that medical instruments and devices have the common goal of improving the quality of healthcare, we can say that designing a smaller and more ergonomic clamp will reduce the worries and provide more comfortable care.

The clamp satisfaction of mothers living in the urban areas and who had one child was lower than the other groups. We think that this may be due to their greater access to healthcare and education in the urban areas. The negative experience about the traditional clamp in families with fewer children may be less than in families with multiple children. Studies have found that primiparous mothers lack information about infant care, development, and diseases, and mothers' level of anxiety about infant care decreases with education and counseling provided by

| Table 1. Mothers' satisfaction and problems experienced with traditional umbilical cord clamp (n=150) | | |
|---|---|---|
| **Satisfaction and problems of mothers with traditional clamp** | **Number (n=150)** | **Percentage (%)** |
| **Traditional clamp dimensions satisfaction** | | |
| Yes | 67 | 44.7 |
| No | 83 | 55.3 |
| **Not satisfied with traditional clamp (reasons)*** | | |
| Too big | 69 | 46 |
| Worried about pricking the skin | 7 | 4.6 |
| Too rigid | 4 | 2.6 |
| Hook to the baby's clothes | 7 | 4.6 |
| Too long | 7 | 4.6 |
| May irritate the skin | 4 | 2.6 |
| **Opinions about traditional clamp sizes** | | |
| Smaller than necessary | 2 | 1.3 |
| Normal | 51 | 34 |
| Bigger than necessary | 97 | 64.7 |
| **Clamp problems*** | | |
| I had no problems | 55 | 36.6 |
| Hooking to the baby's clothes | 80 | 53.3 |
| Pricking the skin | 45 | 30 |
| Bleeding from the cord because the clamp opened | 9 | 6 |
| **Wrap something around the cord** | | |
| Wrapping | 53 | 35.3 |
| Not wrapping | 97 | 64.7 |
| *More than one answer was accepted, n: number. | | |

| Table 2. Mothers' views on a possibly different umbilical cord clamp design (n=150) | | |
|---|---|---|
| **Mothers' views on a possibly new design** | **Number (n=150)** | **Percent (%)** |
| **Current clamps need new design** | | |
| Yes | 100 | 66.7 |
| No | 50 | 33.3 |
| **How should the new design of the clamp be?** | | |
| Should close safely | 3 | 2 |
| Should be soft | 16 | 10.6 |
| Should be smaller | 74 | 49.3 |
| Should be with rounded corners | 4 | 2.6 |
| Should be thinner | 4 | 2.6 |
| Should be oval | 17 | 11.3 |
| Should be shorter | 3 | 2 |
| Other* | 18 | 12 |
| *Rope-shaped, bead-shaped, colorful, animal figured. The statements are combined as other. n: number. | | |

**Table 3. Comparison of demographic characteristics of mothers and satisfaction with the traditional clamp (n=150)**

| Socio-demographic characteristics | | Satisfaction with traditional clamp | | | $X^2$ | df | p-value |
|---|---|---|---|---|---|---|---|
| | | Total n (%) | Yes n (%) | No n (%) | | | |
| **Age** | 18–23 | 11 (7.3) | 3 (4.5) | 8 (9.6) | 5.308 | 3 | 0.151 |
| | 24–29 | 37 (24.7) | 22 (32.8) | 15 (18.1) | | | |
| | 30–35 | 68 (45.3) | 29 (43.3) | 39 (47.0) | | | |
| | 35+ | 34 (22.7) | 13 (19.4) | 21 (25.3) | | | |
| **Education** | High school | 37 (24.7) | 13 (19.4) | 24 (28.9) | 3.570 | 2 | 0.168 |
| | Undergraduate | 66 (44.0) | 35 (52.2) | 31 (37.3) | | | |
| | Postgraduate | 47 (31.3) | 19 (28.4) | 28 (33.7) | | | |
| **Employment** | Employed | 105 (70.0) | 48 (71.6) | 57 (68.7) | 0.155 | 1 | 0.693 |
| | Unemployed | 45 (30.0) | 19 (28.4) | 26 (31.3) | | | |
| **Income status** | Income less than expense | 27 (18.0) | 13 (19.4) | 14 (16.9) | 1.807 | 2 | 0.405 |
| | Income equal to expense | 86 (57.3) | 41 (61.2) | 45 (54.2) | | | |
| | Income is more than expense | 37 (24.7) | 13 (19.2) | 24 (28.9) | | | |
| **Social security** | Yes | 139 (92.7) | 60 (89.6) | 79 (95.2) | 1.728 | 1 | 0.220 |
| | No | 11 (7.3) | 7 (10.4) | 4 (4.8) | | | |
| **Place of residence** | Rural | 15 (10.0) | 3 (4.5) | 12 (14.5) | 4.103 | 1 | **0.043*** |
| | City | 135 (90.0) | 64 (95.5) | 71 (85.5) | | | |
| **Family type** | Elementary family | 131 (87.3) | 57 (85.1) | 74 (89.2) | 0.558 | 1 | 0.455 |
| | Extended family | 19 (12.7) | 10 (14.9) | 9 (10.8) | | | |
| **Number of pregnancies** | 1 | 81 (54.0) | 41 (61.2) | 40 (48.2) | 3.329 | 2 | 0.189 |
| | 2 | 43 (28.7) | 18 (26.9) | 25 (30.1) | | | |
| | 3 and above | 26 (17.3) | 8 (7.5) | 18 (16.9) | | | |
| **Number of living children** | 1 | 93 (62.0) | 49 (73.1) | 44 (53.0) | 7.007 | 2 | **0.030*** |
| | 2 | 40 (26.7) | 14 (20.9) | 26 (31.3) | | | |
| | 3 and above | 17 (11.3) | 4 (6.0) | 13 (15.7) | | | |
| **Total** | | 150 (100) | 67 (100) | 83 (100) | - | | |

Significant values are shown in bold.

*p<0.05 level of significance, n: number.

healthcare workers.[7,8] We found that approximately half of the mothers who were employed, who had lower education, and middle-income mothers were more likely to wrap the umbilical cord with a cloth. Wrapping the umbilical cord with a non-sterile fabric or drapes increases the risk of infection and adversely affects the healthy drying of the umbilical cord. The umbilical cord should be kept as dry and clean as possible. The wrapping of the cord is mostly done to prevent the traditional clamp traumatizing the abdominal skin of the newborn. This result suggests that mothers' education and income levels may adversely affect their awareness of cord care. Nearly half of the mothers who had only one child wrapped a cloth around the clamp. This is thought to be the result of mothers' concerns about baby care when they have children for the first time. Published studies determined that education level, employment, and income status were important variables affecting neonatal infant care. It was determined that prenatal health education, given to mothers expecting their first baby reduced mothers' anxiety and increased correct practices in infant care.[9-11]

We found that mothers in the younger age group experienced more problems related to the clamps and it is a fact that women who give birth at an early age are less experienced in terms of infant nutrition and care compared to older women.[12,13] Also, we found that a large proportion of women living in the urban setting had more problems with the umbilical clamp. Women living in the city do not have difficulty accessing health education, health institutions, social media, and health personnel and it can be stated that their satisfaction with cord care and clamp compared to women living in the

**Table 4. Comparison of demographic characteristics of mothers and wrapping the cord (n=150)**

| Socio-demographic characteristics | | Wrapping the cord with a cloth | | | $X^2$ | df | p-value |
|---|---|---|---|---|---|---|---|
| | | Total n (%) | Yes n (%) | No n (%) | | | |
| **Age** | 18–23 | 11 (7.3) | 7 (15.2) | 4 (3.8) | 6.711 | 3 | 0.082 |
| | 24–29 | 37 (24.7) | 11 (23.9) | 26 (25.0) | | | |
| | 30–35 | 68 (45.3) | 17 (37.0) | 51 (49.0) | | | |
| | 35+ | 34 (22.7) | 11 (23.9) | 23 (22.1) | | | |
| **Education** | High school | 37 (24.7) | 20 (43.5) | 17 (16.3) | 13.199 | 2 | **0.001*** |
| | Undergraduate | 66 (44.0) | 17 (37.0) | 49 (47.1) | | | |
| | Postgraduate | 47 (31.3) | 9 (19.6) | 38 (36.5) | | | |
| **Employment** | Employed | 105 (70.0) | 27 (58.7) | 78 (75.0) | 4.037 | 1 | **0.045*** |
| | Unemployed | 45 (30.0) | 19 (41.3) | 26 (25.0) | | | |
| **Income status** | Income less than expense | 27 (18.0) | 13 (28.3) | 14 (13.5) | 6.290 | 2 | **0.043*** |
| | Income equal to expense | 86 (57.3) | 26 (56.5) | 60 (57.7) | | | |
| | Income is more than expense | 37 (24.7) | 7 (15.2) | 30 (28.8) | | | |
| **Social security** | Yes | 139 (92.7) | 43 (93.5) | 96 (92.3) | 0.064 | 1 | 0.549 |
| | No | 11 (7.3) | 3 (6.5) | 8 (7.7) | | | |
| **Place of residence** | Rural | 15 (10.0) | 8 (17.4) | 7 (6.7) | 4.027 | 1 | **0.047*** |
| | City | 135 (90.0) | 38 (82.6) | 97 (93.3) | | | |
| **Family type** | Elementary family | 131 (87.3) | 37 (80.4) | 94 (90.4) | 2.854 | 1 | 0.091 |
| | Extended family | 19 (12.7) | 9 (19.6) | 10 (9.6) | | | |
| **Number of pregnancies** | 1 | 81 (54.0) | 18 (39.1) | 63 (60.6) | 5.964 | 2 | 0.051 |
| | 2 | 43 (28.7) | 17 (37.0) | 26 (25.0) | | | |
| | 3 and above | 26 (17.3) | 11 (23.9) | 15 (14.4) | | | |
| **Number of living children** | 1 | 93 (62.0) | 20 (43.5) | 73 (70.2) | 11.649 | 2 | **0.003*** |
| | 2 | 40 (26.7) | 16 (38.4) | 24 (23.1) | | | |
| | 3 and above | 17 (11.3) | 10 (21.7) | 7 (6.7) | | | |
| **Total** | | 150 (100) | 46 (100) | 104 (100) | | | |

Significant p-values are shown in bold

*p<0.05 level of significance, n: number.

rural areas was because of their increased awareness of care. In addition to the problems experienced by the families regarding the clamp, we observed that the healthcare workers experienced some problems (difficulty in locking the clamp, slipping from hand when inserting, spontaneous clamp opening and cord bleeding) in the clinic. More than half of the healthcare staff reported that they unsatisfied with the traditional clamp dimensions and the majority stated that the clamps tended to slip from their hands while applying. Additionally, a significant portion of the health team stated that the families were worried until the umbilical cord fell off and that most of the families tended to wrap something around the cord and clamp. Most of the healthcare personnel agreed to need in a different design.

Our findings suggest that healthcare personnel experienced similar problems to those we have observed during our practice. We also found that the satisfaction of more experienced healthcare personnel in the area of neonatology was significantly lower.

## CONCLUSION

The currently used umbilical cord clamps were designed to provide secure clamping of the cords of various thicknesses and apparently the appearance and size of the clamp were not considered a priority compared to its functionality. However, our observations and the results obtained from the surveys agree with the fact that parents and health personnel frequently raise doubts and experience problems about the traditional clamps.

**Table 5. Comparison of mothers' demographic characteristics with their problems with traditional clamps (n=150)**

| Socio-demographic characteristics | | Problems with the clamp** | | | $X^2$ | df | p-value |
|---|---|---|---|---|---|---|---|
| | | Total n (%) | Yes n (%) | No n (%) | | | |
| Age | 18–23 | 11 (7.3) | 11 (12.2) | 0 (0.0) | 9.713 | 3 | **0.021*** |
| | 24–29 | 37 (24.7) | 22 (24.4) | 15 (25.0) | | | |
| | 30–35 | 68 (45.3) | 41 (45.6) | 27 (45.0) | | | |
| | 35+ | 34 (22.7) | 16 (17.8) | 18 (30.0) | | | |
| Education | High school | 37 (24.7) | 26 (28.9) | 11 (18.3) | 2.557 | 2 | 0.279 |
| | Undergraduate | 66 (44.0) | 39 (43.3) | 27 (45.0) | | | |
| | Postgraduate | 47 (31.3) | 25 (27.8) | 22 (36.7) | | | |
| Employment | Employed | 105 (70.0) | 57 (63.3) | 48 (80.0) | 4.762 | 1 | **0.029*** |
| | Unemployed | 45 (30.0) | 33 (36.7) | 12 (20.0) | | | |
| Income status | Income less than expense | 27 (18.0) | 16 (17.8) | 11 (18.3) | 0.830 | 2 | 0.660 |
| | Income equal to expense | 86 (57.3) | 54 (60.0) | 32 (53.3) | | | |
| | Income is more than expense | 37 (24.7) | 20 (22.2) | 17 (28.3) | | | |
| Social security | Yes | 139 (92.7) | 85 (94.4) | 54 (90.0) | 1.046 | 1 | 0.349 |
| | No | 11 (7.3) | 5 (5.6) | 6 (10.0) | | | |
| Place of residence | Rural | 15 (10.0) | 13 (14.4) | 2 (3.3) | 4.938 | 1 | **0.026*** |
| | City | 135 (90.0) | 77 (85.6) | 58 (96.7) | | | |
| Family type | Elementary family | 131 (87.3) | 81 (90.0) | 50 (83.3) | 1.446 | 1 | 0.229 |
| | Extended family | 19 (12.7) | 9 (10.0) | 10 (16.7) | | | |
| Number of pregnancies | 1 | 81 (54.0) | 47 (52.2) | 34 (56.7) | 3.994 | 2 | 0.136 |
| | 2 | 43 (28.7) | 23 (25.6) | 20 (33.3) | | | |
| | 3 and above | 26 (17.3) | 20 (22.2) | 6 (10.0) | | | |
| Number of living children | 1 | 93 (62.0) | 55 (61.1) | 38 (63.3) | 2.367 | 2 | 0.306 |
| | 2 | 40 (26.7) | 22 (24.4) | 18 (30.0) | | | |
| | 3 and above | 17 (11.3) | 13 (14.4) | 4 (6.7) | | | |
| Total | | 150 (100) | 90 (100) | 60 (100) | | | |

*p<0,05 level of significance, **Irritation, pricking, hooking to the clothes.

n: number.

## MAIN POINTS

- Conventional design umbilical cord clamps are being used for a long time without a major change in the design. Families and health professionals frequently express concerns about the problems they experience with the clamp.
- Most of the families stated that the clamp was hooked by the baby's clothes and they were afraid that the umbilical cord would break off.
- Health professionals mostly stated that the clamp tend to slip from their hands during application.
- Both families and health professional emphasized the need for a different umbilical cord clamp design.

## ETHICS

**Ethics Committee Approval:** This study was approved by Near East University Ethics Committee (YDU/2018/55-520).

**Informed Consent:** The aim of the study was explained both verbally and written, and an informed consent form was obtained from the participants.

**Peer-review:** Externally peer-reviewed

### Authorship Contributions

Concept: B.M., G.V., Design: B.M., G.V., Data Collection and/or Processing: B.M., G.V., Analysis and/or Interpretation: B.M., G.V., Literature Search: B.M., G.V., Writing: B.M., G.V., Critical Review: B.M., G.V.

**Table 6. Satisfaction of healthcare personnel with traditional umbilical cord clamps (n=55)**

| Traditional health professionals clamping opinions | | Number (n=55) | Percent (%) |
|---|---|---|---|
| **Satisfied with the clamp dimensions** | Yes | 14 | 25.5 |
| | No | 36 | 65.5 |
| | Undecided | 5 | 9 |
| **Encountered a problem with the clamp** | Yes | 30 | 54.5 |
| | No | 21 | 38.2 |
| | Undecided | 3 | 7.3 |
| **Clamp tends to slip from hand while clamping** | Yes | 33 | 60.0 |
| | No | 13 | 23.6 |
| | Undecided | 9 | 16.4 |
| **Families are worried until the clamp falls off** | Yes | 42 | 76.4 |
| | No | 5 | 9.1 |
| | Undecided | 8 | 14.5 |
| **Families wrap the cord and the clamp** | Yes | 37 | 67.3 |
| | No | 11 | 20.0 |
| | Undecided | 7 | 12.7 |
| **We need a different design** | Yes | 41 | 74.5 |
| | No | 4 | 7.3 |
| | Undecided | 10 | 18.2 |

n: number.

**DISCLOSURES**

**Conflict of Interest:** The authors declare no conflict of interest.

**Financial Disclosure:** The authors declare that this study received no financial support.

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# Validity and Reliability of Turkish Version of the Self-Awareness of Falls in Elderly Scale Among Elderly Inpatients

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## Abstract

**BACKGROUND/AIMS:** This research was conducted methodologically to assess the Turkish adaptation, validity, and reliability of the Self-Awareness of Falls in Elderly (SAFE) Scale.

**MATERIALS AND METHODS:** This methodological study was conducted with 346 elderly individuals who received inpatient treatment in the hospital. Demographic Characteristics Questionnaire and the Awareness of Falls in Elderly Scale were used as data collection tools.

**RESULTS:** The average age of elderly individuals is 71.20±5.8, they have at least one chronic disease, 19.2% of them have dropped at least once in the past year, and 36.7% are afraid of falling. Language adaptation of the scale was provided using the translation and back translation method. Ten experts' opinions were taken for content validity and Content Validity Index was found to be 0.942. Because of factor analysis, it was found that the scale obtained in the Turkish adaptation consisted of 21 items and 4 sub-dimensions, the items formed in the sub-dimensions of the scale showed a different structure from the original scale. The reliability of the scale was examined by internal consistency and stability (test-retest). The internal consistency Cronbach's Alpha coefficient of the scale was calculated as 0.811.

**CONCLUSION:** As a result, the scale obtained because of the Turkish adaptation study of the SAFE scale is a valid and reliable measurement tool.

**Keywords:** Nursing, falls in elderly, scale, self-awareness, elderly inpatients, validity and reliability

## INTRODUCTION

Falling is the main reason for unintentional injury around the world.[1] Falling is an important geriatric problem not only due to its prevalence but also because of its consequences.[2] Even small-scale falls may lead to injuries and disabilities, which negatively affect the health and independence of the elderly, and by 12.1% to fatal injuries.[3] Falling is the most common type of accident among people more than 65 and may result in death, hospitalization, disability, loss of independence and fear of falling which may also cause a limitation of physical activities.[4] One-third of people aged greater than 65 falls every year and half of the them experience recurring falls. Furthermore, people who fall more than once are under the highest risk of injury and falling.[5] Rate of falls per year among elderly people more than 65 is 32%–42%, while this rate is 50% for people above 85.[6] Moreover, it is estimated that the global rate of falls within the total hospital death rate has risen by 114.3% while the rate of falling related deaths in total deaths increased by 43.1%.[7]

Falling is a patient security problem that occurs mostly to hospitalized elderly patients and has costly medical, social and

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economic consequences.[1,4,8] Thus, it is clinically vital to prevent elderly patients from falling. Studies have confirmed various objective risk factors including personal characteristics (i.e.; age, gender, marital status, and education), medication, physical functions, cognitive behavior, and environmental factors.[9] Generally, more than one reason is responsible for falling in the elderly individuals. The factors that are proved to be risky according to research are; being over 65 years old, prior history of falling, fear of falling, being female, living alone, having lower limb prostheses, using a walking aids, wearing slippers, medical conditions (stroke, Parkinson's, incontinence, acute diseases, arthritis, feet problems, dizziness, syncope, orthostatic hypotension, vitamin D deficiency, depression, diarrhea, chronic pain, sleeplessness, vascular diseases), changes in blood glucose level, cognitive disorders, executive function disorders, medication (benzodiazepine, antihypertensive, psychoactive medications), polypharmacy (actively using more than 4 medications), sarcopenia, fragility, having weak lower limbs, walking disorders, limited daily life activities, sedentary life style, visual impairment,[10] balance disorders, slippery floor, having no sturdy handles to hold on to in toilet and next to bed, wobbly IV poles, high platform beds, objects around that are not fixed.[8,11] In the study by Fernández et al.[12], using hypnotic, sedative, diuretic and opioids and also polypharmacy were risk factors in the elderly, especially among female population. Hignett et al.[13] analyzed US national incident data and concluded that the factors that cause falls in inpatients include dizziness, vision, and hearing disorders and medication. In their study, Li et al.[14] found that the main risk factors resulting from fall-related injuries are internal factors, not situational or environmental risk factors. In a systematic research done between 1995 and 2010, 87 studies were analyzed and according to the results of this study, it was determined that fractures in every part of the body were common, yet most of the fractures were observed in pelvis.[15] The results of this study create significant awareness in the evaluation of fall risk factors of elderly patients.

Realizing the risks before elderly patients fall and arrangements toward prevention must have high priority.[8] Falls risk factors should be considered discretely for each older patient and it must be ensured that elderly patients take measures against falls themselves. Patients with a low awareness of falls risk may overlook related risks and fail to follow prevention strategies as well. Thus, in addition to the objective assessment of falls risk, evaluating the awareness of a patient toward falls risks by care personnel may actively help prevent falls during clinical care. In this respect, it is vital to help elderly patients gain awareness toward falls.[16,17] It is expected that patients who are aware of fall risks and behaving accordingly will decrease the rate. While helping elderly patients realize factors that cause falls through an accurate measurement tool and raising their awareness on falls risks, topics that they should pay attention to will also be specified.[16] Additionally, many scales such as St. Thomas Risk Assessment Tool in falling elderly inpatients (STRATIFY), Hendrich fall risk model II (HFRM) and Morse Fall Score (MFS) was used to determine falls risk during clinical care and evaluate the group at highest possible level. These tools assess falls in multiple places and can assess falls risk in elderly inpatients and determine risks.[18] However, these tools are used in accordance with the views of care personnel; as a result, individual perception of falls in the elderly inpatients are not taken into consideration. Commitment to falls prevention strategies by elderly people who have an awareness of falls risk is higher;[19] yet, few scales analyze subjective fall risks. Hence, there is a need for developing an appropriate tool to assess falls risk in elderly patients. This study adapts the Self-Awareness of Falls in Elderly Scale (SAFE) developed by Shyu et al.[16] which can determine self-awareness of elderly patients on falls into Turkish, and to analyze its reliability and validity. In tandem with other falls risk assessment methods, the SAFE scale could assist in raising awareness against falls risk of elderly inpatients and determining high-risk groups. This study was conducted to determine the validity and reliability of the SAFE scale for Turkish society.

### Research Questions

1. What is the reliability coefficient of the Turkish version of the SAFE scale?
2. Is the confirmatory factor analysis compatible with the pre-factor structure?
3. Is the SAFE scale suitable for determining Turkish elderly individuals' risk of falling risks?

## MATERIALS AND METHODS

The research is methodological and descriptive. It was conducted between July-December 2019. The sample has more than 10 times the number of 21 items[20,21] and consists of 346 patients. The sample of the research were selected, via improbable sampling,[20,21] out of volunteer patients aged 65 and older, with at least one chronic disease, without cognitive disabilities or any other conditions that may cause difficulty in understanding the questions.[8,16] Patients with at least one chronic disease were included in the sampling, since elderly patients with chronic disease were more likely to be hospitalized and had a risk of falling. The study of medical and surgical clinic was conducted in a public hospital in western Turkey.

### Data Collection Tools

In data collection, a demographic questionnaire and "the SAFE scale" was used.

Demographic Information Questionnaire includes questions on the patients' age, gender, marital status, financial information, social security, chronic diseases, education, reason for

hospitalization, prior history of fall, and history of falls in the last one year and the fear of falling.[8,16] "Patients with at least one chronic disease were included in the sampling, since elderly 42 patients with chronic disease were more likely to be hospitalized and had a risk of 43 falling" sentence has been added.

The SAFE scale was developed in Northern Taiwan by Shyu et al.[16] in 2018 to measure the awareness and risk measures of elderly patients about fall risk factors. The original language of the scale is English and consists of 21 items in four sub-dimensions that are awareness of activity safety and environment, awareness of physical functions, awareness of medication, awareness of cognitive behavior. The scale has a 5-point Likert, one being the lowest, 5 as the highest point. The maximum total point is limited to 105, while the lowest total result can be 21. High results of the scale show that elderly patients are highly aware of the risk factors associated with falling and take precautions. In the original of the scale, Cronbach Alpha coefficient is $\alpha$=0.81. In the four sub-dimensions, $\alpha$=0.85, $\alpha$=0.86, $\alpha$=0.92, and $\alpha$=0.70, respectively, indicating adequate internal consistency across items. The Content Validity Index is 0.83, test-retest correlation is r=-0.71 ($p<0.001$).[16]

### Application of Data Collection Tools

The initial application of the study was conducted on 91 patients. Because there were no changes made in data collection tools, the patients who attended the initial application were added to the sample size. Research data was collected between July-November 2019 in the hospital through face-to-face interviews from 346 patients. In the context of the study, after the patients were informed about the purpose of the study and their verbal consent was acquired, Demographic Information Questionnaire and the SAFE scale were applied. For each patient, the average duration of filling data collection forms was 30 min. The data were collected by the researcher. It was confirmed by their caregivers to describe the reliability of the patient's responses. The meeting was held in a safe, comfortable, and undisturbed environment.

Translation-retranslation method was used to determine language validity. Scale was initially translated from English to Turkish by five experts separately. The translations were examined by the researchers and a draft form of the scale were obtained. After the translation, the draft was translated back to English by two experts separately. The original scale and retranslation were compared, and necessary changes were made to obtain the final scale. After the completion of translation and retranslation of the form, it was submitted to 10 experts who work on falls in the elderly for content validity. Content Validity Index (CVI) was implemented to evaluate expert opinions. CVI assessment criteria are; 1- not appropriate, 2- not at acceptable level (items must be revised to increase appropriateness), 3- fairly appropriate (minor changes are needed), and 4-highly appropriate.[20,21] At the end of grading, content validity index (CVI) was calculated. According to expert opinions, CVI for the items returned 0.942. Construct validity of the study was determined using exploratory and confirmatory factor analysis. Turkish adaptation of the form was reorganized according to expert opinions and initial trial was conducted on 91 elderly patients outside the actual sampling population.

The reliability study for the research was accomplished through internal consistency and test-retest application.[22] To assess time invariance of the scale, a test-retest analysis was applied to 91 patients after a period of 3 weeks.[20,21]

### Ethics

Before starting the study, the necessary permissions were obtained from the researcher who developed the original scale for the use permit of the scale, in a public hospital and the Provincial Health Administration in western Turkey. Ethics committee approval was obtained from Muğla Sıtkı Koçman University Human Research Ethics Committee on 07.02.2019, protocol no: 190023/decision no: 23. Additionally, the purpose of the study was explained to the elderly individuals and their relatives, and their verbal consent was obtained.

### Statistical Analysis

The analysis for the study was conducted using IBM SPSS V25 and IBM SPSS AMOS software packages. Language and content validity was calculated to ensure the validity of the scale. An item analysis was conducted, and Pearson Moment Correlation coefficients were calculated for item-total scores to evaluate internal consistency of the scale. Test-Retest method was implemented to determine whether results would remain unchanged and, Cronbach's Alpha coefficient and internal consistency (item total correlation scores) were calculated to evaluate the validity of the scale.[23] To determine whether the data obtained in the study are compatible with factor analysis, Bartlett and Kaiser-Meyer-Olkin (KMO) tests were applied. Bartlett Sphericity (chi-square) was used to evaluate the suitability of parametric methods on the data.[24] To determine the number of factors in the study, eigenvalues and scree plot were implemented on items. While principal components factor analysis was used to explain the factor structure, Varimax was chosen as the rotation method. Confirmatory factor analysis was performed to evaluate the scale structure. Modification indices in obtaining the suitable model are as the following: $X^2$/SD, RMSA, GFI, AGFI, NFI, TLI, PNFI, PCFI, and CFI.[23] The level of significance was set at $p<0.05$.

## RESULTS

### Findings Related to Demographic Information of Patients

Of the patients who took part in the survey, 54.3% are females with an average age of 71.20±5.8, 45.1% are married, 55.6% have

a balanced financial situation, and 89.6% have social security. Moreover, 83.2% of elderly patients were hospitalized for medical treatment and have at least one chronic disease, 26% of which are related to neurological, 23.2% of them to cardiovascular, and 19.2% to respiratory system disorders. It was seen that 19.2% of the elderly have fallen at least once in the past year and 36.7% have a fear of falling.

### Evaluation on Construct Validity of the SAFE Scale

Exploratory and confirmatory factor analysis was used to evaluate the construct validity of the SAFE scale, which was developed by Shyu, et al.[16], consisting of 21 items under four sub-dimensions.

### Evaluating Exploratory Factor Analysis Results of the SAFE Scale

For the structure validity of the scale, initially an exploratory factor analysis was implemented.[23] In factor analysis, the factors with an eigenvalue of one and over were studied. Before statistical analysis, KMO value and Bartlett sphericity test results were evaluated for the sufficiency of the sampling. Because of exploratory factor analysis, KMO value for the scale returned as 0.771 and Bartlett sphericity test results were found as $X^2$=1,965,395, p<0.001. A high Kaiser-Meyer Olkin value means that each variable in the scale can be predicted accurately by other variables.[23] It was concluded that a sufficient structure for factor analysis was accomplished, considering KMO value of 0.771. Cronbach's Alpha value was calculated as $\alpha$=0.811.

While using principal components factor analysis for factorability to explain factor structure of the SAFE scale, Varimax, which is the best method to explain variance, was chosen as the rotation method. Table 1 displaying eigenvalues and variance percentage and scree plot graph is given below.

According to the results of exploratory factor analysis, while the first factor can explain 21.791% of the total variance, the second factor can explain 10.613%, the third factor 9.756%, and lastly the fourth factor can explain 6.155% of the total variance. Thus, it is seen that four factors with eigenvalues more than one of 21 items explain 48.316% of the total variance. Factor structures are illustrated through scree plot (Figure 1).

The distribution of the items forming the four factors in the original structure of the SAFE scale was evaluated. A rotated component matrix was used to determine which factors correlate strongly with items. At the end of the evaluation, it was observed that the decomposition of items followed the criteria (Table 2).

It was seen that there are structural differences within results compared to the original structure of the SAFE Scale (Table 3). Emerging factors were named with the help of Activities of Daily Living model by Roper, Logan, Tierney.[25] New sub-dimensions formed through factor analysis that are; Activity Safety has six items, Awareness of Physical Functions and Medication consists of seven, Habits and Environmental Awareness is comprised of four, and Cognitive Behavior Awareness sub-dimension has four items (Table 3).

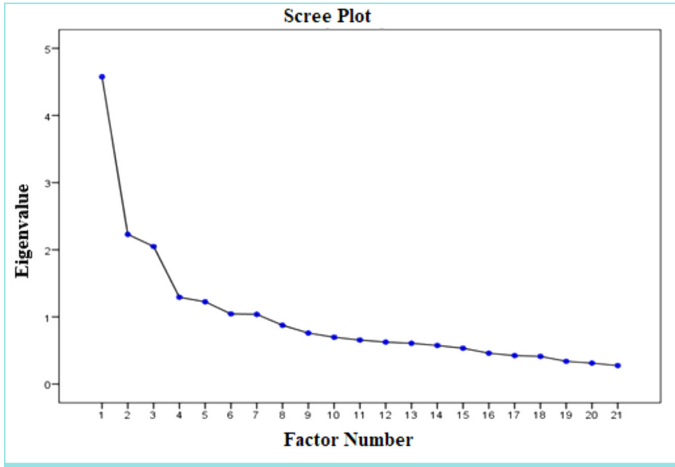


**Figure 1.** Scree plot of SAFE Scale on the elderly (n=346)
SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

Sub-dimensions of the SAFE scale and item total correlation scores are given in Table 4. When the sub-dimensions of the SAFE scale are evaluated, correlation values of F1 sub-dimension are found to be between 0.340–0.541, correlation values for F2 sub-dimension returned between 0.294–0.363, for F3 sub-dimension the values are between 0.355–0.641 and finally for F4 sub-dimension, the values range between 0.335–0.453 (p<0.001).

### Findings Related to Time Invariance of the SAFE SCALE

Time invariance was determined by reapplying the scale to 91 individuals who accepted reapplication, 21 days after the initial questioning under similar conditions. In the analysis, it was found that two measurements have a strong relationship between (r=0.575, p<0.001) and the scale results do not differ in time.

### Findings on the SAFE Scale Confirmatory Factor Analysis

Confirmatory factor analysis was conducted to confirm the suitability of factors obtained from exploratory factor analysis of the SAFE Scale structural validity. At the end of the validity study of the scale carried out in Turkey within a theoretical framework, the model of this structure, which consists of 21 items and four sub-dimensions, was assessed with factor analysis. Findings on confirmatory factor analysis are given in Figure 2.

According to the results of CFA conducted for the construct validity of the measurement tool, $X^2$/SD, which displays the goodness of fit, were calculated as CMIN/df=2.058, RMSEA=0.055, GFI=0.918, AGFI=0.899, NFI=0.827, TLI=0.877, PNFI=0.666, PCFI=0.725, and CFI=0.901. $X^2$/degree of freedom was found to be significant with the value of 2.058. When the values obtained

from goodness of fit indicators were studied, it was found that the new scale with 4 sub-dimensions proves an acceptable fit (Table 5).

In the study, it was seen that there is a strong relationship between two measurements (r=0.575, p<0.001) and the scale is time invariant (Table 6).

## DISCUSSION

This is a study for the validity and reliability of Turkish language adaptation of the SAFE Scale which was developed by Shyu et al.[16] originally in English to analyze falls risk awareness in the elderly patients. The SAFE scale components that are the critical characteristics of falls risk in the elderly consist of four factors:

**Table 1. Factor structure of the SAFE Scale (n=346)**

| Factor | Eigenvalue | Variance percentage | Total variance percentage |
|---|---|---|---|
| Factor 1 | 4.576 | 21.791 | 21.791 |
| Factor 2 | 2.229 | 10.613 | 32.405 |
| Factor 3 | 2.049 | 9.756 | 42.161 |
| Factor 4 | 1.293 | 6.155 | 48.316 |

SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

**Table 2. Rotated component matrix for the SAFE Scale (n=346)**

| Items | | | Components | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| Activity Safety F1 | 3 | Stacking things by or on the bed makes them easier to retrieve. | 0.742 | 0.012 | 0.024 | 0.108 |
| | 1 | I sit down to take rest when feeling uncomfortable. | 0.703 | 0.081 | 0.108 | 0.008 |
| | 2 | Whether handrails are installed in the bathrooms or restrooms does not affect me. | 0.702 | 0.257 | 0.021 | -0.021 |
| | 4 | I walk by the wall in crowded environments. | 0.684 | 0.083 | 0.056 | 0.364 |
| | 5 | When the floor is wet, I walk carefully so I will not fall down. | 0.602 | -0.124 | 0.076 | 0.419 |
| | 11 | I use a walker to prevent myself from falling when I get up and begin my day. | 0.259 | 0.164 | 0.035 | 0.069 |
| Awareness of Physical functions and medication F2 | 13 | Although I have difficulty in hearing, it does not cause me to fall. | 0.009 | 0.668 | -0.025 | 0.029 |
| | 12 | Although I have poor eyesight, it does not cause me to fall. | 0.003 | 0.663 | -0.047 | 0.211 |
| | 15 | I know whether the daily medications I take can make falls more likely. | 0.172 | 0.574 | 0.197 | -0.078 |
| | 14 | Although I do not sleep well at night, lack of sleep does not cause me to fall. | -0.060 | 0.550 | -0.035 | 0.321 |
| | 16 | I have to take more than four types of medication every day, but they do not make falls more likely. | -0.020 | 0.533 | 0.363 | 0.088 |
| | 10 | Although I get dizzy sometimes, it does not cause me to fall. | 0.128 | 0.465 | -0.041 | 0.082 |
| | 9 | Although my steps are unstable. I do not fall when I get up from bed and walk to the restroom if I hold on to something. | 0.207 | 0.455 | 0.083 | 0.018 |
| Awareness of Cognitive Behavior F4 | 19 | I tend not to bother others when I need to use the restroom at night. | -0.046 | -0.025 | 0.818 | 0.133 |
| | 18 | I do not like to bother nurses. | -0.031 | -0.008 | 0.760 | 0.097 |
| | 20 | I think I am not likely to fall. | 0.312 | 0.154 | 0.657 | -0.040 |
| | 21 | Although I am getting older, I will not fall as long as I am careful. | 0.315 | 0.040 | 0.548 | -0.187 |
| Habits and Environmental Awareness F3 | 8 | I wear slip/fall-preventing footwear. | 0.199 | 0.232 | 0.054 | 0.752 |
| | 7 | I leave on a small lamp at night while asleep. | 0.266 | 0.228 | -0.063 | 0.707 |
| | 6 | I sit on the bed for 10 minutes after waking up every morning before I get up and begin the day's activities. | 0.520 | -0.054 | 0.090 | 0.556 |
| | 17 | Although the medications I take are likely to cause falls, I will not fall because I am used to them. | -0.112 | 0.297 | 0.376 | 0.432 |

SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

**Table 3. Comparison of factor structures between the SAFE scale and its Turkish adaptation (n=346)**

| Original sub-dimensions of SAFE scale | The items of the original sub-dimensions of SAFE scale | Sub-dimensions of the Turkish adaptation of SAFE scale | Items from the sub-dimension of the Turkish adaptation of SAFE scale |
|---|---|---|---|
| Activity safety and environmental awareness (Factor 1) | 1,2,3,4,5,6,7,8 | Activity safety (Factor 1) | 1,2,3,4,5,11 |
| Awareness of physical functions (Factor 2) | 9,10,11,12,13,14 | Awareness of physical functions and medication (Factor 2) | 9,10,12,13,14,15,16 |
| Medication awareness (Factor 3) | 15,16,17 | Habits and environmental awareness (Factor 3) | 6,7,8,17 |
| Cognitive behavior awareness (Factor 4) | 18,19,20,21 | Cognitive behavior awareness (Factor 4) | 18,19,20,21 |

SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

activity safety and environmental awareness, physical function awareness, awareness of medication and awareness of cognitive behavior. After ensuring language validity, expert opinions were gathered from ten experts through Davis technique and as a result, CVI value which is expected to be above 0.80 was calculated as 0.942. This figure was found as acceptable in the literature.[26] Because of content validity, it was found that the language structure of the SAFE scale which was interpreted into Turkish is comprehensible and has suitable content.

EFA was conducted for the construct validity of the scale and factors with an eigenvalue of 1 and higher were interpreted. According to EFA results, it was determined that 21 scale items with eigenvalues greater than 1 comprise of four factors, explaining 48.316% the of total variance. In the original scale model, based on the model structure, four factors together constituted 61.15% of the variance.[16] When determining the factors, a meaningful interpretation was expected and achieved by loading at least two variables onto one factor.[22,27] High levels of explained variance is an indicator that it measures the concept or the construct effectively and it was seen that the variance in the scale is sufficient.[22] It was found that the acceptance level of items in the factor is high, thus no items needed to be removed from the scale because none of the items had a load value below 0.259 (Table 2). A high level of item acceptance in the factor, or the difference between load values of the item on two or more factors being below 10% should be considered when evaluating item-factor relationship.[24]

Another factor analysis method which was used as a validity criterion; EFA is a process that determines whether the items in the scale will group under different dimensions.[20] According to the results of exploratory factor analysis, items in the original SAFE Scale developed by Shyu et al.[16], matched with 21 items in four sub-dimensions in the Turkish adaptation of the scale and proved to explain 48.316% of the total variance. Similar to the original study in which the scale was developed, adapted scale proved a good fit level. However, a difference in the factor pattern was detected (Table 3). It can be assumed that the scale, created as an adaptation to Turkish, was formed as a distinctive scale. It is common for scales to vary in construct validity analysis when they are applied in different countries or

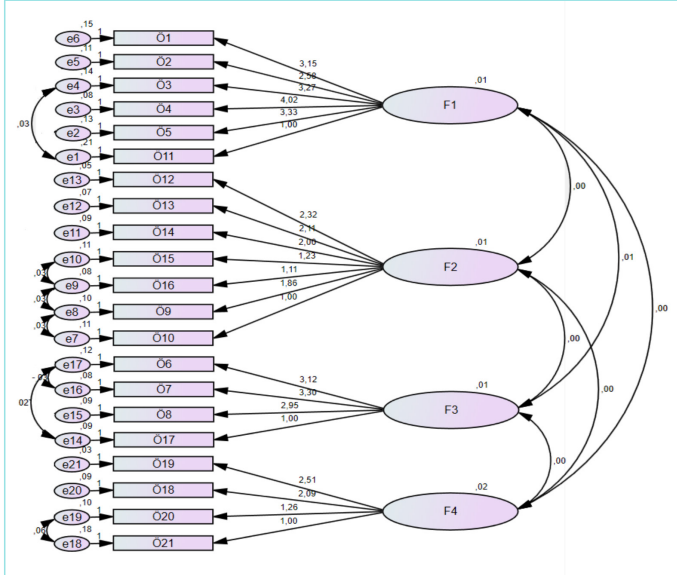


**Figure 2.** SAFE Scale confirmatory factor analysis distribution (n=346).

SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

**Table 4. The SAFE Scale sub-dimensions and item total correlation scores (n=346)**

| Items | Item-sub dimension score correlations | Sub-dimension score- scale score correlations |
|---|---|---|
| Stacking things by or on the bed makes them easier to retrieve. | 0.541** | 0.859 |
| I sit down to take rest when feeling uncomfortable. | 0.526** | |
| Whether handrails are installed in the bathrooms or restrooms does not affect me. | 0.512** | |
| I walk by the wall in crowded environments. | 0.637** | |
| When the floor is wet, I walk carefully so I will not fall down. | 0.544** | |
| I use a walker to prevent myself from falling when I get up and begin my day. | 0.340** | |
| Although I have difficulty in hearing, it does not cause me to fall. | 0.329** | 0.618 |
| Although I have poor eyesight, it does not cause me to fall. | 0.363** | |
| I know whether the daily medications I take can make falls more likely. | 0.352** | |
| Although I do not sleep well at night, lack of sleep does not cause me to fall. | 0.359** | |
| I have to take more than four types of medication every day, but they do not make falls more likely. | 0.361** | |
| Although I get dizzy sometimes, it does not cause me to fall. | 0.294** | |
| Although my steps are unstable, I do not fall when I get up from bed and walk to the restroom if I hold on to something. | 0.331** | |
| I tend not to bother others when I need to use the restroom at night. | 0.346** | 0.577 |
| I do not like to bother nurses. | 0.335** | |
| I think I am not likely to fall. | 0.453** | |
| Although I am getting older, I will not fall as long as I am careful. | 0.388** | |
| I wear slip/fall-preventing footwear. | 0.553** | 0.508 |
| I leave on a small lamp at night while asleep. | 0.543** | |
| I sit on the bed for 10 minutes after waking up every morning before I get up and begin the day's activities. | 0.601** | |
| Although the medications I take are likely to cause falls, I will not fall because I am used to them. | 0.355** | |

**p<0.001 level of significance, SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

regions. A construct designed for a specific culture may appear in a different constitution in different settings.[28] This situation is a reflection of the difference in the concept people in different countries have in their minds. In this respect, analysis results are valid only for the population in a region, not countries or regions themselves. In our country, chronical care environments are mostly known to be hospitals with inpatient treatment, as a result people with chronic diseases admit to hospitals at first to get medical care service. Patients' relatives are expected to be present as care attendants. Thus, extra measures to prevent the elderly inpatients from falls are not taken by administrations. Another reason for the difference may be the duration of hospitalization and care environment that can affect nurse-patient relationship, causing a difference in factor pattern.

There is a widely accepted assumption that using a larger sample size leads to factor loads having more accurate predictions on population-related loads and tend to provide more consistent results.[24] The sampling included 346 patients for the 21 items in the study and it was seen in the KMO analysis result that a favorable structure for factor analysis was obtained. According to the results of exploratory factor analysis conducted for the construct validity of the measurement tool, $X^2$/SD, which determines the level of fit, was calculated as $X^2$/SD CMIN=2.058, RMSEA=0.055, GFI=0.918, AGFI=0.899, NFI=0.827, TLI (NNFI)=0.877, PNFI=0.666, PCFI=0.725, and CFI=0.901. $X^2$/freedom level proved significant with a value of 2.058. According to confirmatory factor analysis, factor loads for scale items are above 0.30 and the items grouped under the factors displayed a similar distribution to the original scale. In the original scale, EFA factor loading >0.40, CFA $X^2$/SD <3.0, RMSEA <0.08, SRMR <0.80, CFI, NNFI, and IFI >0.90.[16] The factor loadings of all items in the model ranged from 0.31 to 0.96 for the original of the scale.[16] In the construct validity of the scale, it was concluded that the four-sub-dimension scale is acceptable (Table 5).

| Table 5. Goodness of fit indicators of the SAFE scale confirmatory factor analysis (n=346) | | |
|---|---|---|
| **Fit indices** | **Value** | **Acceptable range** |
| **Good fit indices** | | |
| GFI | 0.918* | ≥0.90 good |
| AGFI | 0.899* | ≥0.90 good |
| RMSEA | 0.055* | 0.08≤ acceptable ≤0.06; 0.06≤ good ≤0.05 |
| Relative fit indices | | |
| NFI | 0.827 | ≥0.90 good |
| TLI (NNFI) | 0.877 | ≥0.90 good |
| CFI | 0.901* | ≥0.95 good ≥0.90 good ≥0.80 acceptable |
| Parsimony fit indices | | |
| $X^2$/df (CMIN/df) | 2.058* | <3 good <5 acceptable |
| PNFI | 0.666* | ≥0.50 good |
| PCFI | 0.725* | ≥0.50 good |

*: Significant values, GFI: Goodness of fit index, AGFI: Adjusted goodness of fit index, RMSEA: Root mean square error of approximation, NFI: Non-normed Fit Index, TLI: Tucker-Lewis Index, CFI: Bentler's Comparative Fit Index, PNFI: Parsimonious Normed Fit Index, PCFI: (Parsimonious Comparative Fit Index, SAFE: Self-Awareness of Falls in Elderly Scale, n: number.

For the reliability of the scale, internal consistency (item analysis, Split-Half) and time invariance (test-retest method) were preferred. Cronbach's Alpha coefficient for the original SAFE scale was calculated as $\alpha$=0.81 by Shyu et al.[16] Cronbach's Alpha value for the first adaptation of the scale to Turkish society was calculated as $\alpha$=0.811. Considering the result related to the Turkish language adaptation of the scale, Cronbach's Alpha value proves a high reliability ($0.81<\alpha<1.00$).[12]

Total scale correlation values of the items are between 0.294 and 0.601, all values for item total correlation were above 0.20, which is accepted as lower limit.[20] Item-total score correlations related to the scale were found to be statistically significant at $p<0.05$ significance level, and therefore no item was removed from the scale. At the end of question average test, it was seen that the results of the averages were different.

According to Table 6, considering the strong correlation between Cronbach values and halves, it was concluded that a sufficient and good reliability was achieved.[17] Test-retest technique was favored in the study and a correlation analysis was conducted accordingly. The scale was applied to 91 people 3 weeks after the first application. Total correlation value for the scale, r was calculated as 0.575 and it was interpreted as a statistically significant relationship ($p<0.05$). In the original of the scale, the total score correlation value was determined as r=-0.71 and it was found statistically significant ($p<0.001$).[16] Correlation and meaningful relation show that the scale has the capacity to provide similar results in recurring measurements and is consistent.[17]

| Table 6. The SAFE Scale test-retest reliability results (n=346) | | | | |
|---|---|---|---|---|
| **Measurements** | $\bar{\chi}$ | **SD** | **r** | **p-value** |
| First measurement | 88.1 | 3.1 | 0.575 | p<0.001 |
| Last measurement | 89.0 | 4.2 | | |

r: correlation coefficient, $p<0.05$ level of significance, SD: standard deviation, n: number.

Compared to available tools that study falls risk groups from the point of care personnel, the SAFE scale has a fully patient-centered view. Additionally, the 21-item SAFE scale is concise, easy to complete and needs a simple interpretation by the care personnel and thus it could be adopted smoothly adopted in clinical care. Moreover, just by evaluating the items that constantly have a low score, it is possible to offer specific interventions and education to prevent falls in the elderly patients. Combining the SAFE scale which was developed against falls risks with current tools may assist the elderly to comprehend the factors that cause them to fall and raise awareness of the risks, determine risk groups not aware of the risks and prevent the increase in falls in the elderly patients.

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### MAIN POINTS

- SAFE Scale Turkish version is a valid and reliable measurement scale for evaluating Awareness of activity safety and environment, Awareness of physical functions, Awareness of

medication, Awareness of cognitive behavior while elderly patients perform their daily living activities at home or during hospitalization.

- SAFE Scale Turkish version measures the extent to which elderly patients are perceived to meet their needs in the evaluation of Awareness of activity safety and environment, Awareness of physical functions, Awareness of medication, Awareness of cognitive behavior while performing their daily living activities at home or during hospitalization.
- SAFE Scale Turkish version provides a way for elderly patients to understand whether their needs are met in the evaluation of Awareness of activity safety and environment, Awareness of physical functions, Awareness of medication, Awareness of cognitive behavior while performing their daily living activities at home or during hospitalization.

## ETHICS

**Ethics Committee Approval:** Ethics committee approval was obtained from Muğla Sıtkı Koçman University University Human Research Ethics Committee on 07.02.2019 (protocol no: 190023/ decision no: 23).

**Informed Consent:** The purpose of the study was explained to the elderly individuals and their relatives, and their verbal consent was obtained.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: F.B., Design: F.B., S.K., Supervision: F.B., Resources: F.B., S.K., Data Collection and/or Processing: F.B., S.K., Analysis and/ or Interpretation: F.B., S.K.; Literature Search: F.B., S.K., N.B.U., Writing: F.B., Critical Review: F.B., N.B.U.

## DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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ORIGINAL ARTICLE

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# Multi-Faceted Evaluation of Psychosocial Function of Elderly Subjects

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## Abstract

**BACKGROUND/AIMS:** With aging, physical, psychological and social changes occur and individuals lose their independence and become semi-or full dependent. Accordingly, physical, psycho-social problems can be seen in the older people and their functionality decreases. For this reason, the study was carried out for the purpose of multidimensional evaluation of cognitive and psycho-social functions of older people.

**MATERIALS and METHODS:** The study was conducted between April 2018 and November 2018. This descriptive and cross-sectional study was performed in two different family health centers in Mardin province. The research was completed with a total of 200 older people who agreed to participate in the study. The data were collected using "Patients Information Form", "Katz Index of Independence in Activities of Daily Living (Katz ADL)" and "Multidimensional Observation Scale for Elderly Persons (MOSES)". The number, percent, mean, Mann-Whitney U, Kruskal-Wallis test and Spearman correlation analysis were used in the data analysis.

**RESULTS:** The mean age of participants was 70.03±8.48 years. 54.2% of older people were female and 45.8% were male. The mean score of Multidimensional Observation Scale for Elderly Persons was 24.36±22.38. The mean score of the Katz Index of Independence in Activities of Daily Living was 16.32±3.14. There was a weak positive correlation between age and Multidimensional Observation Scale for Elderly Persons ($p<0.001$, $r=0.43$), and a moderate negative correlation was found between Katz Index of Independence in Activities of Daily Living and MOSES ($p<0.001$, $r=-0.56$).

**CONCLUSIONS:** This study revealed that older people had high functional and independence levels, and this is due to the fact that older people who come to family health care centers form a sample group. However, multidisciplinary studies periodically are needed to evaluate the cognitive, psychological and social functioning of older people living at home.

**Keywords:** Psychosocial functioning, multidimensional observation, older people

## INTRODUCTION

Aging is a physiological, psychological and sociological process that involves all of the functional and structural changes that occur over time at the level of cells, tissues, and systems of the organism.[1] The psychological dimension of old age, perception, learning, psycho-motor, problem-solving and personality characteristics of the human adaptability capacity in terms of changes as the chronological age progresses. Sociologically, old age is related to the behaviors expected from a particular age group and the values that society gives to that group.[2]

Looking at population statistics in the world and Turkey, there has been a significant increase in the older population in recent years. There are 901 million older people,[3] who account for 12% of the world's population. It is expected that this figure will be doubled in 2025 and reach about two billion in 2050.[4]

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The older population is the fastest growing group, which has the most health problems and needs of health care.[5] The need for long-term care and support with the growing population is also increasing.[6] Physical problems in older people (falls, bone fractures, etc.) and chronic diseases increase dependency level.[7] The difficulties that start with the loss of physical power, functional losses and difficulty in adapting the body to changing situations negatively affect the mental state of older people. This situation leads to negative feelings such as introversion, unwillingness and decreasing life satisfaction together with the sense of loneliness in older people.[8] Dementia, delirium, Alzheimer's disease, cognitive disorders, incontinence, physical limitations and problems with relatives cause social isolation among older people.[7,9] The social isolation and mental problems of older people lead to a deterioration in health status and a significant decrease in the quality of life.[10] In addition, with the increase of age, loss of peers and close friends, social support and decrease in income levels may lead to significant changes in bio-psychosocial health. This situation affects the daily living activities of older people and causes significant changes in quality of psychosocial functioning.[11] Functional capacity is usually assessed through questionnaires of the elderly's report on the performance of daily living activities, and the physical performance related to functional limitations is investigated through physical tests where individuals perform specific tasks, which confers greater responsiveness to relevant clinical changes.[12,13] Changes in the physiological, psychological, economic and social dimensions of the life not only affect older people, but also everyone who lives with older people.[14]

Limitations in functioning and dependence on other people in performing daily activities lead to a worse quality of life for older people and an increase in the social costs of care and health.[13]

Psychosocial functioning is a multidimensional concept that encompasses different aspects of functioning such as intellectual, social and cognitive functioning, psychosocial aptitude and measurement of physical needs.[15] A national approach that providing care for older people should be developed to meet the needs of a growing population and improve the quality of care. Adaptation of the environment to meet the needs of older people, capacity, functionality and daily living activities need to be evaluated continuously.[6] The belief that dependence is inherent to the aging process produces negative attitudes and intimidates the elderly population within a sociocultural context that values the preservation of autonomy and independence.[12] The World Health Organization has set five main goals to guide countries on how to improve the functional abilities of older people: to have a pleasant time with their peers, to organize health systems according to the needs of the older population, to develop sustainable and equitable long-term care systems, and to involve older people in decision-making process.[4]

For this reason, health and social services for older individuals should be addressed not only in traditional values but also in a holistic approach. Physiological, psychological, social and economic deficiencies must be identified and supported earlier stage to provide a better healthy aging of individuals. Self-care skills of older people, disorientation, depressive and anxious moods; the evaluation of psychosocial characteristics such as disquiet behavior and secession withdrawal from the society are very important in terms of planning health and social services for older population. There are a limited number of studies in the literature evaluating the psychosocial functionality of the elderly.[11,15-17] In line with this information, this study was conducted to evaluate the cognitive, psychological and social functioning of the older people who apply to primary health care services in a multi-faceted way.

### Research Questions

**Research question 1:** Is there a difference between older people MOSES total, sub- dimension scores and their socio-demographic characteristics?

**Research question 2:** Is there a correlation between older people Katz ADL and MOSES score averages?

## MATERIAL and METHODS

### Study Design

This descriptive and cross-sectional study was carried out between April and December 2018.

### Sample of the Study

The population of the study was composed of older people who applied two different Family Health Centers in the city of Mardin. In the study, no sample calculations were made and 200 elderly people who meet the inclusion criteria between the dates of the study were included.

### Inclusion Criteria

Individuals who are over 60 years old, who do not have mental health problems and communication problems and who volunteer to participate in the study were included in the study.

### Exclusion Criteria

Individuals who are tired of answering questions and do not volunteer to participate in the research are excluded.

### Data Collection Tool

The Patients Information Form was used which included questions regarding socio-demographic information of the older people. Katz Index of Independence in Activities of Daily Living (Katz ADL) was used to determine the activity level. As for functional status, Multidimensional Observation Scale for Elderly Persons (MOSES) was used.

Patients Information Form: 17 open-ended and multiple-choice questions developed by the researchers in the literature[11,18-20] constitute independent variables.

Katz Index of Independence in Activities of Daily Living (Katz ADL): The Katz ADL index developed by Katz and collegues. In 1963 consists of six questions which include the information about the bath, dressing, toilet, movement, excretion, nutrition activities that evaluate the dependency status of the individual in performing daily life activities.

In the Katz ADL index, 0–6 points are dependent, 7–12 points are semi-dependent,13–18 points are evaluated as independent of 19, 20.[18] While the Cronbach Alpha of the scale was 0.83, in our study, the Cronbach Alpha was found 0.85.

MOSES: The validity and reliability of the Multi-Dimensional Observation Scale for Elderly Persons (MOSES) developed by Helmes, Csapo and Short (1987) was conducted by Soygür and collegues. The Multidimensional Observation Scale for Elderly Persons has been developed in order to evaluate the psychosocial aspects and the functionality of the elderly. This scale consists of 40 items and evaluates five functional areas, each consisting of eight items. The lowest score and the highest score that can be obtained from the sub-dimensions of the scale; 0–25 for self-care, 0–30 for disorientation, 0–29 for depressive/anxious mood, 0–29 for disquiet behaviors, 0–25 for the community. Each item in the scale is scored between 0–4. Eighteen items of the scale are five and 22 items have four options. The lowest total score that can be taken from the scale is 0, and the highest score is 138 and the low scale score shows that the functionality of the elderly persons is high and the scale score is high, whereas the functionality of the elderly persons is low.[11] While the Cronbach Alpha of the scale was 0.87, in our study, the Cronbach Alpha was found 0.96.

### Data Collection and Analysis

The data were collected from both the face-to-face interviews of the older people and the observations of nurses and family members who care for the older people. The application of data collection tools to the older people who agreed to participate in the study took approximately 15–20 minutes for each older people. SPSS 21.0 package program was used in the evaluation of data. The mean standard deviations, number and percent values were used in descriptive tables. For the evaluation of data that do not conform to a normal distribution, Kruskal-Wallis, Mann-Whitney U test and Spearman's correlation analysis were used. The significance level of the study was accepted as $p<0.05$.

### Ethics

For the application of the research, written permission was obtained from the scientific publication Ethics Committee of Mardin Artuklu University (approval number: 2018/01-6) and the institution to which the study will be conducted. After informing the older people who participated in the study voluntarily, they were informed about the research and their written and oral informed consent was obtained. This was conducted in consideration of the declaration of Helsinki.

## RESULTS

### Image Indices

The mean age of older people was 70.03±8.48 years. 54.2% of older people were female, 82.5% were married, 68% have chronic disease, 60% were illiterate, 87.5% were not working, and 71.5% used drugs, and 53.5% stated that their care was done by their spouses (Table 1).

The mean age of women participating in our study was 70.25± 9.32, and men 69.76

±7.39 years. It was found that 35.8% of women and 74.7% of men received care by their spouses. It was found that 70.6% of women and 96.7% of men were married.

The mean scores of Multidimensional Observation Scale for Elderly Persons (MOSES) were 24.36±22.38, the corresponding scores of Katz Index of Independence in Activities of Daily Living (Katz ADL) were 16.32±3.14. The mean scores of MOSES sub-dimension were followed as given. The mean scores of self-care sub-dimension were 3.73±6.10, 3.31±5.28 was for the disorientation sub-dimension, 8.45±6.24 was for the depressive-anxious mood sub-dimension, 3.42±3.61 was for the disquiet behavior sub-dimension, and 5.44±5.58 for secession from society sub-dimension (Table 2). The mean of Katz ADL in women was found 15.74±3.73, and 17.01±2.05 among men.

A significant difference was found between gender and MOSES total and self-care, depressive/anxious mood sub-dimensions ($p<0.05$). A significant difference was found between marital status and MOSES total and self-care, depressive/anxious mood, and disquiet behavior sub-dimensions ($p<0.05$). A significant difference was found between MOSES total and all sub-dimensions of education, study and assistive device use ($p<0.05$).

A significant difference was found between the presence of chronic disease and drug use and MOSES total and self-care, disorientation, depressive/anxious mood, and secession from society sub-dimensions ($p<0.05$). While there was no significant difference between the caregiver and depressive/anxious mood and disquiet behavior sub-dimensions ($p<0.05$), a significant difference was found between MOSES total and other sub-dimensions ($p<0.05$) (Table 3).

A moderate correlation was found between age and MOSES ($p<0.001$, $r=0.503$), and a moderate negative correlation between Katz ADL and MOSES ($p<0.001$, $r=-0.581$) (Table 4).

## DISCUSSION

As it is the case in many countries all over the world, the demographic structure of Turkey has been rapidly changing. As fertility rates are falling and average life span is increasing, the share of the elderly within the population is constantly increasing.[15] As the number of older people increase, the need for rehabilitative services will be increased and more psychological and social support will be needed in order to effectively manage the problems of the older individuals and their families in order to plan and develop older people' care and health services and to support independence.[11] In addition, it is stated that care needs and activity levels of older people have an effect on life satisfaction and quality.[5,21,22] In this study, multidimensional evaluation of cognitive and psycho-social functionality of older people based on their daily life activities was performed.

In our study, the mean score of MOSES was 24.36±22.38. Since the scale has no predictive value, the highest score that can be obtained from the scale is 138, and the cognitive and psycho-social functionality of the elderly people who participated in our study was found to be low. This situation can be related to the fact that the majority of older people (68%) have chronic diseases, 53.5% of them are cared for by their spouses and the average age is high. Similarly, in the study of Nakamae et al.[19] and Van Haitsma et al.[17] the mean score of MOSES was found to be low. In some studies, conducted with different sample groups, the mean score of MOSES was found to be higher.[6,7,15,20] Nakamae et al.[19] average age of the participants who participated in the study is advanced. It can be concluded that age is a factor affecting cognitive and psycho-social functionalities.

When the MOSES sub-dimensions were examined; while the mean scores of depressive/anxious mood and distance from society were high, the mean scores of self-care, disquiet behavior, and disorientation sub-scale were low. This situation can be deduced from the fact that the older people who participated in our research were depressed and moved away from the society. It may be due to the fact that the majority (53.5%) of the elderly individuals who participated in our research were dependent on their daily care. Van Haitsma et al.[17], Nakamae et al.[19] and Yamagami et al.[20] studied people with dementia, disorientation, secession from society and self-care sub-scale mean scores were high, while disquiet behavior and depressive/anxious mood sub-dimension mean scores were found to be low. In contrast to our study, it is thought that the high incidence of disorientation and self-care scores is due to the formation of dementia patients.

In our study, MOSES total, self-care and depressive/anxious mood sub-dimension scores were higher in women than in men. In addition, MOSES total and self-care, depressive/anxious mood, disquiet behavior sub-dimensions scores were higher in single or widowed than married. In the literature, it is stated that being a woman is a risk factor for depressive mood.[23,24] Similar to our study, Kaur et al.[25] reported that the lack of self-care was higher in older people who were widowed or divorced, whereas Ishak et al.[26] did not find a significant difference between

**Table 1. Socio-demographic characteristics of older people (n=200)**

| Features | n (%) |
|---|---|
| **Age (mean ± SD) 70.03±8.48** | |
| **Gender** | |
| Male | 91 (45.8) |
| Female | 109 (54.2) |
| **Marital status** | |
| Single | 35 (17.5) |
| Married | 165 (82.5) |
| **Education** | |
| Illiterate | 120 (60.0) |
| Literate | 46 (23.0) |
| Elementary and above | 24 (12.0) |
| High school and above | 10 (5.0) |
| **Working condition** | |
| Working | 25 (12.5) |
| Not working | 175 (87.5) |
| **Chronic disease** | |
| No | 64 (32.0) |
| Yes | 136 (68.0) |
| **Drug use** | |
| Yes | 143 (71.5) |
| No | 57 (28.5) |
| **Who is looking at you?** | |
| Spouse | 107 (53.5) |
| Children | 62 (31.0) |
| Other | 31 (15.5) |

SD: Standard deviation, n: number.

**Table 2. MOSES total and sub-dimension scores and Katz ADL total**

| Features | (Mean ± SD) | Min-max |
|---|---|---|
| Self-care | 3.73±6.10 | 0.00–23.00 |
| Disorientation | 3.31±5.28 | 0.00–29.00 |
| Depressed/anxious mood | 8.45±6.24 | 0.00–25.00 |
| Disquiet behavior | 3.42±3.61 | 0.00–15.00 |
| Secession from society | 5.44±5.58 | 0.00–22.00 |
| MOSES total | 24.36±22.38 | 0.00–107.00 |
| Katz ADL total | 16.32±3.14 | 6.00–18.00 |

MOSES: multidimensional observation scale for elderly persons, Katz ADL: Katz index of independence in activities of daily living, SD: standard deviation, Min: minimum, max: maximum.

**Table 3. Comparison of socio-demographic characteristics and MOSES total, sub-dimension scores**

| Features | n | Self-care Median (min ± max) | Disorientation Median (min ± max) | Depressed/anxious mood Median (min ± max) | Disquiet behavior Median (min ± max) | Secession from society Median (min ± max) | MOSES total points Median (min ± max) |
|---|---|---|---|---|---|---|---|
| **Gender** | | | | | | | |
| Female | 109 | 1.00 (0.00±23.00) | 1.00 (0.00±29.00) | 9.00 (0.00±25.00) | 3.00 (0.00±15.00) | 4.00 (0.00±22.00) | 23.00 (1.00±107.00) |
| Male | 91 | 0.00 (0.00±22.00) | 0.00 (0.00±20.00) | 6.00 (0.00±21.00) | 2.00 (0.00±15.00) | 3.00 (0.00±22.00) | 13.00 (0.00±84.00) |
| Test value | | z=-2.349* p=0.019 | z=-1.953* p=0.051 | z=-3.347* p=0.001 | z=-1.612* p=0.107 | z=-1.935* p=0.053 | z=-0.14* p=0.003 |
| **Marital status** | | | | | | | |
| Single/widow | 35 | 3.00 (0.00±23.00) | 3.00(0.00±29.00) | 11.00 (1.00±25.00) | 4.00 (0.00±15.00) | 6.00 (0.00±22.00) | 28.00 (1.00±107.00) |
| Married | 165 | 0.00 (0.00±22.00) | 1.00(0.00±26.00) | 7.00 (0.00±24.00) | 2.00 (0.00±15.00) | 4.00 (0.00±22.00) | 14.00 (0.00±106.00) |
| Test value | | z=-3.202* p=0.001 | z=-1.691* p=0.091 | z=-3.174* p=0.002 | z=-200* p=0.027 | z=-1.957* p=0.050 | z=-3.279* p=0.001 |
| **Education status** | | | | | | | |
| Illiterate | 120 | 2.00 (0.00±23.00) | 2.500 (0.00±29.00) | 10.00 (0.00±25.00) | 3.00 (0.00±15.00) | 5.50 (0.00±22.00) | 24.00 (0.00±107.00) |
| Literate | 46 | 0.00 (0.00±22.00) | 0.00 (0.00±20.00) | 5.50 (0.00±18.00) | 2.00 (0.00±12.00) | 3.00 (0.00±15.00) | 12.50 (0.00±84.00) |
| Primary school | 24 | 0.00 (0.00±6.00) | 0.00 (0.00±7.00) | 5.00 (0.00±20.00) | 1.50 (0.00±15.00) | 0.00 (0.00±18.00) | 9.50 (0.00±45.00) |
| High school and above | 10 | 0.00 (0.00±6.00) | 0.00 (0.00±3.00) | 2.00 (0.00±12.00) | 0.00 (0.00±6.00) | 1.00 (0.00±2.00) | 7.00 (0.00±15.00) |
| Test value | | $\chi^2$=24.568** p<0.001 | $\chi^2$=24.184** p<0.001 | $\chi^2$=25.793** p<0.001 | $\chi^2$=11.099** p=0.011 | $\chi^2$=29.602** p<0.001 | $\chi^2$=36.050** p<0.001 |
| **Working condition** | | | | | | | |
| Working | 25 | 0.00 (0.00±16.00) | 0.00 (0.00±7.00) | 5.00 (0.00±20.00) | 1.00 (0.00±15.00) | 0.00 (0.00±8.00) | 10.00 (0.00±38.00) |
| Not working | 175 | 0.00 (0.00±23.00) | 1.00 (0.00±29.00) | 8.00 (0.00±25.00) | 3.00 (0.00±15.00) | 4.00 (0.00±22.00) | 20.00 (0.00±107.00) |
| Test value | | z=-2.877* p=0.004 | z=-3.567* p<0.001 | z=-2.370* p=0.018 | z=-2.244* p=0.025 | z=-4.637* p<0.001 | z=-3.729* p<0.001 |
| **Chronic disease** | | | | | | | |
| No | 64 | 4.00 (0.00±22.00) | 0.00 (0.00±20.00) | 5.50 (0.00±22.00) | 2.00 (0.00±15.00) | 2.00 (0.00±18.00) | 11.00 (0.00±84.00) |
| Yes | 136 | 0.00 (0.00±23.00) | 2.00 (0.00±29.00) | 9.00 (0.00±25.00) | 2.50 (0.00±15.00) | 5.00 (0.00±22.00) | 23.00 (0.00±107.00) |
| Test value | | z=-2.655* p=0.008 | z=-3.296* p=0.001 | z=-2.955* p=0.003 | z=-1.151* p=0.250 | z=-3.072* p=0.002 | z=-3.433* p=0.001 |
| **Drug use** | | | | | | | |
| Yes | 143 | 0.00 (0.00±23.00) | 1.00 (0.00±29.00) | 9.00 (0.00±25.00) | 3.00 (0.00±15.00) | 4.00 (0.00±22.00) | 21.00 (0.00±107.00) |
| No | 57 | 0.00 (0.00±13.00) | 0.00 (0.00±10.00) | 7.00 (0.00±22.00) | 2.00 (0.00±15.00) | 2.00 (0.00±18.00) | 12.00 (0.00±63.00) |
| Test value | | z=-2.794* p=0.005 | z=-2.926* p=0.003 | z=-2.514* p=0.012 | z=-1.196* p=0.232 | z=-2.354* p=0.019 | z=-2.920* p=0.004 |

**Table 3. Continued**

| Features | n | Self-care Median (min ± max) | Disorientation Median (min ± max) | Depressed/anxious mood Median (min ± max) | Disquiet behavior Median (min ± max) | Secession from society Median (min ± max) | MOSES total points Median (min ± max) |
|---|---|---|---|---|---|---|---|
| **Caring person** | | | | | | | |
| Spouse | 107 | 0.00 (0.00±22.00) | 1.00 (0.00±20.00) | 7.00 (0.00±21.00) | 2.00 (0.00±15.00) | 3.00 (0.00±20.00) | 13.00 (0.00±84.00) |
| child | 62 | 4.00 (0.00±23.00) | 3.00 (0.00±26.00) | 9.00 (0.00±24.00) | 4.00 (0.00±15.00) | 5.00 (0.00±22.00) | 26.00 (0.00±107.00) |
| Other | 31 | 0.00 (0.00±22.00) | 0.00 (0.00±29.00) | 8.00 (0.00±25.00) | 2.00 (0.00±13.00) | 2.00 (0.00±22.00) | 13.00 (0.00±107.00) |
| Test value | | $\chi2$=24.427** p<0.001 | $\chi2$=7.265** p=0.026 | $\chi2$=5.791** p=0.055 | $\chi2$=5.452** p=0.065 | $\chi2$=10.409** p=0.005 | $\chi2$=13.402** p=0.001 |
| **Using the assistive device** | | | | | | | |
| Glasses | 67 | 0.00 (0.00±21.00) | 0.00 (0.00±20.00) | 8.00 (0.00±24.00) | 2.00 (0.00±15.00) | 2.00 (0.00±16.00) | 13.00 (0.00±86.00) |
| Wheelchair/ walker | 15 | 18.00 (0.00±23.00) | 10.00 (0.00±26.00) | 14.00 (1.00±24.00) | 6.00 (0.00±12.00) | 15.00 (0.00±22.00) | 63.00 (10.00±106.00) |
| Cane | 30 | 6.00 (0.00±22.00) | 5.00 (0.00±20.00) | 11.50 (0.00±21.00) | 4.00 (0.00±15.00) | 6.50 (0.00±22.00) | 32.00 (0.00±84.00) |
| Other | 88 | 0.00 (0.00±22.00) | 0.00 (0.00±29.00) | 6.00 (0.00±25.00) | 2.00 (0.00±13.00) | 3.00 (0.00±22.00) | 12.50 (0.00±107.00) |
| Test value | | $\chi2$=58.843** p<0.001 | $\chi2$=45.314** p<0.001 | $\chi2$=21.816** p<0.001 | $\chi2$=16.530** p=0.001 | $\chi2$=27.827** p<0.001 | $\chi2$=45.313** p<0.001 |

*Mann-Whitney U test, **Kruskal-Wallis chi-square value, MOSES: multidimensional observation scale for elderly persons, min: minimum, max: maximum, n: number. Significant values are shown in bold.

marital status and self-care. It is thought that depressive/anxious mood is high among single or widowed people, lack of social support, lack of motivation, difficulties in communicating with the environment and may be caused by feeling alone. Similarly, in some studies, the prevalence of depression is more common in single and widowed ones; in some cases, it was determined that the marital status did not affect the level of depression.[23,27,28] This result is thought to be due to the fact that the mean age of women participating in our study was higher than that of men, the majority of women received care from people other than their spouses (children and caregivers, etc.) and the proportion of married people was lower than that of men. Because with aging, individuals' dependence on others increases in meeting self-care needs such as nutrition, bathing, and discharge. In case of receiving care from people other than their spouses, they may think that there is a burden on others and cause anxiety and communication difficulties. Losing spouse or living alone can lead to problems such as depression, leading to a lack of social support and loneliness.[11,25]

In our study, MOSES total and sub-dimension scores were higher in the elderly who were illiterate, not working, and who used assistive device. Similar to our study, Ikegami et al.[12] stated that low education level and non-working status are related to low functional capacity. In addition to keeping the elderly active, it is stated that being employed positively affects the psychosocial functionality by living with other people, maintaining cooperation and interaction and social support mechanisms.[9,12] Education level is important in providing and channeling financial resources related to care while contributing to the development of the skills and confidence necessary to maintain and maintain healthy aging.[12,13,16,29] The use assistive device (wheelchairs, canes, etc.) of the elderly reduces their functional capacity and increases dependency on others.

This situation can cause anxiety and social isolation in the elderly. Therefore, in our study, it is thought that the majority of the elderly do not work, are illiterate and use auxiliary equipment reduces psychosocial functionality. A significant difference was found between the presence of chronic disease and drug use, and MOSES total and self-care, disorientation, depressive/anxious mood, and secession from society sub-dimensions. With age, the number of chronic diseases seen in older people increase.[30] Chronic diseases may cause frequent hospitalizations, multiple drug use, economic and psychosocial problems in older people.[25,26,30] It is thought that this situation will affect psychosocial functioning in older people and decrease the quality of life.

**Table 4. Correlation between age and Katz ADL and MOSES score averages**

| | | MOSES |
|---|---|---|
| | r** | p-value |
| Age | 0.503 | p<0.001 |
| Katz ADL | -0.581 | p<0.001 |

MOSES: multidimensional observation scale for elderly persons, Katz ADL: Katz index of independence in activities of daily living, **Pearson correlation

In our study, the mean total score of the Katz ADL was 16.32±3.14. Those with an ADL score of 13 or above applied to the participants it has been evaluated as "independent". Therefore, it is seen that older people who participate in the study have a high level of independence in performing daily activities. The results of some studies are similar to our research.[9,12,13,18,31] Differently, in the study of Knapik et al.[16], with patients with Parkinson, stroke and multiple sclerosis, daily life activity scores were lower. In this case, it is thought that the individuals participating in our study are physically less dependent.

Impaired cognitive and psycho-social functions are associated with the daily lives of the elderly. In our study, cognitive and psycho-social functions of older people decreased as age progressed. With aging, not only physical functions but also psychosocial functions decrease and slow down.[7,8] In our study, the MOSES score decreased as the independence of older people increased in the activities of daily living. The high level of independence of the older people in daily living activities shows the ability to perform independently in the self-care activities such as nutrition, dressing, bathroom, toilet, movement, and excretion without getting help from anyone. The problems in the physical field and the high level of dependence in the activities of daily living in older people cause a loss in the psychological and social areas.[23,30] This situation may affect the physical, social and psychological aspects of older people, and affect the well-being of the older population, which may lead to decreased life satisfaction and psychosocial functioning.[21,23] Therefore, it is thought that the high level of independence of older people in our study positively affects psychosocial functioning.

### Limitations of the Study

This study, due to be made in two different Family Health Center providing primary health care services in the southeast of Turkey results cannot be generalized. Forthis reason, it is recommended to conduct the study in secondary and tertiary healthcare places and in different sample groups.

### Conclusion

It is thought that the functionality and independence levels of older people are high and this is due to the fact that older people living with their family and coming to the Family Health Centers constitute the sample group. As the age increases, the MOSES score increases and therefore the functionality of older people decrease as the age progresses.

In addition, as the Katz ADL score increases, The MOSES decreases. This shows that as the independence levels of older people increase, the functionality increases. The evaluation of cognitive, psychological and social functions of the elderly who live alone or live with family members at home will support the psychosocial functionality of the elderly. Support by healthcare professionals can encourage older people to autonomy. For this reason, the psychosocial functionality of the elderly should be monitored periodically by the healthcare professionals and the deficiencies should be supported.

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## MAIN POINTS

- Physiological, psychological, social and economic deficiencies must be identified and supported earlier stage to provide a better healthy aging of individuals.
- Self-care skills of older people, disorientation, depressive and anxious moods; the evaluation of psychosocial characteristics such as disquiet behavior and secession withdrawal from the society are very important in terms of planning health and social services for older population.
- This study revealed that older people who come to family health care centers had high functional and independence levels.

### ETHICS

**Ethics Committee Approval:** For the application of the research, written permission was obtained from the scientific publication Ethics Committee of Mardin Artuklu University (Approval number: 2018/01-6) and the institution to which the study will be conducted.

**Informed Consent:** Written and oral informed consent was obtained.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: H.U., Design: H.U., Data Collection and/or Processing: H.U., Analysis and/or Interpretation: B.V.D., Literature Search: B.V.D., Writing: B.V.D., Critical Review: B.V.D.

**DISCLOSURES**

**Conflict of Interest:** The authors declare no conflict of interest.

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# Effects of Corchorus Olitorius and Protocatechuic Acid on Cadmium-Induced Rat Testicular Tissue Degeneration

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## Abstract

**BACKGROUND/AIMS:** Cadmium element, a heavy metal, has toxic effects on the reproductive system. The current study investigates the possible therapeutic effects of *Corchorus olitorius* (CO) and Protocatechuic acid (PCA) on the damage caused by cadmium chloride on rat testicular tissue.

**MATERIALS AND METHODS:** Control, CO, PCA, cadmium chloride, cadmium chloride + PCA and cadmium chloride + CO was formed groups. CO and PCA was administered orally 250 mg/kg and 20 mg/kg respectively. Cadmium chloride dose of 3.5 mg/kg was administered intraperitoneally. At the end of the three-week experiment period, body weight of rats was measured then testicular tissues were removed and weighed separately. Testicular tissue sections were stained with, Hematoxylene & Eosin, Periodic Acid Shiff, Masson trichrome and terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL). TUNEL (+) apoptotic cells were counted and evaluated statistically.

**RESULTS:** Testicular weights of the cadmium-given group decreased significantly compared to the control groups. In the cadmium-administered group, basal membrane structures and seminiferous tubules were disrupted, tubules without sperm were observed, connective tissue and inflammatory cell increase and oedema occurred in the interstitial space. It was determined that degeneration was continuing in the treatment groups, but inflammatory cell numbers and oedema in the interstitial tissue were reduced. Additionally, the same seminiferous tubules with sperm were also observed. It was observed that apoptotic cells increased significantly in the cadmium-administered group compared to the control groups and decreased in the treatment groups.

**CONCLUSION:** PCA and CO were realized to be unable to completely prevent but reduce the toxic effects of cadmium on testicular tissue.

**Keywords:** Testis, cadmium chloride, protocatechuic acid, *Corchorus olitorius*

## INTRODUCTION

Cadmium (Cd) is a toxic substance included in the list of heavy metals that is hazardous to the human health published by the World Health Organization and is frequently encountered in daily life. The half-life in humans is about 20–30 years, the rate of excretion from the body is low and accumulates primarily in the liver and kidneys. Cadmium is absorbed from cigarettes, food, contaminated water and air in significant quantities and has many undesirable effects in living organisms. Professions such as mining, nickel-cadmium battery production, electro plating and pigmented paint also expose people to cadmium.[1-3] Cadmium has been reported that it reduces male fertility, impair reproductive capacity and play an important role in the pathogenesis of infertility. Testicular tissue is very sensitive to the

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toxic effect of cadmium. Cadmium reduces testicular weights, causes structural disorders in seminiferous tubules, disrupts the blood-testicle barrier, causes the death of germ cells and inhibits the production of testosterone from Leydig cells and generates oedema. It negatively affects sperm production, sperm count, and morphology.[4,5] Extended exposure to cadmium, hence increased accumulation, causes DNA methylation in the testicle that can result in epigenetic changes.[6]

Cadmium induces oxidative stress, causing irreversible damage to organs. Protocatechuic acid (PCA), which has an antioxidant effect, has a protective effect against toxic substances in the body. PCA is mainly found in fruits, nuts, vegetables.[7] PCA reduces apoptosis caused by cadmium and has an anti-inflammatory effect. It has been reported that PCA increases sperm count, prevents changes in morphology, reduces the presence of weak sperms and prevents infertility.[8] It has been observed to increase the level of testosterone and sperm function.[9] It has also been reported that degenerative changes and oxidative stress occurring in testicular tissue due to cadmium are reduced by PCA.[10]

Experimental studies are conducted on protective effects of plants and herbal extracts and their roles in reducing or preventing tissue damage.[11] One of the ethnic plants with antioxidant properties is *Corchorus olitorius* and it is widely used in Mediterranean Countries. This plant known as "Molehiya" and consumed as food in their dietary habits. It is very rich in protein, carbohydrate, calcium, potassium, iron, sodium, vitamins A, C, and E. Because of the studies, it was found that it reduces oxidative stress due to its anti-inflammatory effect.[12]

Today, an effective treatment method or an effective component against Cd toxicity has not been found yet. In cadmium-bound tissues, the effects of various antioxidant substances are studied to prevent or alleviate degeneration in organs. The current study investigates the effects of *Corchorus olitorius* and antioxidant PCA on the damage caused by cadmium chloride on testicular tissue. There have been a limited number of studies on this subject in the literature review.

## MATERIALS AND METHODS

In the study, young adolescent male (2 months old) Wistar albino rats, weighing an average of 170–250 gr, were used. Rats contained at 22°C temperature in 12 h of dark/light care rooms and fed at controlled amounts with standard feed and water as ad libitum. Rats were randomly divided into six groups:

Group 1 (n=6): Control group

Group 2 (n=6): 3.5 mg/kg intraperitoneal $CdCl_2$ administration (Sigma-Aldrich USA) twice a week.

Group 3 (n=6): 20 mg/kg oral Protocatechuic Acid administration.

Group 4 (n=6): 250 mg/kg oral *Corchorus olitorius* administration.

Group 5 (n=6): 3.5 mg/kg intraperitoneal $CdCl_2$ administration twice a week and 250 mg/kg oral *Corchorus olitorius* administration daily.

Group 6 (n=6): 3.5mg/kg intraperitoneal $CdCl_2$ administration twice a week and 20 mg/kg oral PCA administration daily.

### *Corchorus Olitorius* Extraction

CO plant was freshly collected from Demirhan Region of Northern Cyprus and its extract was prepared in the Pharmacognosy laboratory of NEU Faculty of Pharmacy.

Cultured *Corchorus olitorius*, the leaves were separated from the stems, and kept at shade until dry. Air dried plant material (500 g) subjected to EtOH (96%) by using percolator for 24 h. After filtration, the extract was transferred into a tared flask and extract was concentrated under reduced pressure to dryness at 40 °C. Finally, the yield was calculated.

### Histology

At the end of three-week experiment period, testes were removed from the subjects under anesthesia of ketamine and xylazine. Body and testes weights of subjects were measured. Testis fixation was done with 10% neutral formaldehyde and paraffin blocks were prepared. 5 µm thick sections were stained with Hematoxylene-Eosin, Periodic Acid Shiff, and Masson Trichrome. Additionally, to determine apoptotic cells Terminal-deoxynucleoitidyl Transferase Mediated Nick end-labeling (TUNEL, Apop Tag, S7101, Merck) staining was performed. TUNEL (+) stained cells were counted in 20 seminiferous tubules belonging to the testicle sections of each subject.

### Statistical Analysis

According to the data distribution, the groups were compared by performing Kruskal-Wallis analysis, and pairwise post hoc comparisons were made using Mann-Whitney U tests with Bonferroni correction. Statistical Package for Social Sciences 25.0 for Windows (SPSS Inc., Chicago, Illinois, USA) was used for conducting the analysis. Statistical significance was set at $p<0.05$.

## RESULTS

At the end of the experiment, it was determined that the body weights of the cadmium-administered group was lower than the other groups, however the difference was not statistically significant. When the testicular weights of the subjects in the groups were evaluated, the cadmium-administered group without treatment and with PCA and CO ($p<0.05$) treatment showed significant decrease compared to the control, PCA and CO groups. While the cadmium-administered group with PCA treatment

showed a significant increase in testicular weight compared to the cadmium administered group without treatment, no significant difference with the CO treated group was observed. Testicular weights of the control group were similar to the PCA-only and CO-only treatment groups (Table 1). In the testicular tissue of the control group (Figure 1a); spermatogenetic, Leydig cells in the interstitial space and Sertoli cells (Figure 1b) were detected to be normal. Seminiferous tubule basal membrane structures (Figure 1c) and connective tissue of interstitial compartment among tubules (Figure 1d) were methodically distinguished. The seminiferous tubule cells, Leydig cells, basal membrane and interstitial tissue of PCA-only and CO-only treatment groups were observed to be similar as the control group. In the subject group with generated cadmium toxicity, it was observed that seminiferous tubules were highly degenerated, the spermatogenetic cell lines were not clearly distinguishable (Figure 2a), cellular debris was present in the seminiferous tubule lumens due to degeneration (Figure 2b), the number of inflammatory cells was high and substantial amount of oedema was existent in the interstitial tissue (Figure 2c). The increased amount of connective tissue in the interstitial tissue (Figure 2d) and basal membrane structures (Figure 2e) was disrupted. In particular, Leydig cells were indistinguishable. It was observed that inflammatory cell numbers and oedema decreased in the interstitial areas, furthermore sperm heads and tails were prominent in seminiferous tubule lumens in the Cd toxicity generated group with PCA treatment compared to the Cd administered group without treatment (Figure 3a). The testicular structure of the Cd-administered group with CO treatment was similar to the group treated with PCA. The number of inflammatory cells decreased in the CO-treated group; however, it was observed that their numbers were higher than the group treated with PCA (Figure 3b). Compared to the control group (Figure 4a), it was observed that TUNEL (+) stained cells were increased in the seminiferous tubule cells in the Cd-administered group (Figure 4b) and decreased in the groups of Cd + PCA (Figure 4c) and Cd

**Table 1. Testis weight of rats in groups**

| Groups (n=6) | Testis weight gr (%) |
|---|---|
| **Control** | 0.60±0.03 |
| **PCA** | 0.65±0.05 |
| **CO** | 0.66±0.05 |
| **Cd+ PCA** | 0.32±0.15[abcd] |
| **Cd + CO** | 0.17±0.03[abc] |
| **Cd** | 0.16±0.02 [abc] |

Values are mean ± standard deviation of six rats from each group (significance value is p<0.05);

[a]values when compared to control statistically significant p<0.05,

[b]values when compared to PCA statistically significant p<0.05,

[c]values when compared to CO statistically significant p<0.05,

[d]values when compared to Cd statistically significant p<0.05.

CO: Corchorus olitorius, Cd: cadmium, PCA: protocatechuic acid, n: number.

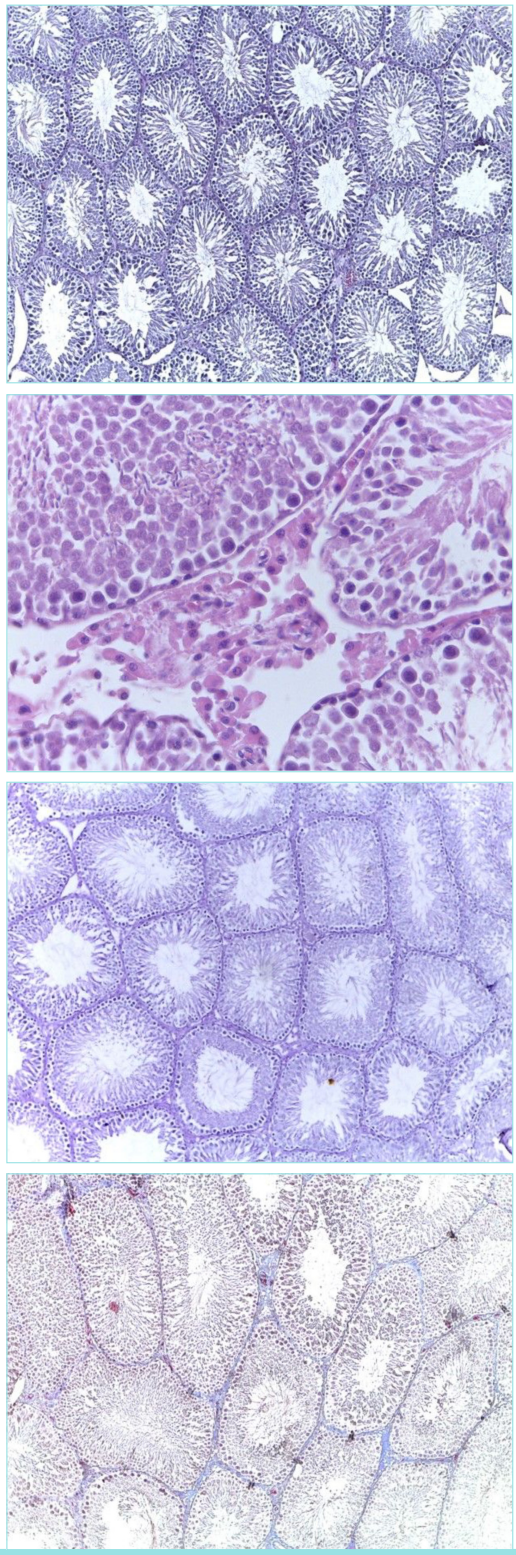

**Figure 1.** Testicular seminiferous tubules belonging to the control group have normal structure (H&E x10) (**a**), eosinophilic stained Leydig cells are in high numbers (H&E x40) (**b**), tubular basal membranes are normal (PAS x10) (**c**), and there is no increase in connective tissue in the interstitial space (Masson Trichrome x10) (**d**).

H&E: Hematoxylin and Eosin stain, PAS: Periodic Acid Schiff

+ CO (Figure 4d), however their numbers were not at the control group level. The data obtained using light microscopy inspections are statistically presented in Table 2.

## DISCUSSION

Spermatozoa are affected in men exposed to cadmium, and apoptotic cell deaths are increased.[1,13,14] The toxic effect of cadmium on the testicles varies depending on the dose. As the dose increases, the number of degeneration and apoptotic cells in the seminiferous tubules increases.[15-17] In the seminiferous tubules, clustered cell debris in the lumen, atrophy in the tubules, congestion and vascular dilatation in the interstitial tissue is observed due to cell degeneration.[18] Depending on the level of cadmium accumulated in the body, testicle and body weight, sperm count and motility decreases. In some studies, cadmium-related decreases in body weights and testicle weights have been reported.[16,19] In the result analysis of our study, it was found that testicular weights decreased significantly compared to the control group, but there was no decrease in body weights depending on cadmium administration. While Adamkovicova et al.[18] reported that there was no significant decrease in body weights of the Cd-administered test subjects, Nna et al.[20] and Mahmoudi et al.[21] reported a decrease in body weights. Because of Cd accumulation, structure of Sertoli cells were disrupted, the blood-testicle barrier was impaired and resulted in infertility.[22] Light microscopic examinations on rat testicular tissue were consistent with the results of this study, in which test subjects were administered with ip 3.5 mg/kg cadmium twice a week for three weeks. In the seminiferous tubules; degenerate

**Table 2. TUNEL (+) cells in groups**

| Groups (n=6) | TUNEL (+) cell |
|---|---|
| **Cd** | $15.17\pm4.40^{abcde}$ |
| **Cd + CO** | $4.67\pm3.78^{afgh}$ |
| **Cd + PCA** | $4.00\pm1.67^{bijk}$ |
| **CO** | $0.33\pm0.51^{cfi}$ |
| **Control** | $0.00\pm0.00^{dgi}$ |
| **PCA** | $0.33\pm0.52^{ehk}$ |

Values are mean ± standard deviation of six rats from each group (significance value is $p<0.05$);

[a]Significance between Cd and Cd + CO group,
[b]Significance between Cd and Cd + PCA group,
[c]Significance between Cd and CO group,
[d]Significance between Cd and control group,
[e]Significance between Cd and PCA group,
[f]Significance between Cd + CO and CO group,
[g]Significance between Cd + CO and control group,
[h]Significance between Cd + CO and PCA group,
[i]Significance between Cd + PCA and CO group,
[j]Significance between Cd + PCA and control group,
[k]Significance between Cd + PCA and PCA group.

TUNEL: terminal deoxynucleotidyl transferase dUTP nick end labeling, CO: Corchorus olitorius, Cd: cadmium, PCA: protocatechuic acid, n: number.

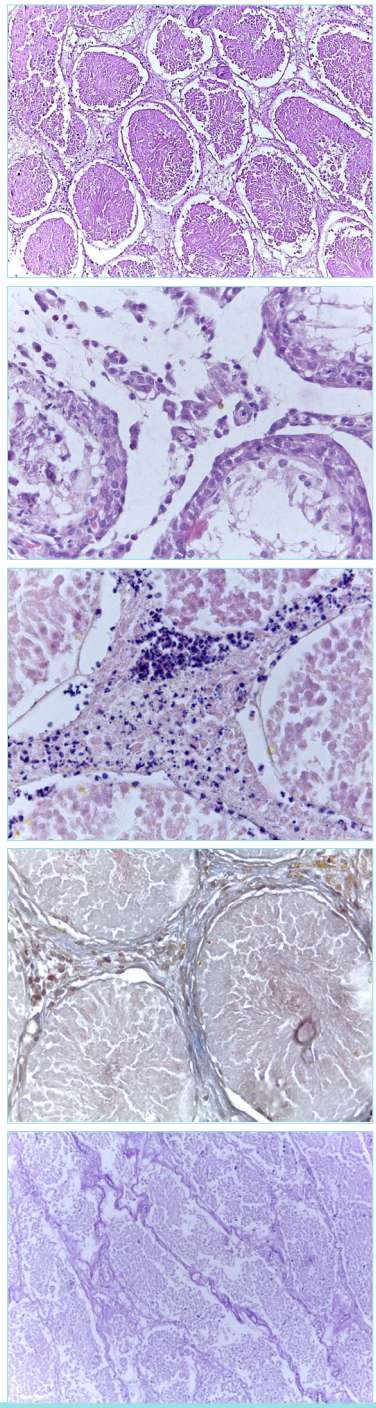

**Figure 2.** In the Cd applied group, high degree of degeneration in testicular seminiferous tubules, an increase in inflammatory cells and connective tissue in the interstitial tissue and presence of oedema (HE x10) **(a)**, reduced amount of spermatogenetic cells and cell debris in the lumen (HE x40) **(b)**, elevated levels of inflammatory cells in the interstitial tissue, especially neutrophil granulocytes (HE x40) **(c)**, increased connective tissue (Masson trichrome x40) **(d)** and disrupted basal membrane structures (PAS x10) **(e)** was observed.

Cd: cadmium, H&E: Hematoxylin and Eosin stain, PAS: Periodic Acid Schiff

spermatogenetic cells, clusters of cell debris in the lumens, indistinguishable Sertoli cells, absence or very few sperm presence, loss of smoothness of the basal membrane structure, increased connective tissue among interstitial compartment, numerous inflammatory cells, mainly neutrophils and oedema were observed. Leydig cells could not be distinguished in interstitial tissue.

There is still no effective treatment method for eliminating and preventing the toxic effects of cadmium in the tissues.[5] Various ethnic plants.[23-26] have been used for antioxidant effects on cadmium testicular toxicity. Protocatechuic Acid (PCA) is a powerful antioxidant and protects the body against the harm of toxic substances. Adedara et al.[8] observed that PCA increases the level of hormones and sperm production in testicles in pre-pubertal rats and positively affects sexual maturity. In testicular toxicity created with Methotrexate, PCA treatment has decreased apoptosis in seminiferous tubule cells and increase FSH, LH, and testosterone hormone levels.[27] During literature search, any studies regarding to the effect of PCA on cadmium-related testicular degeneration have not been found. The results of this study showed that in the cadmium-administered group with PCA treatment, the number of seminiferous tubules containing sperm was increased, the number of inflammatory cells in the interstitial tissue and apoptotic cells was decreased. We observed that the increase in testicular weight in this group was statistically significant compared to the cadmium administered and Cd + CO groups, hence the effect of PCA on cadmium toxicity was concluded. *Corchorus olitorius* is grown in various parts of the world, consumed in ethnic cuisines and used as a supplement.[28] Chemical contents of *Corchorus olitorius* vary according to the region it is grown. The CO identified to contain Caffeoyl glucose, 3-Caffeoylquinic acid, Quercetin glucoside, Quercetin acetylglucoside, 3,5-Dicaffeoylquinic acid, 1,3-Dicaffeoylquinic acid and Luteolin/kaempferol acetylglucoside.[29] It was shown that when the extrusion of CO leaves was administered as 250 and 500 mg/kg in male rats, the number of mature spermatozoon increased in seminiferous tubules, but when 1000 mg/kg was delivered, sperm count decreased and high dose CO inhibited reproductive functions.[30] In recent studies, it has been shown that CO has a good anti-inflammatory effect.[31] Furthermore, it has been reported that CO extract can be used as a food supplement against arsenic toxification.[32] Literature search revealed that the effects of CO extract on Cadmium-dependent degeneration in the testicles has not been studied. Because of our study, it was observed that degeneration in seminiferous tubules continued, but inflammation and oedema in the interstitial tissue decreased when the rat testicle tissue in the group treated with CO 250 mg/kg was compared with the cadmium administered group. The improvement was less effective than the group treated with PCA. It was identified that apoptotic cell numbers were higher than the PCA-treated group. When the testicular weights were examined, there was no significant increase in the CO-treated group and the values were very similar to the cadmium-administered group. It was thought that the desired protective effect did not occur because of CO dosages used in the study.

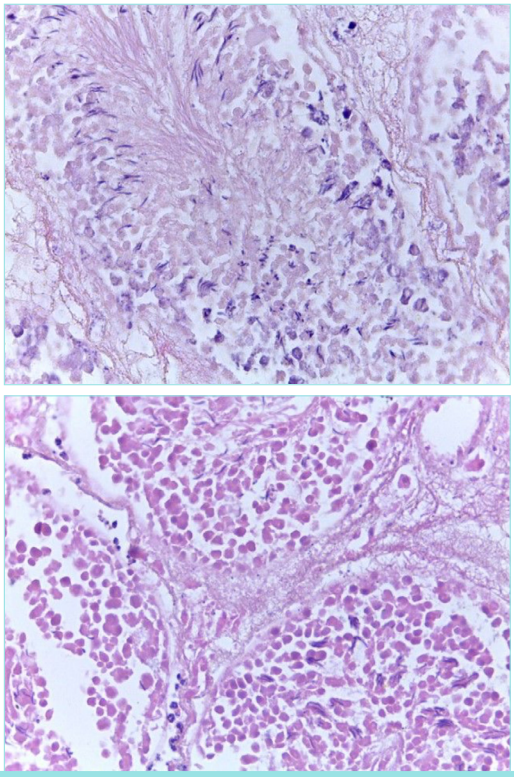

**Figure 3.** In the cadmium group treated with PCA, the inflammatory cells in the interstitial tissue are reduced, the sperms are clearly distinguished in the seminiferous tubules (**a**), and the inflammatory cells are in higher numbers in the CO-treated group (**b**). HE x40.

PCA: protocatechuic acid, CO: *Corchorus olitorius*, H&E: Hematoxylin and Eosin stain

## CONCLUSION

Three weeks of Cadmium administration and accumulation in rats caused degeneration in testicles. In cadmium groups treated with antioxidant PCA and CO, slight prevention of degeneration was observed. The PCA treatment was identified to be significantly more effective than the CO treatment. The anti-inflammatory and antiapoptotic effects of these compounds have been prominently detected. The results of this study are published by us for the first time. It is in our belief that further molecular studies focusing on the application of different doses and experimental time durations will surely provide a more precise information on this research. We hope that the results of our study will be the source of new studies that will help reduce the destructive effects of Cadmium on testicular tissue.

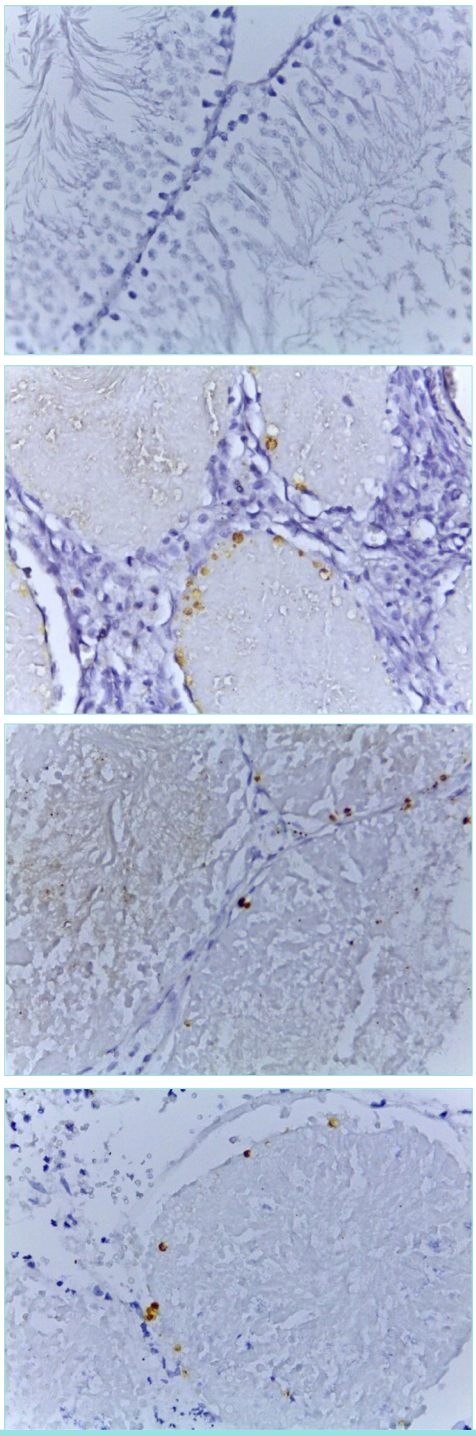

**Figure 4.** Testis tissues belonging to the experimental groups with TUNEL staining are as presented. In the control group, TUNEL (+) stained cells were not observed (**a**), in the cadmium administered group, apoptotic cell numbers were increased (**b**) whereas in the PCA- and CO-treated groups, apoptotic cell numbers were decreased (**c, d**). The number of apoptotic cells were higher in CO-treated group when compared to the PCA-treated group (**d**). TUNEL staining x40.

TUNEL: terminal deoxynucleotidyl transferase dUTP nick end labeling, CO: *Corchorus olitorius*, PCA: protocatechuic acid

## MAIN POINTS

- One of the primary target organs of affected by cadmium, which is one of the heavy metals, is the testicle organ in men. Cadmium causes infertility.
- In this study, it was determined that toxic effects of cadmium on the testicles cause degeneration in tubules where sperms are made and testicle weights decreased. Apoptotic cell death increased in cells. PCA and CO substances used against emerging degeneration reduce cell death and infection, but degeneration was not fully prevented at the administered doses.

### ETHICS

**Ethics Committee Approval:** The study was conducted with the permission of Near East University, Experimental Animals Ethics Committee (20018/20-36).

**Informed Consent:** Animal experiment study.

**Peer-review:** Externally peer-reviewed.

#### Authorship Contributions

Concept: A.K., K.K., Design: A.K., K.K., Data Collection and/or Processing: İ.Ç., K.K., G.S., P.T., Analysis and/or Interpretation: K.K., G.S., A.K., Literature Search: K.K., A.K., P.T., İ.Ç. Writing: K.K., A.K., Critical Review: A.K.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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# Anxiety, Motivation, Stress Levels and Associated Factors Among University Students in the COVID-19 Pandemic

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## Abstract

**BACKGROUND/AIMS:** The global coronavirus disease (COVID-19) pandemic affects society seriously in terms of psychosocial aspects, but this effect is more intense on some specific population groups. University students are among the most affected population groups by the pandemic. This study was conducted to determine the anxiety, motivation, stress levels, and associated factors among health science students during the COVID-19 pandemic.

**MATERIALS AND METHODS:** The population of this descriptive and cross-sectional study consisted of students studying at health-related departments in three universities in Turkey. The data were collected from 855 students determined by the stratified sampling method using the online survey method. A questionnaire developed by the researchers and the Beck Anxiety Inventory (BAI) were used to collect the data. Percentage, mean, standard deviation, t-test, One-Way ANOVA test, Pearson correlation, and linear regression analysis were performed to evaluate the data.

**RESULTS:** The results revealed that the mean age of the students was 20.85±2.37 years (min: 18; max: 41), 80.5% were women, 38.0% were nursing students, 13.7% had a family member with the diagnosis of COVID-19. The BAI mean score was found to be 29.00±7.8. According to the multiple linear regression analysis, the factors affecting students' anxiety scores significantly were being female, impaired sleep and nutrition patterns, decreased motivation, increased stress level and having a family member with the diagnosis of COVID-19.

**CONCLUSION:** Health science students experience severe anxiety due to COVID-19 pandemic and have moderate motivation and stress scores. Being a woman, having impaired sleep and nutrition patterns, reduced motivation, increased stress level and a family member diagnosed with COVID-19 are factors influencing the level of anxiety.

**Keywords:** COVID-19, psychological effect, health science student

## INTRODUCTION

Coronaviruses (CoV) are a large family of viruses that can lead to various diseases, from the common cold to more serious diseases such as the Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV).[1] COVID-19 causes coronavirus disease. The novel COVID-19 was first identified on January 13, 2020 because of examinations in a group of patients who developed respiratory tract symptoms (fever, cough, shortness of breath) in Wuhan Province in late December.[2] The epidemic was initially detected in those in the seafood and

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animal market in this region.[3] Then, it spread from one person to another, other cities in Hubei province, other provinces of the People's Republic of China and finally almost all the countries in the world.[4,5] The World Health Organization (WHO) declared the Coronavirus as an International Health Emergency and announced on February 11, that the disease caused by the novel coronavirus would be called as "COVID-19".[6]

With the diagnosis of the first positive case on March 11, 2020, the pandemic began in Turkey.[7] As in the world, health authorities in Turkey have taken several measures to struggle against the pandemic such as social distancing, travel restrictions on visitors arriving from high-risk counties, quarantine for nationals returning from high-risk locations, and suspending education-related activities and closure of certain types of workplaces. On March 12, the government declared that all schools including universities were to be closed starting from March 16.[7,8] The rapid spread of the disease, tight isolation measures, interrupting face-to-face education in schools, and transition to distance education may negatively influence the mental health of students, causing psychological symptoms to occur.[9]

Because of the worldwide pandemic due to COVID-19 infection, people have experienced significant changes in many areas such as health, education, and social life. It is an inevitable fact that rapid and sudden lifestyle changes impact human psychology.[10] Reports on the psychological effects of the epidemic on society, patients, healthcare professionals, children, and the elderly have been prepared.[11-13] Due to the worldwide pandemic, the fear of getting ill, lockdown, delays in education and graduation may negatively affect the mental health of university students.[9]

COVID-19-related studies show that students' feelings of anxiety, stress, and depression increase,[9,14-16] their concentration and academic performance decrease,[17] and their sleep patterns are disrupted.[16] Outbreaks have negative effects on medical education and students just like healthcare workers.[9] A study by Loh et al.[18] showed that lower-class students' anxiety rates were higher than senior students during SARS epidemic. Yakar et al.[19] examined the knowledge, attitude, and concerns of medical students about the current COVID-19 outbreak in Turkey and found that they had sufficient knowledge and positive attitudes about the outbreak, and the state and trait anxiety scores of female students were higher. The number of studies conducted on university students who have been heavily influenced by the COVID-19 pandemic in terms of both education and socialization is limited. As highlighted in multiple recent correspondences, there is an urgent need to assess the effects of the current pandemic on the mental health and well-being of college students.[20-22] For this reason, this study determines the anxiety, motivation, stress levels and associated factors among students studying at three different universities in Turkey and seeks the answers to the following questions:

- What are the anxiety, motivation, and stress mean scores of the students during the COVID-19 pandemic?
- Do students' socio-demographic characteristics impact their anxiety, motivation, and stress levels during the COVID-19 pandemic?
- What is/are the most significant determinant variable/s on students' anxiety levels during the COVID-19 pandemic?

## MATERIAL AND METHODS

### Study Design

This study is a descriptive and cross-sectional study.

### Setting

The research data were collected from three different universities in the Eastern Black Sea region of Turkey.

### Sample

The data were collected between May 10, 2020 and May 17, 2020. The population of the study consisted of 2,440 students studying at health-related departments of three universities located in the eastern Black Sea region in Turkey. Determined by using a stratified random sampling method (the departments were used as the stratum criterion), the sample of the study included 989 students from nursing department (278), faculty of medicine (123), pharmacy faculty (175), health management department (196) and the other vocational schools of health services (217). Eight hundered and fifty-five students who volunteered to participate in the study and completed the forms were included in the study with a response rate of 86.4%.

### Measurements

The data of the study were collected using the Beck Anxiety Inventory and a questionnaire form developed by the researchers. After obtaining the necessary permissions, the online questionnaire form was prepared using the Google Forms web application and sent to the students' smartphones through WhatsApp messaging program.

### Questionnaire Form

The questionnaire form consists of three sections and 17 questions. In the first part, there are nine questions to determine the socio-demographic characteristics of students, the second part includes six questions regarding students' experiences in the COVID-19 pandemic, and the third part has two questions created using the numerical scale '0-10' to define the motivation and stress levels of the students. In this numerical scale created by researchers, '0' refers to the low level of motivation/stress and '10' refers to the highest level of motivation/stress. Students were asked to evaluate their motivation and stress levels in response

to the question "How many points do you give to your current level of motivation/stress?"

You can access the survey form from the link below.

https://docs.google.com/forms/d/15A4KwHbJTRunFvmH6Zz6VuSwvwDcgBeRQZBfTTDvPXA/edit

### The Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory (BAI) that includes 21 items ranked on a 0–3 scale with total raw scores ranging from 0–63 was used to assess students' anxiety levels. High scores indicate high anxiety levels. The BAI scores are classified into four categories, including normal (≤7), mild (8–15), moderate (16–25), and severe (≥26) anxiety levels. The Turkish validity and reliability study of the scale was done by Ulusoy et al.[23] Cronbach's alpha internal consistency coefficient of the scale was found to be 0.93 by Ulusoy et al.[23] and 0.89 in this study.

### Ethical Considerations

Ethical approval was obtained from the Human Research Ethics Committee of the Gümüşhane University (2020/5) and approval numbered 2020-05-05T12_24_34 was obtained from the Turkish Republic Ministry of Health. All the participants gave their electronic informed consent before their inclusion in the study, and they were informed that they could withdraw from the survey at any moment without providing any justification.

### Statistical Analysis

All analyses were conducted using SPSS statistical software, version 22 (SPSS Inc., Chicago, USA). Cronbach's alfa was used to assess the internal consistency of the scale, and descriptive statistics, t-test, One-Way ANOVA test, Pearson correlation, and linear regression analysis were used to evaluate the data. In the study, all findings were tested at a significance level of p=0.05.

### Limitations of the Study

The study was conducted with the students studying at health-related departments at three universities located in the eastern Black Sea region in Turkey, however not all students could be reached. The research is based on students' self-report. It is possible that some students avoided or exaggerated their real situation during the application. These reasons limit the generalizability of the results.

## RESULTS

The study results revealed that the mean age of the students was 20.85±2.37 years (min: 18; max: 41), and 80.5% of them were female. 38.0%, 26.0%, 14.7%, 9.0%, 7.0%, and 5.3% of the students studied at nursing, medical services and techniques, faculty of medicine, pharmacy, health management, and physiotherapy departments, respectively. During the lockdown, 64.3% followed the coronavirus news, 55.4% had increased sleep time, 52.5% had increased appetite, 78.6% had decreased motivation, 0.5% were treated with COVID-19 diagnosis, and 13.7% had a family member with the diagnosis of COVID-19.

The comparison between the students' mean scores and their gender showed that female students' BAI mean scores were significantly higher than the male students (p<0.001). No significant relationship was found between students' gender and motivation scores (p>0.05) and between students' genders and stress scores (p>0.05). The motivation levels of the students with high family income were found to be significantly higher (p<0.001), but there was no significant difference between the BAI and stress scores. The BAI scores of those who started smoking after the pandemic (p=0.005), the motivation scores of nonsmokers (p<0.001), and the stress scores of those who started smoking after the pandemic (p=0.002) were found to be significantly higher. Despite not statistically significant, the BAI scores of the students living in the metropolis during the COVID-19 were higher. Besides, the BAI and stress scores (p<0.50) of students with chronic and psychological diseases are significantly higher than those without any psychological diseases (p<0.001) (Table 1).

The mean BAI scores of the students having a family member with the diagnoses of COVID-19 were significantly higher (p<0.001). Not statistically significant, but they also had higher stress and lower motivation scores. The mean BAI scores of students who had decreased sleep time and appetite during the lockdown due to COVID-19, and the motivation scores of those whose sleep time and nutrition did not change were found to be significantly higher (p<0.001) (Table 2).

Table 3 shows how the mental health of healthcare worker candidate students was affected by the COVID-19 pandemic. It was seen that the students did not have a normal and mild level of anxiety symptoms, 28.1% had moderate anxiety, and 71.9% had a severe anxiety level. The students' mean BAI score was 29.00±7.8, the motivation score was 5.00±2.00, and the stress score was 5.00±2.37. According to the mean BAI score, all students experienced moderate (23.14±1.43) and severe (34.02±7.2) anxiety. The relationship between the variables demonstrated a statistically significant relationship between the BAI, motivation, and stress scores. A negative relationship was observed between students' motivation score and the BAI (r=-0.35, p<0.001) and stress scores (r=0.27, p<0.001), and a moderately significant positive relationship was found between the BAI and stress scores (r=0.39, p<0.001) (Table 3).

According to the multiple linear regression analysis, factors affecting students' anxiety scores significantly were being female, impaired sleep and nutrition patterns, decreased motivation, increased stress level and having a family member diagnosed with COVID-19. These variables explain 30.0% of the total variance (Table 4).

**Table 1. Distribution of the BAI, motivation and stress scores according to some socio-demographic characteristics of students (n=855)**

| Characteristics | n | (%) | BAI (mean ± SD) | Motivation score (mean ± SD) | Stress score (mean ± SD) |
|---|---|---|---|---|---|
| **Gender** | | | | | |
| Female | 688 | (80.5) | 31.78±7.98 | 4.80±1.94 | 4.94±2.36 |
| Male | 167 | (19.5) | 27.61±6.50 | 5.06±2.23 | 4.66±2.42 |
| p-value | - | - | p<0.001* | p=0.139 | p=0.178 |
| **Family income** | | | | | |
| High | 158 | (18.5) | 30.96±8.69 | 5.34±2.22 | 4.72±2.31 |
| Moderate | 657 | (76.8) | 30.81±7.43 | 4.76±1.94 | 4.88±2.38 |
| Low | 40 | (4.7) | 33.42±11.05 | 4.47±1.96 | 5.55±2.28 |
| p-value | - | - | p=0.128 | p=0.002** | p=0.147 |
| **Cigarette smoking** | | | | | |
| Yes | 51 | (6.0) | 30.76±8.71 | 4.31±2.15 | 4.84±2.62 |
| Yes; decreased after COVID-19 | 96 | (11.2) | 31.76±9.87 | 4.40±2.24 | 4.96±2.53 |
| Yes; increased after COVID-19 | 15 | (1.8) | 36.40±10.21 | 3.00±1.88 | 7.26±2.28 |
| Yes; started after COVID-19 | 8 | (0.9) | 37.62±14.32 | 2.37±1.50 | 5.87±3.27 |
| No | 685 | (80.1) | 30.67±7.28 | 5.03±1.91 | 4.81±2.29 |
| p-value | - | - | p=0.005* | p<0.001* | p=0.002* |
| **Place of residence** | | | | | |
| Metropolis | 378 | (44.2) | 31.62±7.89 | 4.67±2.01 | 4.81±2.34 |
| Countryside | 308 | (36.0) | 30.20±7.49 | 5.1±1.91 | 4.87±2.32 |
| City | 169 | (19.8) | 30.89±8.48 | 4.74±2.12 | 5.07±2.53 |
| p-value | - | - | p=0.063 | p=0.007** | p=0.481 |
| **Chronic disease[a]** | | | | | |
| Yes | 49 | (5.7) | 34.46±8.17 | 4.42±1.96 | 5.61±2.53 |
| No | 806 | (94.3) | 30.75±7.80 | 4.88±2.01 | 4.84±2.35 |
| p-value | - | - | p=0.001* | p=0.122 | p=0.027* |
| **Psychological disease[b]** | | | | | |
| Yes | 92 | (10.8) | 37.28±10.70 | 4.00±2.09 | 5.80±2.63 |
| No | 763 | (89.2) | 30.20±7.11 | 4.96±1.97 | 4.77±2.31 |
| p-value | - | - | p<0.001* | p<0.001* | p<0.001* |

Significant p-values are shown in bold.

[a]Chronic disease: diabetes mellitus, hypertension, cardiac diseases, respiratory tract diseases, [b]psychological disease: depression, anxiety disorder, obsessive-compulsive disorder, *t-test, **One-Way ANOVA, BAI: Beck Anxiety Inventory, COVID-19: coronavirus disease-2019, SD: standard deviation, n: number.

## DISCUSSION

This study was conducted to determine the anxiety, motivation, stress levels of university students and associated factors during the COVID-19 pandemic. This section includes the discussion of the results with the literature.

The COVID-19 outbreak, which emerged in China and spread worldwide, not only caused the risk of death from infection, but also a severe psychological impact on individuals.[9] It has been reported that epidemics lead to many psychological effects such as anxiety, stress, and depression on the public, healthcare workers, children, elderly individuals, and students.[11-13] As in the world, the sudden closure of the universities in Turkey, the discharge of student dormitories, the transition to online education, and not knowing how long this epidemic will continue has caused some uncertainties. All these uncertainties can negatively influence the mental health of students, causing them to experience anxiety and stress, and may affect students' motivation.[16,24-26] Our study demonstrated that during the COVID-19 pandemic, students' anxiety mean scores were high and their motivation and stress mean scores were moderate. In a relevant study, students' anxiety, stress, and depressive thinking levels increased due to the COVID-19 outbreak.[15] In another study,

**Table 2. Distribution of students' experiences regarding COVID-19 process according to BAI, motivation and stress scores (n=855)**

| Characteristics | n | % | BAI (mean ± SD) | Motivation score (mean ± SD) | Stress score (mean ± SD) |
|---|---|---|---|---|---|
| **Having a family member with a diagnosis of COVID-19** | | | | | |
| Yes | 117 | (13.7) | 33.58±9.66 | 4.55±2.23 | 5.26±2.45 |
| No | 738 | (86.3) | 30.55±7.79 | 4.09±1.96 | 4.82±2.35 |
| p-value | - | - | **p<0.001** | p=0.078 | p=0.063 |
| **Sleep pattern during COVID-19 process** | | | | | |
| Decreased sleep time | 137 | (16.0) | 34.36±8.57 | 4.34±1.98 | 5.55±2.49 |
| Increased sleep time | 474 | (55.4) | 31.93±8.05 | 4.55±1.93 | 5.03±2.27 |
| No change | 244 | (28.5) | 27.19±5.35 | 5.73±1.90 | 4.22±2.34 |
| p-value | - | - | **p<0.001** | **p<0.001** | **p<0.001** |
| **Nutrition pattern in the COVID-19 process** | | | | | |
| Decreased appetite | 101 | (11.8) | 33.20±8.30 | 4.50±2.23 | 4.48±2.53 |
| Increased appetite | 449 | (52.5) | 32.54±8.19 | 4.42±1.88 | 5.18±2.34 |
| No change | 305 | (35.7) | 27.90±6.19 | 5.61±1.88 | 4.46±2.3 |
| p-value | - | - | **p<0.001** | **p<0.001** | **p<0.001** |

Significant p-values are shown in bold.

COVID-19: coronavirus disease-2019, BAI: Beck Anxiety Inventory, SD: standard deviation, n: number.

the anxiety, stress, and depression levels of university students were moderate and severe due to the COVID-19 pandemic.[27] The results of our study are consistent with the literature.

The rapid increase in the number of countries affected by the COVID-19 pandemic, the number of cases and deaths has caused great concern in the public.[25] Our study showed that the anxiety levels of university students associated with the pandemic were related to their socio-demographic characteristics such as gender, family income level, place of residence, the presence of chronic and psychological disease, and the presence a family member diagnosed with COVID-19 in the immediate environment. Besides, it was found that the anxiety mean score of female students was much higher than that of men. Studies have reported that women are more exposed to stress, anxiety, and depression, which are the psychological effects of the epidemic.[5,28] Additionally, individuals develop psychological, somatic, and behavioral conditions and their sleep quality deteriorates during the epidemic process.[29] In our study, the anxiety and stress mean scores of the students who started smoking after the COVID-19 epidemic, whose sleep time decreased and whose appetite increased was found to be higher. The anxiety mean score of the students living in big cities was high, while the average motivation scores of the students living in rural areas were high. This situation can be explained by the fact that these people have houses in the countryside and with gardens, they are in touch with nature, and they engage in relaxing physical activities. Contrary to our study, another study found that students living in urban areas had lower anxiety levels than those living in rural areas. This situation is explained by the differences in access to economic, cultural, and educational resources. People living in urban areas can easily access health services, masks, disinfectants, and all kinds of information about transmission, protection, and treatment.[9,26,30] In our study, the

**Table 3. Students' BAI, motivation and stress mean scores (n=855)**

| Scale | n | (%) | Mean ± SD | Median (min-max) |
|---|---|---|---|---|
| **BAI** | - | - | 29.00±7.8 | 30.96 (21–63) |
| Normal anxiety level | - | - | - | - |
| Mild anxiety level | - | - | - | - |
| Moderate anxiety level | 240 | (28.1) | 23.14±1.43 | 23.14 (21–25) |
| Severe anxiety level | 615 | (71.9) | 34.02±7.2 | 32.00 (26–63) |
| **Motivation score** | - | | 5.00±2.00 | 4.85 (1–10) |
| **Stress score** | - | | 5.00±2.37 | 4.88 (1–10) |

BAI: Beck Anxiety Inventory, SD: standard deviation, min: minimum, max: maximum, n: number.

**Table 4. The results regarding multiple regression analysis between students' BAI and independent variables**

| Model | B | SE | β | t | p-value |
|---|---|---|---|---|---|
| **Constant** | 24.109 | 2.263 | | 11.979 | <0.001 |
| **Gender** | 3.350 | 0.572 | 0.168 | 5.853 | <0.001 |
| **Sleep pattern** | -2.367 | 0.559 | -0.136 | -4.232 | <0.001 |
| **Nutrition pattern** | 1.991 | 0.528 | 0.121 | 3.773 | <0.001 |
| **Motivation score** | -0.735 | 0.123 | -0.187 | -5.998 | <0.001 |
| **Stress score** | 0.972 | 0.100 | 0.293 | 9.748 | <0.001 |
| **Having a family member with the diagnosis of COVID-19** | -1.929 | 0.661 | -0.084 | -2.919 | <0.001 |

Model R=0.552; $R^2$=0.304; adjusted $R^2$=0.300; F=61.87; p<0.01. Dependent Variable: Beck Anxiety Inventory. Gender (0. Male, 1. Female), Sleep pattern (0. Affected 1. Not affected), Nutrition pattern (0: Not affected, 1: Affected), Having a family member with the diagnosis of COVID-19 (0: Yes, 1: No).

BAI: Beck Anxiety Inventory, SE: standard error, COVID-19: coronavirus disease.

anxiety and stress mean scores of the students with chronic and psychological diseases and those who had a family member diagnosed with COVID-19 in their immediate environment were high, while the motivation mean scores the students without chronic diseases were high. The fear of the unknown, being in the risk group, the high risk of virus transmission cause anxiety, fear, and anxiety even in healthy individuals, so they further increase the anxiety level of students with chronic and psychological diseases and those having a family member diagnosed with COVID-19.

The variables that significantly affected the anxiety score of the students in our study were being a woman, impaired sleep and nutrition patterns, decreased motivation, increased stress level and having a family member with a diagnosis of COVID-19. Studies show that women are highly exposed to the psychological effects of the epidemic.[5,28] High levels of anxiety negatively affect sleep and diet patterns. Literature shows that the level of anxiety negatively affects sleep quality because it makes it difficult to fall asleep and interrupts sleep frequently. Anxiety, depression, and stress are closely related to sleep quality and eating habits.[31-35] A study reported that as the motivation of the students decreased, their anxiety levels increased, and individuals with high motivation and satisfaction had low stress and anxiety levels.[5] In another study, students fear and worry about their own health and of their loved ones, so they have difficulty in concentrating, disruptions to sleeping patterns, decreased social interactions due to physical distancing, and increased concerns about academic performance.[15] Another factor affecting the students' anxiety level in our study is the presence of a family member with a diagnosis of COVID-19. This is related to the high transmission rate of the virus, poor course of the disease, and high morbidity and mortality rates.[6,9,36]

## CONCLUSION

The study showed that students' anxiety scores were high, and their motivation and stress scores were moderate during the COVID-19 pandemic. Their anxiety levels are affected by gender, family income level, place of residence, the presence of chronic and psychological illness, and presence of a family member diagnosed with COVID-19. Family income and place of residence do not affect students' anxiety levels. Students' motivation levels are influenced by family income, smoking status, place of residence, and the presence of psychological illness. Gender and presence of chronic disease do not affect motivation levels. The stress levels of students are affected by smoking, having chronic and psychological diseases, but gender, family income, and place of residence are not effective on stress levels. Being a woman, impaired sleep and nutrition patterns, reduced motivation, increased stress level and having a family member diagnosed with COVID-19 are factors affecting the level of anxiety. It is recommended that the mental health of students should be carefully monitored, intervention programs on psychological health should be created and psychosocial support to students through online training during and after the pandemic should be provided.

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### MAIN POINTS

- The mean score of the healthcare worker candidate university students on the BAI was 29.00±7.8, which means severe anxiety due to COVID-19.
- Being a woman, impaired sleep and nutrition patterns, reduced motivation, increased stress level, and having a family member diagnosed with COVID-19 are factors affecting the level of anxiety.
- There are no statistically significant differences between the students' mean scores on the BAI according to family income and place of residence.

## ETHICS

**Ethics Committee Approval:** Ethical approval was also granted by the Human Research Ethics Committee of a Gümüşhane University (2020/5). To conduct the study, approval numbered 2020-05-05T12_24_34 was obtained from the Turkish Republic Ministry of Health.

**Informed Consent:** All the participants gave their electronic informed consent before their inclusion in the study, and they were informed that they could withdraw from the survey at any moment without providing any justification.

**Peer-review:** Externally peer-reviewed.

### Author contributions

Conception: C.U.Ş., M.A., N.K., Design: C.U.Ş., M.A., N.K., Data Collection and/or Processing: C.U.Ş., M.A., N.K., Analysis and/or Interpretation: C.U.Ş., M.A., N.K., Literature Search: C.U.Ş., M.A., N.K., Writing: C.U.Ş., M.A., N.K., Critical Review: C.U.Ş., M.A., N.K.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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ORIGINAL ARTICLE

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# A Qualitative Study: What Did Say the Patients with Total Knee Arthroplasty About Their Lived Experiences

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## Abstract

**BACKGROUND/AIMS:** Patients may experience problems before and after total knee arthroplasty. To provide adequate support, it is necessary to understand a patient's experiences. In order to understand the experiences of total knee arthroplasty patients in the preoperative and postoperative periods.

**MATERIALS AND METHODS:** A descriptive qualitative approach, one of the purposeful sampling methods criterion sampling method and semi-structured interview form was used in this study. In-depth interviews were conducted with 17 patients who met the sampling criteria. Data analysis was performed using descriptive analysis method.

**RESULTS:** Three categories and nine themes were determined. Categories were "reasons affecting the decision to undergo the surgery", "effect of surgery decision on the individual", "effects of surgery on individuals". Themes were "effects of osteoarthritis on quality of life (knee pain and its effects)", "ineffective conservative treatment modalities", "feelings about surgery (fear, sorrow, despair, and worry)", "lack of information about the surgery", "postoperative pain", "difficulties in walking and in performing exercises and physical activities due to postoperative pain", "fear of falling in postoperative period", "satisfaction with surgical outcomes", "lack of information of the postoperative process".

**CONCLUSION:** The most obvious patient problems in the preoperative and postoperative periods were knee pain and its effects, and patients experienced fear of falling in the postoperative period. The pain and mostly the information they obtained from their environment helped patients decide whether to undergo surgery, but were less informed about issues in the postoperative period.

**Keywords:** Nursing, qualitative study, total knee arthroplastypatient' experiences

## INTRODUCTION

Recently, total knee arthroplasty (TKA) is commonly performed on patients with osteoarthritis that is refractory to conservative treatment (pharmacological, non-pharmacological, and intra-articular injection treatments) to relieve knee pain, restore joint movements, and increase self-care agency and quality of life.[1,2] Besides the surgical benefits to patients, TKA also involves risks such as serious surgical trauma, long healing process, venous thromboembolism, pulmonary embolism, surgical site infections, patellofemoral problems, aseptic loosening, and periprosthetic fractures.[3]

Patients undergoing TKA surgery experience various problems before and after surgery. The preoperative problems experienced by patients who underwent TKA include knee pain due to osteoarthritis, difficulty in walking, limitations in daily life activities, reduction in quality of life, obligation to quit job, and anxiety and fear regarding the surgery and anesthetic

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procedures, waiting period for the surgery, and uncertainties about the postoperative period.[2,4-6] Also patients have problems with postoperative pain, return to normal physical activity, recovery management, rehabilitative practices, wound care, and medication following TKA.[6]

Recently, patients are discharged early after surgery due to the insufficient number of beds in hospitals, the cost of prolonged stays and the increased risk of infection. This is a difficult process for patients and their families who complete most of the recovery period at home. In conducted studies recently qualitative study methods have been used in order to reveal the thoughts and experiences of patients about surgery. Studies have been conducted on certain subjects related to the surgical process (eg: preoperative experiences, postoperative experiences, surgical results, decision-making for surgery, spinal anesthesia experience, etc.) Understanding the pre-operative and post-operative experiences as a whole in order to ensure that patients are prepared for the operation process and to plan their nursing care has formed the basis of this research. A qualitative research method was chosen for the patients to express their experiences more easily and to obtain in-depth data.

The purpose of this study is to understand the preoperative and postoperative experiences of patients who underwent TKA.

## MATERIALS AND METHODS

### Study Design

The descriptive qualitative research design was used in this study to understand the preoperative and postoperative experiences of patients who underwent TKA.

### Sampling

One of the purposeful sampling methods criterion sampling method was used and the criterion sampling criteria were as follows: Patients who undergo TKA due to osteoarthritis, who had TKA surgery for the first time and who have passed at least one month after the operation. In the beginning, the number of samples was not determined and interviews were stopped when they reached the saturation point. The criteria for inclusion in the sampling were: permission to participate in the study voluntarily; being at least 18 years old; orientation of person, place and time; no psychiatric illness; no known history of cancer; no hearing or speech impairment, illiteracy; speaking and understanding Turkish. The sampling exclusion criteria were diagnosis of delirium in the postoperative period and incidence of complications (surgical site infection, deep vein thrombosis etc.). Data were collected from 17 patients who underwent TKA at the Orthopedics and Traumatology Clinic of hospital of a university. The average age of the participants was 65.58±7.85 years. Most of them were women (88.2%, n=15), housewives (93.3%, n=14), married (82.3%, n=14), and primary school graduates with social security (100%, n=17).

### Ethical Consideration

Patients visiting the policlinics for medical checkup after operation were informed of the purpose of the study and given details of relevant study methods and procedures including information on how to use the tape record. Volunteer patients provided written informed consent by completing the written consent form. The study protocol was approved by Dokuz Eylül University's Ethics Committee for Non-Invasive Research (institutional review board number: 3015-GOA). Also, an institutional permit was obtained from the hospital where the study was conducted.

### Data Collection

This qualitative study was conducted with patients who agreed to take part in the study at the Orthopedics and Traumatology Clinic of a University Hospital from February 1, 2017 to September 30, 2017. The in-depth interview method was used in the study and a tape recorder (Philips SA2RGA02RN/02) was used in the interviews with patients in a suitable environment (a bright, silent, illuminated, and sufficiently ventilated room in the Orthopedics and Traumatology Service). The interviews were conducted by the researcher who took the doctoral lesson and course in theory and practice about qualitative research methods. The interviews were performed using semi-structured interview forms. The study question was decided on the basis of the purpose of the study, relevant literature, and pilot interviews conducted prior to the study. The appropriateness of the questions was evaluated by three experts (those who teach and have experience in qualitative research methods). Three main questions and sub-questions about the process were asked in the interviews. The 3 main questions the patients were asked in the interviews were: "What did you experience before the TKA?" "What did you experience after the TKA?" and "What would you like to know to solve the problems you experienced?".

Before the study, a pilot interview was conducted with a patient to test the clarity of the questions and the relevance of the research, and the researcher gave a preview of the interview process. The pilot interview lasted 35 minutes and the data obtained from this interview were not included in the analysis. The duration of interviews in the research was approximately 30 minutes although it varied according to patient statements. Interviews continued until it was apparent that there was repetition of key concepts and no new information was heard.

### Statistical Analysis

Patient sociodemographic data were evaluated using the descriptive statistics method.[7] However, tape-recorded interviews were evaluated using the descriptive analysis method. Data analysis has been made by a second researcher for research validation. All of themes and codes discussed by researchers, and the members of research team as a whole agreed upon

descriptions themes. The analysis phase includes the following steps; 1) Recorded interviews were downloaded to the computer in their original format and features such as gestures and voice tone changes of the participants, if any, were noted down next to the text, 2) Data were written down without using patient names and each interviewed individual was numbered and coded, 3) Themes to be organized and presented were determined based on the study questions, the conceptual framework of the study, and the interviews, 4) The data were read and edited and findings were defined according to the determined category and themes, 5) The defined findings were then interpreted and reported.[7]

In reporting the data, examples were given from expressions of interviewed patients to show how the themes were obtained. In giving these examples, the patient expressions were presented as accurately as possible without additional comments. The emotional responses of the interviewed patients were expressed as "smiling" or "crying". In reporting the data, patients' statements, age, sex and the time after the surgery have been stated.

## RESULTS

Results were presented as three categories and nine themes (Table 1).

**Table 1. Categories and themes of the study**

| Category | Theme |
|---|---|
| Reasons affecting the decision to undergo the surgery | Effects of osteoarthritis on Quality of Life (knee pain and its effects) |
| | Ineffective conservative treatment modalities |
| Effect of surgery decision on the individual | Feelings about surgery (fear, sorrow, despair, and worry) |
| | Lack of information about the surgery |
| Effects of surgery on individuals | Postoperative pain |
| | Difficulties in walking and in performing exercises and physical activities due to postoperative pain |
| | Fear of falling in postoperative period |
| | Satisfaction with surgical outcomes |
| | Lack of information of the postoperative process |

### Category 1: Reasons Affecting the Decision to Undergo the Surgery

### Theme 1: Effects of osteoarthritis on Quality of Life (Knee pain and its effects)

It was observed that the negative effects of knee pain on the daily lives of patients reduced their quality of life and necessitated surgery. The patients stated that the severe knee pain made it difficult for them to move their legs or walk, and their daily life activities were limited and their sleep patterns were disturbed.

*"I could not do any housework. I had troubles while cooking and performing ablution" (66 years old, female, postoperative 1 month).*

"At night, there was a lot of pain. I was awakened from sleep" (71 years old, female, postoperative 3 months).

### Theme 2: Ineffective Conservative Treatment Modalities

It was observed that when most of the patients visited specialists for problems like knee pain, movement restriction, and difficulty in walking caused by osteoarthritis, they initially tried conservative treatment (pharmacological, non-pharmacological, and intra-articular injection treatments) and decided on surgery as a last resort when conservative treatment proved ineffective. Patients also reported that they got the information from other patients that had previously undergone this surgery.

*"Before the surgery, I always had knee pain. I could handle it by taking pills and applying ointment. I could not bear the pain anymore and decided to undergo the surgery." (74 years old, female, postoperative 5 five weeks).*

*"I had pain in my knee, I came to the doctor, he said surgery. Then there was not much pain, the doctor gave pills and cream, I was relieving with them. After two or three months, my pain increased, it started hitting my foot and hip. I was exercising (showing flexion - extension movements). But even though I did, it didn't help anymore. I decided to have surgery as a last resort" (55 years old, male, postoperative 5 weeks).*

"I asked the people who had this surgery how to get rid of my pain. They said that the surgery would relieve my pain. We came here on their advice" (66 years old, male, postoperative 4 weeks).

### Category 2: Effect of Surgery Decision on the Individual

### Theme 3: Feelings About Surgery (Fear, sorrow, despair, and worry)

Patients reported that they had feelings of fear, sorrow, despair, and worry regarding the surgical process when they first learned of the surgical indications. They stated that these feelings were in regard to anesthesia, being awake during the surgery, having no previous experience of such an operation, and the information received from patients who had previously undergone this surgery.

*"My feelings at the moment… I wondered if I could not go ahead with the surgery and I feared I may awaken from the anesthesia during the surgery." (72 years old, female, postoperative 1 year).*

*"I felt sorry for that. I had no choice. I had to undergo the surgery because I could not walk." (66 years old, female, postoperative 1 month).*

*"Of course, I wondered how the surgery would go and what could happen." (76 years old, female, postoperative 5 weeks).*

### Theme 4: Lack of Information About the Surgery

During the interviews, some patients expressed that they did not receive comprehensive training about the preoperative period and that the patients learned about the surgery mostly from individuals who had previously undergone the surgery.

*"I was trying to get information from people around me. After I was hospitalized, I asked patients who had undergone the surgery." (72 years old, female, postoperative 1 year).*

### Category 3: Effects of Surgery on Individuals

### Theme 5: Postoperative Pain

All the patients reported severe pain in the early postoperative period. Many patients said that they did not think before the surgery that they would have such severe postoperative pain. They said they would not have undergone the surgery had they known before-hand that they would experience such pain and that they regretted going through with the surgery for this reason. They stated that postoperative pain was more difficult for them than surgery.

*"I regretted going through with the surgery because I could not bear the pain on the day of surgery. I felt it would be better to have my leg cut off completely. I sometimes told myself I should not have undergone the surgery" (62 years old, female, postoperative 2 months).*

*Some patients reported that TKA was a serious operation and that the severe postoperative pain was quite normal and a part of the process.*

*"I could not bend my knee and I felt pain. However, I did not regret undergoing the surgery. The pain is normal. It is part of the operation." (65 years old, female, postoperative 4 weeks).*

### Theme 6: Difficulties in Walking and in Performing Exercises and Physical Activities due to Postoperative Pain

Patients reported that they experienced limitations in movement and had difficulties with first mobilization and with performing exercises and did not want to exercise because of the pain.

*"On the first day, I could not move until morning due to the pain. It was very severe." (55 years old, male, postoperative 5 weeks).*

*"I had difficulty walking for the first time after the surgery and with performing the exercises." (74 years old, female, postoperative 5 weeks).*

### Theme 7: Fear of Falling in the Postoperative Period

The patients in our study said they were careful not to fall and worried about living with knee prosthesis after discharge. They experienced fear of falling because the specialist stressed it during discharge and the patients therefore thought that, if they fell, the prosthesis would be damaged and they may have to be operated on again.

*"I was careful not to fall. I feared falling." (74 years old, female, postoperative 5 weeks).*

### Theme 8: Satisfaction with Surgical Outcomes

Patients reported that they were satisfied with the surgical outcomes as they walked easier with the new knee joint, went up and down flights of stairs more easily, slept more comfortably, and performed their daily activities independently.

*"I could not do anything before the surgery. Now, I can clean my home, wash the dishes, cook, and can even go to the field to work. I feel happy. (Smiling)." (54 years old, female, postoperative 11 weeks).*

*"Now I have no pain. I can walk without a walking stick (Smiling)." (74 years old, female, postoperative 5 weeks).*

### Theme 9: Lack of Information of the Postoperative Process

In the interviews, some patients stated that they did not receive a comprehensive discharge training and that they lacked information on many issues. They lacked information on what changes in the surgical site would warrant a visit to the doctor, how often they need to perform exercises, and what things to consider regarding the knee prosthesis. Some patients expressed that they were not well informed, their knowledge was insufficient and they wanted to get more information.

*"I wanted to be trained in areas such as self-care and medication. I tried to keep what the doctor told me in mind, but I am an elderly woman." (72 years old female, postoperative 1 year).*

*"I do not know the circumstances under which I should visit the doctor." (66 years old, female, postoperative 4 weeks).*

## DISCUSSION

The study participants reported how the osteoarthritic knee pain affected them and their quality of life, how they reached a decision to undergo surgery, their experience during the surgical procedure, and the situations in which they experienced difficulties.

### Category 1: Reasons Affecting the Decision to Undergo the Surgery

The study participants said that the most important problem they faced in the preoperative period was knee pain and its

associated difficulties. They said that they had difficulty moving and walking, could not perform their daily life activities, and were often awakened at night by the knee pain. In most recently published literature, it was stressed that the most important problems before TKA were pain and the limitations in the lives of patients.[5,8,9] In the study by Leov et al.[5], patients defined their preoperative pain as constant and disturbing and reported that the pain limited their daily life activities and negatively affected them emotionally. In another study, the women who underwent TKA reported that pain hindered their daily life and made it more tiring. They had to call in sick due to the difficulty in walking and were therefore negatively affected economically.[4] In many studies on the relationship between osteoarthritis and sleep quality, osteoarthritis patients stated that their sleep quality and sleep duration decreased, that the osteoarthritic pain disrupted their sleep, and that they had difficulty sleeping for which they had to take medications.[10,11] The patients in our study said they first tried conservative treatment (pharmacological, non-pharmacological, and intra-articular injection treatments) when they visited the doctor because of these problems. However, they decided on surgery as a last resort when they had no relief from conservative treatment.

### Category 2: Effect of Surgery Decision on the Individual

As it was the first time the patients in our study were undergoing surgery, it was very difficult for many of them to decide on surgery because they experienced fear, sorrow, despair, and worry. Patients said they feared going under general anesthesia and not coming out from under it. They wondered about the surgical procedure but also felt obliged to undergo surgery because they could not cope with the pain. In a study that analyzed the preoperative and postoperative TKA experiences of patients, the participants said they decided to undergo surgery when they experienced serious limitations in their daily lives due to the pain and had to take painkillers everyday.[8] The feelings about the surgery in patients who underwent TKA were often related to anesthesia, anxiety over possibly awakening during surgery, fear of undergoing surgery, disappointing surgical outcomes, possibility of disability, development of complication, and information received from patients who had previously undergone the surgery.[12-14] In our study, the patients said that the views of the specialist and people with TKA experience were effective in helping patients decide on surgery. Some patients stated that they did not receive sufficient information in the preoperative period from healthcare professionals regarding the surgery and the postoperative period and this led to more fear, anxiety, and postoperative pain in the patients. Some patients, on the other hand, said they obtained information about the surgery and postoperative process from individuals who had previously undergone the surgery and they feared due to the statements of other people with experience of the surgery. In a qualitative study that analyzed the experiences of individuals who participated in a preoperative patient training program, the patients said that the training program increased the level of information they had about their situation and the treatment. Consequently, they felt psychologically ready for the operation and the postoperative period. They also demanded written notification because they may forget verbal notification.[15] Studies have shown that preoperative education reduces hospitalization period, anxiety, and postoperative pain level and positively affects surgical outcomes.[16,17]

### Category 3: Effects of Surgery on Individuals

Patients reported that the pain experienced on the day of the surgery was the most difficult part of the postoperative period. They said that the pain was severe, unbearable, and a worse experience than the surgery itself as they experienced movement limitation on the first day because of the pain. Most of the patients said that, due to the pain, their first mobilization was on the first postoperative day. As early mobilization in the postoperative period was hindered, the risk of postoperative complications increased. To reduce postoperative complications, it is therefore important to prepare the patients well for surgery, control their pain, plan administration of painkillers before mobilization, and support them as they carry out their daily activities.[17,18] While some patients said that they regretted undergoing the surgery on account of the postoperative pain, some others said they considered the pain a part of the process and healthcare personnel worked to help to relieve the pain. It was also reported in published literature that orthopedic procedures cause moderate to severe pain in patients. Patients should therefore not expect to undergo this surgical procedure without experiencing pain.[19,20] Thus, it is necessary to diagnose the pain, use pharmacological and/or non-pharmacological methods to relieve the pain, appreciate the effects of the pain, and plan the administration of analgesics before patient mobilization.[19,21,22] In Turkish culture, postoperative pain is considered natural by some people and patients can tolerate this negative experience. In an earlier study, patients described the postoperative pain as severe and difficult to bear and said that the pain especially increased during physiotherapy and the physiotherapy exercises, in terms of pain, were more difficult than the surgery.[4] In another study on patient experiences after knee arthroplasty, it was shown that postoperative pain was considered normal and was more easily accepted when patients were informed of postoperative pain in the preoperative period. Furthermore, patients said they thought the surgeons were reluctant to talk about the pain in the postoperative period and only focused on the functionality of the knee and on radiological results.[1]

Most study participants said they had fear of falling in the postoperative period and were careful not to fall. The physicians told patients not to fall as they think a fall may damage the

knee prosthesis and they may have to operate on the patients again. Fear of falling is commonly experienced in the early postoperative period and may affect the process of adaptation to living with a prosthesis in patients.[23-26]

In this study, patients reported that they were satisfied with the surgical outcomes because they can walk easily, go up and down flights of stairs, have no pain, and can perform their daily life activities independently with the new knee joint. In many published literatures on this topic, TKA was shown to relieve knee pain, improve mobilization levels in patients, and increase self-care agency and quality of life as well as sleep quality and satisfaction.[27-29] We found that some patients in our study did not have sufficient information regarding living with prosthesis and did not get comprehensive training on this issue. Some patients said they wanted training on what to pay attention to and when to visit the doctor. Training and support by healthcare personnel are important factors that help patients cope with the postoperative problems of TKA and the support should begin in the preoperative period.[19,27] Initiating discharge training of patients as soon as decision on surgery is made, providing comprehensive training and counseling on the perioperative process, and providing effective patient participation in this process positively affect surgical outcomes.[17,27,29,30]

### Limitations of the Study

As most of the participants were women, it was agreed that the results of the study did not adequately reflect the experiences of male patients.

## CONCLUSION

Patients expressed their preoperative and postoperative experiences clearly. The most significant problems were pain and its effects. In addition, the patients stated that they had a fear of falling in the postoperative period. The knee pain and mostly the information they obtained from their environment (experiences of individuals who attained relief after previously undergoing the surgery as well as their advice regarding the surgery) were effective in helping patients decide on the surgery. Patients lacked information on many issues (total knee replacement surgery, expected postoperative pain, things to consider after surgery, postoperative exercises etc.) of the postoperative period. Patients should therefore be informed both verbally and in writing about the preoperative, intraoperative, and postoperative periods and they should then make a conscious informed decision on the surgery with sufficient knowledge of the risks and benefits of TKA which will help them more easily cope with the problems. This study contributes to literature by comprehensively presenting the preoperative and postoperative experiences of individuals who underwent TKA.

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## MAIN POINTS

- Total knee arthroplasty, typically performed to alleviate end-stage knee osteoarthritis, is the most commonly performed elective surgery in the World.
- The contribution of the study to the literature is that the preoperative and postoperative experiences of the individuals who underwent total knee arthroplasty are presented comprehensively.
- The most important problems that the patients expressed before and after surgery were the effects of pain and pain.
- Patients stated that they had problems with their physical exercise (for example, not knowing their exercises, not getting support during exercise, not being able to do it due to pain) and fear of falling in the postoperative period.

### ETHICS

**Ethics Committee Approval:** The study protocol was approved by Dokuz Eylül University Ethics Committee for Non-Invasive Research (institutional review board number: 3015-GOA).

**Informed Consent:** Written informed consent was obtained from patients.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: Ö.B., Design: Ö.B., Supervision: Ö.B., Resource: Ö.B., Ç.K., Materials: Ö.B., Ç.K., Data Collection and/or Processing: Ö.B., Ç.K., Analysis and/or Interpretation: Ö.B., Ç.K., Literature Search: Ö.B., Ç.K., Writing: Ö.B., Ç.K., Critical Review: Ö.B.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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ORIGINAL ARTICLE

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# Do We Properly Manage Smoking Cessation as a Part of Our Daily Practice? A Pilot Study from a University Hospital

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## Abstract

**BACKGROUND/AIMS:** Smoking is common affecting millions of subjects worldwide and is linked to numerous medical disorders. We aimed to determine and to evaluate the appropriateness of smoking cessation counseling to adult active smokers.

**MATERIALS AND METHODS:** This cross-sectional study conducted between October 2014-May 2015 and statistical analysis of the data was performed in June 2015 in a university hospital. Adult patients under 65 years of age seen at the general internal medicine clinics were asked to fill in a questionnaire about smoking habits, doctors' questioning about smoking status, and advice received about smoking cessation.

**RESULTS:** A total of 512 patients (64.6% females) with a mean age of 39±14 years completed the questionnaire. Of them, 142 (27.7%) were active smokers. The mean age of the current smokers was 39±12 years and 52.1% were females. Fagerström test revealed that 33.8% of them were high-dependent smokers. Among the smokers, 135 (95.1%) reported having been asked about their smoking status and 72.5% had been advised to quit smoking. Any method to quit smoking was discussed with only 41 (28.9%) of smokers. The most common advice was to visit the smoking cessation clinic of the same hospital. The advice rate for smoking cessation did not change with regard to the dependence score.

**CONCLUSION:** Although asking about smoking was a common practice in internal medicine clinics, advising about cessation and discussing methods for cessation in particular, were not parts of the doctor visit in many of the patient-doctor encounters. Smoking cessation counseling should be an indispensable part of the patient examination.

**Keywords:** Smoking, tobacco, cessation, preventive medicine

## INTRODUCTION

Tobacco consumption is a common addiction affecting millions of people worldwide and is linked to numerous medical disorders. According to World Health Organization (WHO), the leading causes for mortality are ischemic heart diseases, stroke and chronic obstructive heart diseases globally.[1] Smoking is the most important reason for preventable mortality and morbidity.[2] More than 8 million deaths are attributed to tobacco annually: more than 7 million of those deaths are the result of direct tobacco use while around 1.2 million are due to exposure to second-hand smoke. Over 80% of the world's 1.3 billion tobacco users live in low- and middle-income countries.[3] The mortality risk of current smokers, compared to never smokers, have been reported as 198% higher for liver cancer among men, 128% higher for cervical cancer among women, and 92% higher

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for stomach cancer among women.[4] By 2030, tobacco use is forecasted to produce the largest burden of premature mortality and disability in the world compared to other health risk factors.[5] While the average incidence of tobacco product use among individuals 15 years and over was 18% in 2017 in Organization for Economic Co-operation and Development (OECD) countries, the same incidence was reported as 27% in Turkey in 2016.[6] The total economic cost of smoking (from health expenditures and productivity losses together) totaled $1,852 billion ($1,436 billion) in 2012, equal in magnitude to 1.8% of the world's annual gross domestic product (GDP).[7] In the United States of America, estimated annual smoking-attributable economic costs for the years, 2009–2012 were reported as between $289–332.5 billion.[8]

It has been shown that the cessation of smoking is related to a decrease in morbidity and mortality due to tobacco-related diseases.[9,10] Smoking is the most important modifiable risk factor for atherosclerotic diseases, so it is recommended to quit smoking for all smokers for a healthy life. Despite the use of various drugs and non-pharmaceutical approaches to manage tobacco dependence, the rate of smoking cessation is far below the targets.[11] Asking about smoking habits and advising about cessation should be an important part of each patient-doctor encounter. However, this important step is being overlooked in busy medical clinics in routine practice. We aimed to determine the nicotine dependence level of adult patients seen at a university hospital's internal medicine outpatient clinic and to evaluate the appropriateness of smoking cessation counseling by physicians.

## MATERIALS AND METHODS

This study was conducted as a cross-sectional study between October 2014 and May 2015 in the general internal medicine outpatient clinic of a university hospital. The study protocol was approved by the institutional Ethics Committee of Hacettepe University Faculty of Medicine (decision no: 14/275, date: 04.06.2014). Adult patients between 17 and 64 years of age were asked for informed consent and those who consented were asked to fill in a questionnaire after their doctor visits. The questionnaire included questions about demographic data, presence of chronic medical illnesses, smoking habits, doctors' questioning about smoking status and advices received about smoking cessation. Components of Fagerström nicotine dependence scale[12] were asked in the questionnaire (smoking frequency, in which hours of the day smoking occurs, smoking status in restricted areas or when they are ill) to determine the nicotine dependence scale of the subjects. Total scores were classified according to Turkish Thoracic Society guidelines:[13] 0–1 as low dependence, 2–3 low-to-moderate, 4–5 as moderate and 6–7 as high, and 8 and above as very high nicotine dependence. Patients were grouped into two categories for comparison: low-level nicotine dependence (if the score was between 0–5) and high-level dependence (if the score was 6 and higher).

### Statistical Analysis

Data were analyzed by SPSS 21.0 (SPSS INC., Chicago, IL, USA) statistical program. Non-parametric data were given as percentages (%). Continuous numerical data were analyzed for normal distribution and normally distributed continuous numerical data were given as mean ± standard deviation. Median (minimum-maximum) was used if the data were not distributed normally. Low-level dependence and high-level dependence groups were compared with Fisher's exact test or chi-square test where appropriate. Correlation analyses were performed with Pearson and Spearman tests. P-values less than 0.005 were accepted as statistically significant.

## RESULTS

Total of 512 patients consented for the study and completed the questionnaire. Mean age of the subjects were 39±14 years and females constituted 64.6% of the study population (Table 1). Active smokers constituted 27.7% of the study group (n=142). The mean age of the smokers were 39±12 years and 52.1% of them were female. There were statistically significant differences between active smokers and non-smokers with regard to gender and status of occupation (Table 1). At least one chronic illness was present in 19.7% of smokers.

According to the Fagerström nicotine-dependence scale, 33.8% of the active smokers were very highly dependent. Pie-chart shows the distribution of smokers according to Fagerström nicotine dependence test in numbers and percentages (Figure 1).

Among the active smokers, 135 (95%) reported that doctors in the current encounter inquired about the smoking status and 103 (72.5%) of them were advised to quit smoking. However, only 41 smokers (28.9%) were advised at least one method for smoking cessation. The most common method recommended to quit smoking was the recommendation to consult the "smoking cessation department" of the same institution. Figure 2 shows the frequency of cessation methods advised to active smokers. Advice rates to quit smoking were not different with regard to different nicotine dependence levels, daily cigarette consumption volume, presence of chronic medical illness or gender. However, smokers aged 46–55 years were advised significantly more about quitting smoking (p=0.018). Advice rates to use any cessation method did not differ with regard to nicotine dependence or gender, while smokers without any chronic medical illness was given advice on at least one of the cessation methods (p=0.020).

Sixty-one percent of active smokers had at least one smoker in the household, whereas 41% of non-smokers had at least one

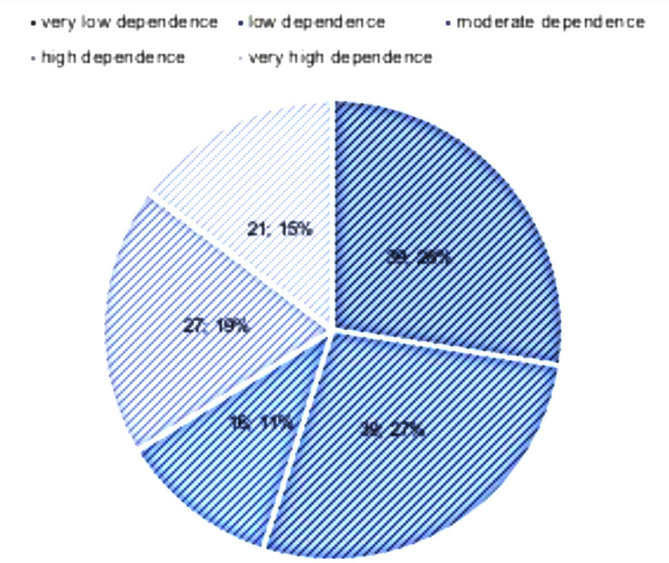


**Figure 1.** Figure showing the distribution of smokers according to Fagerström nicotine dependence test in numbers and percentages.

smoker household contact and this was statistically significant (p<0.01). The frequency of having at least one smoker household did not differ significantly among subjects with high-level nicotine dependence and low-level nicotine dependence (54.2% vs. 64.9%, respectively; p=0.215). Thirty-seven (26.4%) of the active smokers admitted that they were not supported by their family members or household contacts about smoking cessation and there was no difference between low-level and high-level dependence groups with regard to family support (26.4% vs. 25%, respectively; p=0.860).

## DISCUSSION

In this study, we evaluated the nicotine dependence level of adult patients seen at a university hospital internal medicine outpatient clinic and the appropriateness of smoking cessation counseling by the physician. As we evaluated the clinical approach of internists with regard to inquiring smoking habits of their patients, we did not inform the doctors about the contents of questionnaire in order not to create a bias. Moreover, patients were interviewed in the outpatient clinic in separate rooms. We found that physicians advised to quit smoking in 72.5% of the encounters with active smokers and any method to quit smoking was discussed in less than one-third of the encounters.

In former studies, doctors questioned about the smoking status in 67%–88% of the subjects, while they advised to quit smoking to 17%–49% of active smokers.[14-18] A population-based phone call study reported that 70% of smokers were given an advice on smoking cessation in the past 12 months.[19] In two different studies, 50%–53.3% of the smokers who were advised to stop smoking were recommended any method of cessation, the majority of which was nicotine replacement therapy.[20,21] In a recent study, Keto et al.[22] pointed out that the doctors' awareness of smoking was the most important public health issue for their country, but practical cessation support to their patients was rare. Besides impressive global and national tobacco control efforts in the last decades, the recommendation of any method for quitting in non-cessation clinics has undramatically increased during this time.

This study did not outline the physicians' perspective about the barriers against tobacco cessation. However, studies elsewhere showed a spectrum of barriers: information level of physicians

**Table 1. Demographic data of the patients concerning the smoking status**

| | All patients (n=512) | Active smokers (n=142) | Non-smokers (n=370) | p-value |
|---|---|---|---|---|
| Age, mean ± SD (years) | 38±14 | 39±12 | 38±14 | 0.622 |
| Gender; female | 331 (64.6) | 74 (52.1) | 257 (69.5) | <0.001 |
| Occupational status (no occupation) | 192 (37.5) | 42 (29.6) | 150 (40.1) | 0.016 |
| Area of accommodation (rural area) | 491 (95.7) | 136 (95.7) | 344 (92.9) | 0.711 |
| Marriage status (married) | 319 (62.3) | 87 (61) | 227 (61.3) | 0.78 |
| Educational status (high school and higher) | 361 (70.5) | 101 (71.1) | 260 (76.5) | 0.840 |
| Presence of chronic illness | 87 (17) | 28 (19.7) | 59 (15.9) | 0.38 |
| Chronic obstructive lung disease | 6 (1.2) | 1 (0.7) | 5 (1.4) | 0.543 |
| Asthma | 29 (5.7) | 10 (7) | 19 (5.1) | 0.404 |
| Coronary heart disease | 7 (1.4) | 2 (1.4) | 5 (1.4) | 0.960 |
| Diabetes mellitus | 49 (9.6) | 16 (11.3) | 33 (8.9) | 0.419 |
| Cancer | 5 (1) | 1(0.7) | 4 (1.1) | 0.698 |

Numbers in the parentheses denote the percentages.
SD: standard deviation, n: number.

about clinical guidelines,[19] experiences in cessation practice, timelessness, the patients' willingness and physicians' smoking status.[19,20,22] Whatever the barriers are, even simple questions about smoking habits and willingness to quit smoking will help.[23-25] A Cochrane meta-analysis in 2013[26] reported that even brief advice about smoking cessation increased cessation rates at almost 1%–3%. Also, Aveyard et al.[27] specified the importance of offering any support for quitting smoking will motivate an additional 40%–60% of smokers attempting to stop compared to a brief advice about smoking cessation. As 80% of the smokers is estimated to visit at least one doctor in a year, this must be an opportunity to advice smokers about smoking cessation. In the scope of preventive medicine, healthy life measures are being advised to individuals in clinical encounters but advice on smoking cessation is not made routinely.[19,28] United States Preventive Services Task Force[29] and local guidelines[13] recommend both behavioral interventions and pharmacotherapy or combination of these deciding according to the patient's medical history, preferences and feasibility. Although brief behavioral counseling increases the cessation rates significantly, longer counseling time in a multidisciplinary approach causes higher cessation rates (at least four session and 90 min of total counseling by physicians, nurses, psychologists, social workers and cessation counselors). Phone counseling and self-help materials are also effective in cigarette cessation. Pharmacotherapy with nicotine replacement therapy (NRT), bupropion sustained release (SR) and varenicline causes significant (17%, and 28%, and 19%, respectively) smoking abstinence compared to controls. Combination pharmacotherapy with two NRT or NRT plus bupropion SR is more effective than single agent therapy.[13,29]

An important point is that active smokers had a significantly higher rate of smokers in their family member or household contacts than non-smokers. This may underline the demoralizing effect of family and circumference on the personal will and circumstances to quit smoking.[30] Future studies may reveal the additional benefit on smoking cessation rates of the family or partner counseling on the behavior of the smokers.

Our study has some limitations: the study population was small. The physicians were aware of a study undertaken in the clinic, but they do not know the scope of the questions. Also, the physicians were changing monthly, indeed, which might be an opportunity observe the behavior of more physicians.

## CONCLUSION

Our study showed that great majority of the individuals are being asked about smoking habits and two-thirds of active smokers were advised to quit smoking but only one-third of active smokers received a formal methodological recommendation about smoking cessation. Smoking cessation counseling should be an indispensable part of the patient-doctor encounter.

## MAIN POINTS

- Asking about smoking habits and advising about cessation should be an important part of each patient-doctor encounter.
- We found that physicians advised to quit smoking in 72.5% of the encounters with active smokers. However, only 41

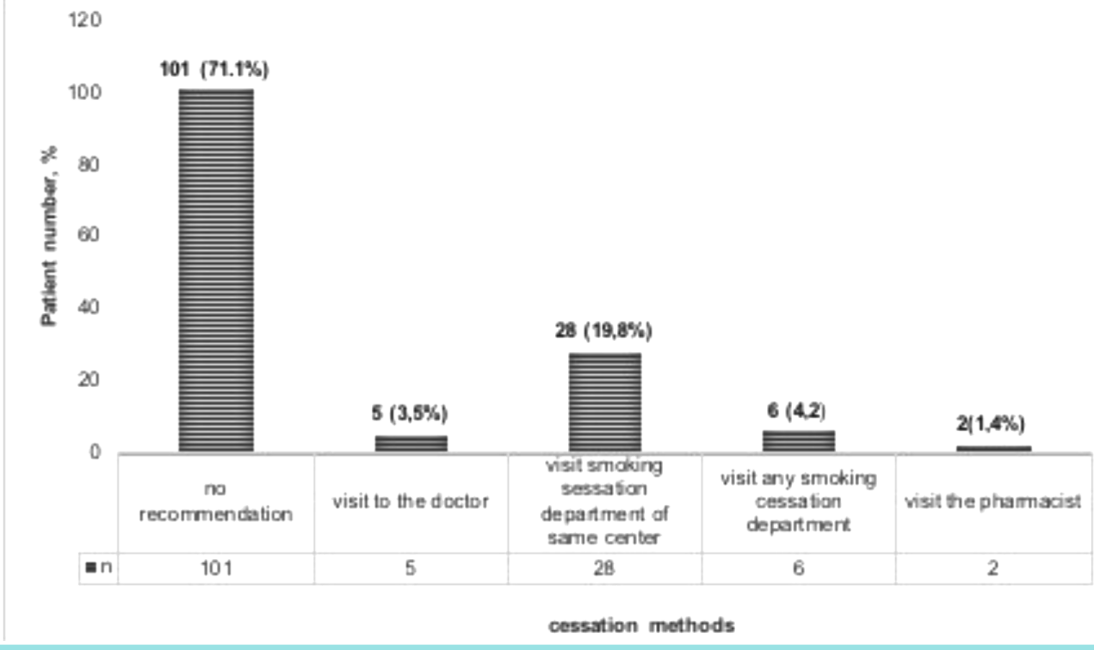


**Figure 2.** Figure showing the distribution of smokers according to Fagerström nicotine dependence test in numbers and percentages.

smokers (28.9%) were advised at least one method for smoking cessation.

- Doctors should not only recommend smoking cessation, but also have information about smoking cessation methods.

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### ETHICS

**Ethics Committee Approval:** The study protocol was approved by the institutional Ethics Committee of Hacettepe University Faculty of Medicine (decision no: 14/275, date: 04.06.2014).

**Informed Consent:** Adult patients between 17 and 64 years of age were asked for informed consent and those who consented were asked to fill in a questionnaire after their doctor visits.

**Peer-review:** Externally peer-reviewed.

#### Authorship Contributions

Conception: N.Ç.B., L.Ö., O.A.U., M.D.T., Ş.G.Ö., G.S.G., Design: N.Ç.B., L.Ö., O.A.U., M.D.T., Ş.G.Ö., G.S.G., Supervision: N.Ç.B., M.D.T., Ş.G.Ö., G.S.G., Data Collection and/or Processing: N.Ç.B., Analysis and/or Interpretation: N.Ç.B., L.Ö., Literature Search: N.Ç.B., L.Ö., O.A.U., G.S.G., Writing: N.Ç.B., M.D.T., Critical Review: N.Ç.B., M.D.T., Ş.G.Ö., G.S.G.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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ORIGINAL ARTICLE

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# Comparative Evaluation of the Push-Out Bond Strength of Root-End Filling Materials by Using Different Condensation Methods

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## Abstract

**BACKGROUND/AIMS:** This study aims to evaluate effect of the application of ultrasonic devices in the simulation models with the push-out test and compare with traditional methods during transfer of bioactive materials to the root canal.

**MATERIALS AND METHODS:** In our study 60 extracted human single-root mandibular premolars without caries, root resorption, or fractures were used. The samples were standardized and divided into four sections randomly. Samples were embedded to alginate impression material for simulating the periapical tissue. Group 1; 4 mm of the apical of teeth were obturated with mineral trioxide aggregate (MTA) (Angelus, Brazil) and condensed by plugger. Group 2; 4 mm of the apical of teeth were obturated with MTA and condensed by plugger and ultrasonic activation. Group 3; 4 mm of the apical of teeth were obturated with Biodentine (Septodont, France) and condensed by plugger. Group 4; 4 mm of the apical of teeth were obturated with Biodentine and condensed by plugger and ultrasonic activation. The push-out test was performed using a universal testing machine.

**RESULTS:** According to result of this study, ultrasonic activation groups (groups 2 and 4) of bond strength values were better than plugger condensation groups (groups 1 and 3) of bond strength values ($p<0.05$).

**CONCLUSION:** The bond strength of bioactive materials used in single visit apexification is an important factor for the success of the treatment in the future. According to the results of this study, the application of materials by ultrasonic activation shows higher bond strength than hand condensation in the application of MTA and Biodentine to the apical region of immature teeth.

**Keywords:** Bioactive materials, bond strength, push-out test

## INTRODUCTION

Trauma or deep caries in the immature tooth can result in pulpal necrosis with incomplete root formation. Encountering immature teeth causes clinical difficulties in root canal treatment. Apexification is mandatory to obtain an adequate root canal filling since no apical terminus of the root and thin fragile walls are observed in the root canals. Calcium hydroxide [$Ca(OH)_2$] material has been used in the apexification procedure for many years to induce apical closure.[1] Andreasen et al.[2] stated that the strength of immature teeth decreased by 50% after a 1-year follow-up of calcium hydroxide application compared to the control group.

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Mineral Trioxide Aggregate (MTA, MTA Angelus, Londrina, Brazil) material is produced by Torabinejad for use in root-end filling and perforations.[3] MTA is the most preferred material in the single session apexification method due to its strong physical, chemical, and clinical properties in the apical region, being bacteriostatic, establishing a good plug, dimensional stability, biocompatibility, and sealing.[4] However, there are also some disadvantages such as application difficulty, long curing time, and apical leakage that may occur until the curing is completed.[5]

Therefore, newly developed calcium silicate-based materials, as alternative fast-curing materials, have been examined to increase clinical success. Biodentine (Septodont, Saint Maur des Fosse, Cedex, France) is a fast curing (~10–12 minutes) calcium silicate-based material. Several *in vitro* studies and case reports suggest the use of Biodentine as an alternative to MTA due to its similar sealing ability, biocompatibility, mineralized tissue formation, superior hydroxyapatite apposition when exposed to tissue fluids, and stimulating the healing ability of periapical tissue.[6]

The mixture and application method of the root end closure material is a factor affecting the success of the dental material. It was suggested that ultrasonic activation could facilitate the compressed air escape and allow the rearrangement of material particles. However, there are discussions about the effectiveness of this method.[7] In a study examining the effect of both mixing and ultrasonic activation techniques of MTA on marginal adaptation, no difference was observed between hand-applied and ultrasonic condensation methods. Moreover, Aguiar et al.[8] reported that materials placed using coronal ultrasonic activation had shown better adaptation. In the study comparing the stress distributions of Biodentine and MTA as a root-end closure material, it was stated that there was no difference between the two materials. Because there was no study examining the effect of condensation of the root-end closure materials using ultrasonic activation on bond strength, this study was conducted on this subject. This study evaluates the effect of the application using ultrasonic devices in the simulation models by the push-out test, as well as, to compare with traditional methods in terms of the transfer of bioactive materials to the root canal. The null hypothesis is that ultrasonic activation affects bond strength and interfacial adaptation of bioactive materials.

## MATERIALS AND METHODS

In this study, 60 extracted human single-root mandibular premolars were used that without caries, root resorption, or fractures. After removing the tissue residues on the teeth, each tooth was stored in 0.1% thymol solution at room temperature until they were used in the study. Teeth crowns were removed from the cervical enamel junction using diamond disks under water cooling, to obtain a standard root length of 13 mm from the apex. Root canal preparation protocol defined by Lawley et al.[9] was applied to the obtained samples. Root canals were instrumented with a #2 Peeso Reamer (Dentsply, Maillefer, Ballaigues, Switzerland) to the working length and then an open apex was prepared #8 (0.60) Profile Series (Dentsply, Maillefer, Ballaigues, Switzerland) 29.04 taper at the foramen retrogradely for sandglass shape. During preparation, root canals were rinsed with 2.5% NaOCl. A final rinse with 2 mL 2.5% NaOCl for 1 min, 2 mL 17% EDTA for 1 min, and 10 mL distilled water was performed. The canals were dried with paper points. Then, samples were divided into four sections randomly and for simulating the periapical tissue, the teeth were embedded to alginate impression material.

**Group 1;** 4 mm of the apical of teeth were obturated with MTA (Angelus, Londrina, PR, Brazil) according to manufacturer recommendations (mix 1 ladle of powder with 1 drop of distilled water for 30 seconds) and condensed by plugger (Dentsply, Maillefer, Ballaigues, Switzerland).

**Group 2;** 4 mm of the apical of teeth were obturated with MTA according to manufacturer recommendations and condensed by plugger and ultrasonic activation (Mini-Endo Unit, SybronEndo, Orange, CA).

**Group 3;** 4 mm of the apical of teeth were obturated with Biodentine (Septodont, France) according to manufacturer recommendations (Mix 1 capsule of powder with five drops of liquid for 30 seconds using vibratory mixing machine) and condensed by plugger.

**Group 4;** 4 mm of the apical of teeth were obturated with Biodentine according to manufacturer recommendations (Mix 1 capsule of powder with five drops of liquid for 30 seconds using vibratory mixing machine) and condensed by plugger and ultrasonic activation.

In Groups 2 and 4, a Mini-Endo ultrasonic unit (SybronEndo, Orange, CA) with a ball-like tip (File Adapter; Spartan) at 50% power was used to apply ultrasonic activation to #7 condensers to flow, settle and compact the MTA and Biodentine to root apex. Using by radiographs, the quality of the fillings evaluated. Specimens that cracks or canals inadequately filled were eliminated and switched by a new sample. After condensation procedure, moist cotton pellet had placed into teeth and coronal region was closure by using provisional filling materials. All samples were stored for 10 days at 37 °C and 100% humidity for materials set up.

The push-out test was applied using a universal testing machine (Lloyd Instruments, Fareham Hants, England). In this study, all samples had embedded acrylic resin, after it was setting, the resin block was divided from the metal meld and put in the cutting machine. 2 samples with 1 mm thickness were taken

from middle of 4 mm apical section of teeth. To verify the thickness of the slices were measured using a digital caliper (Digimess, São Paulo, Brazil) with 0.01-mm accuracy. Under ×2 magnification, the sections that observed irregular cement thickness or voids were excluded from the study. Each dentin/resin material disc with root-end filling was set in the mechanical test machine (EMIC DL 2000), with a 5 kN load cell. (Figure 1) Progressive compression test was achieved with the power applied from coronal to apical at 1 mm/min speed, from the touch of the device tip to filling material displacement.[10-11]The cylindrical piece had 1.3 mm caliber and continued connection with sealer. After these measures the values were obtained in newton (N) and converted into MPa. The value attained was divided by the adherence surface area of root canal filling, calculated by a certain formula for explain the bond strength in megapascal (MPa).

$$Area = \pi(R1 + R2)\sqrt{(R1 - R2)^2 + h^2}$$

The area ($mm^2$) under the load was calculated from the cylinder lateral surface area formula: bonding area=2πrh, where "r" is the radius of the preparation circumference, and "h" is the thickness of the root slice (2.0 mm). Divided the load (N) into the bonding area ($mm^2$), the bond strength value in megapascals (MPa) was calculated. Data were statistically analyzed to Two-way ANOVA and post hoc Tukey's tests at significance level of 0.05.

## RESULTS

The bond strength values (MPa) between groups are shown in Table 1. Group 4 had the highest bond strength value and there were no differences between Group 2 and 4 and Group 1 and 3 ($p>0.05$). Ultrasonic activation groups (Group 2 and Group 4) were better results than plugger condensation groups (Group 1 and Group 3).

## DISCUSSION

Studies reported that marginal adaptation and bond strength are closely related to each other. Bioactive materials containing calcium silicate produce apatite-like structures and precipitate between calcium phosphate material and dentin, and dentin tubules. This molecular tag-like structure provides the formation and allows the formation of a hybrid layer on the interface.[12] In this study, materials were placed in the root canal by ultrasonic activation to strengthen the connection. Ultrasonic activation is provided by the conduction of micrometric acoustic energy. The acoustic energy generated by the ultrasonic device is transmitted to the material as a mechanical vibration to achieve better adaptation at the cement-dentin interface.[11-13] The MTA shows a good bond strength for facilitating the tooth to show resistance to masticatory forces.[14] The push-out mechanical test is used to assess the bond strength of root-end filling and post-core materials to the dentin. The push-out test is a suggested method that shows effective and consistent results.[15] Lawley et al.[9] examined the effect of MTA placed in the canal manually and using the ultrasonic device on root fracture formation. The authors reported that ultrasonic activation of MTA during obturation was more successful than manual condensation alone. Camilleri et al.[3] stated that the application of Biodentine into the root canal by ultrasonic activation increased the adaptation of the material on the root canal surface. Many clinical and laboratory studies have proven that the porosity of the material caused mechanical and physical problems.[16,17] In their study comparing the porosity of MTA at the end of hand condensation and ultrasonic activation, Rahimi et al.[18] observed less porosity in the ultrasonic method compared to the hand condensation method. These results are similar to the results

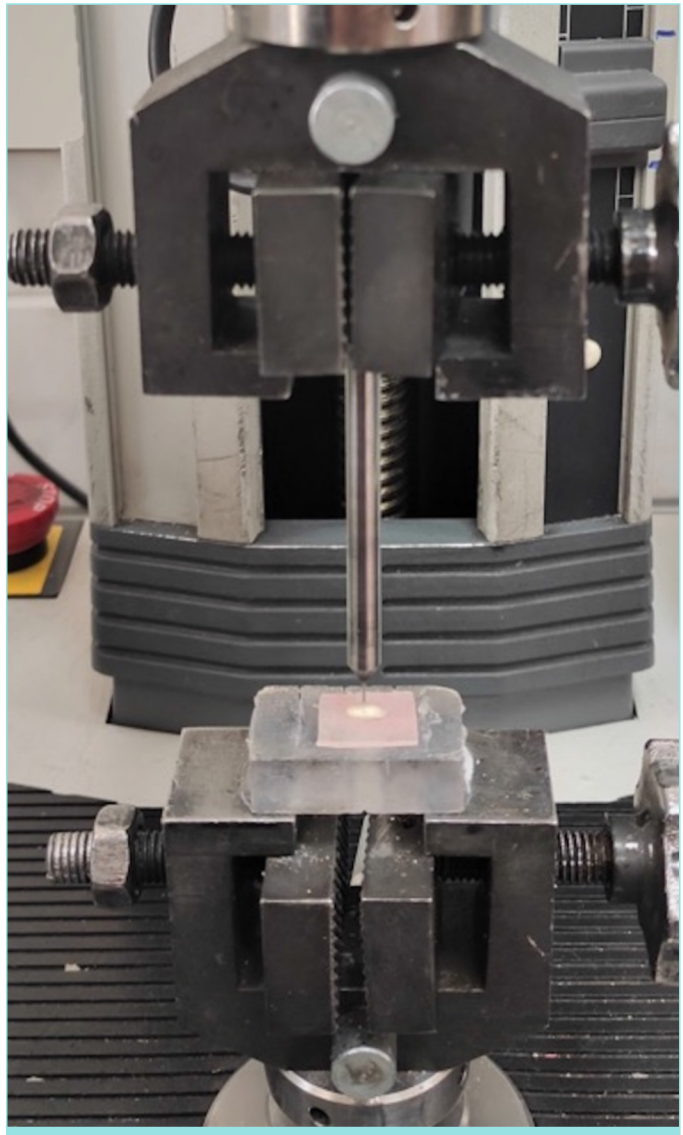

**Figure 1.** Illustration of PBS test of the specimens.
PBS: Push-out Bond Strength.

**Table 1. Bond strength of values (MPa), mean ± standard deviation and number of slices**

| Materials | n | Bond strength (MPa) | Standard deviation |
|---|---|---|---|
| Group 1 (MTA condensed with plugger) | 30 | 14.25[a] | ±1.36 |
| Group 2 (MTA condensed with plugger and ultrasonic activation) | 30 | 19.33[b] | ±2.47 |
| Group 3 (Biodentine condensed with plugger) | 30 | 14.78[a] | ±1.45 |
| Group 4 (Biodentine condensed with plugger and ultrasonic activation) | 30 | 21.36[b] | ±2.66 |

*Different letters in the same column indicate statistically significant differences ($p<0.05$). MTA: mineral trioxide aggregate

of this study. Similarly, the application of MTA and Biodentine materials into the root canal by ultrasonic activation increased the bond strength in the groups using these materials in this study.

Moreover, the physical characteristics of the materials are other factors that affect the prognosis of the treatment. These characteristics depend on temperature, particle size, humidity, liquid/powder ratio, the quantity of air trapped in the mixture.[19] In previous studies, researchers stated that calcium silicate-based materials penetrate more easily into dentin tubules and exhibit higher bond strength due to their smaller particle size.[20] Biodentine contains less dicalcium silicate than MTA, thus, exhibited a more homogeneous structure that increased bond strength.[20,21] Torres et al.[22] evaluated the porosity of MTA and Biodentine and observed that MTA had a more porous structure than Biodentine in their study. They also stated that the porosity of the material could affect bond strength. Dawood et al.[23], Kaup et al.[24], and Natale et al.[11] reported that Biodentine showed higher hardness, elastic modulus, and flexural strength compared to MTA. In another study, Biodentine and MTA used for treating immature teeth did not result in any significant difference against the risk of root fracture resistance.[25] Similar to a study by Villat et al.[26], no difference was observed between the bond strength values of the hand-condensed MTA and Biodentine in this study. This result can be explained using different powder-liquid ratio in the mixture and may be due to the experimental differences in the studies. As a limitation of this study, mixing the MTA material manually may cause operational errors. This may be because factors such as powder-liquid ratio and the curing time cannot be standardized in the manual mixing method, also, the manual mixing method results in more air voids. However, Biodentine is mixed using an amalgam vibrator; thus, it provides the same standard conditions in each mixing. Also, it was reported to eliminate errors that may be caused by the operator.[27]

Another limitation of this study is the lack of periodontal ligament and bone structure that absorbs the forces applied to the teeth clinically and affects the distribution of these forces.[28] Note that the results obtained using the alginate model to simulate clinical conditions do not directly reflect the clinical settings.

## CONCLUSION

The bond strength of bioactive materials used in single visit apexification is an important factor for the success of the treatment in the future. According to the results of this study, the application of materials by ultrasonic activation shows higher bond strength than hand condensation in the application of MTA and Biodentine to the apical region of immature teeth.

## MAIN POINTS

- Single visit apexification procedures are applied to teeth incomplete root development.
- Ultrasonic activation is an effective application in the condensation of bioactive materials.
- The bond strength of bioactive materials used in apexification is an important factor for the success of the treatment in the future.

### ETHICS

**Ethics Committee Approval:** The ethical approval was obtained from the Ethics Committee of the Hatay Mustafa Kemal University (Ref no: 2017/18).

**Informed Consent:** N/A.

**Peer-review:** Externally peer-reviewed.

**Authorship Contributions**

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**DISCLOSURES**

**Conflict of Interest:** The authors declare no conflict of interest.

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ORIGINAL ARTICLE

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# Management of Endocrine Complications Affecting Survival and Quality of Life in Children and Adolescents with Thalassemia Major: A Single Center Experience

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## Abstract

**BACKGROUND/AIMS:** Although advances for treating beta-thalassemia major have improved the survival of patients, endocrine complications are still quite common in these patients. These complications continue to negatively affect the survival and quality of life of patients with thalassemia major. This study aimed to determine the frequency and distribution of endocrine complications and to investigate the relationship between these complications and serum ferritin levels in children and adolescents followed up with the diagnosis of beta-thalassemia major

**MATERIALS AND METHODS:** Fifty-eight children and adolescents (female/male: 27/31, mean age 12.6±5.16 years) diagnosed beta-thalassemia major were included in the study. Anthropometric (body weight and height standard deviation score), laboratory and radiological evaluations according to International Network of Endocrine Complications in Thalassemia (ICET) recommendations were performed.

**RESULTS:** The median serum ferritin level was 2,969 ng/mL (562–10,251 ng/mL). In this study, the rate of at least one endocrine complication was 83% (n=48). Fifteen of them (31%) were under 10 years of age. The most common endocrine complications were vitamin D deficiency (53%), short stature (45%), osteopenia (34%), pubertal disorder (mean 25% for each sex) and osteoporosis. Ferritin levels did not correlate with anthropometric, laboratory parameters and endocrine complications.

**CONCLUSION:** Regular monitoring of growth, vitamin D status, puberty, and all other endocrine functions is important to improve the quality of life of patients with thalassemia major. Increasing the quality of life and survival of these patients may be possible with early diagnosis and treatment of endocrine complications.

**Keywords:** Hemoglobinopathy, thalassemia major, endocrinopathies, children and adolescents

## INTRODUCTION

Beta-thalassemia major (BTM) is a hereditary disease caused by a defect in hemoglobin synthesis. The basis of BTM therapy is transfusion. The main purpose of transfusion therapy is to keep the hb levels between 9 and 10 g/dL before transfusion. For this purpose, blood transfusion is applied at 2–4 weeks intervals. Iron chelation treatments are used to prevent iron buildup and related complications. Splenectomy is performed in patients with transfusion requirement >200 to 220 mL RBC/kg per year and developing symptoms of hypersplenism. In patients with

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appropriate donors, hematopoietic stem cell transplantation (HSCT) has been increasingly applied recently.[1]

The life expectancy in thalassemia major patients has increased significantly thanks to regular blood transfusions, chelation therapy, and increased knowledge and experience of the disease. Although increased life expectancy, cardiopulmonary system, liver, renal and endocrine complications are common still, due to iron accumulation because of regular blood transfusions in thalassemia major. Proper chelation of iron overload could improve the quality of life of these patients and decrease the endocrine and cardiac complications. Effective management of iron overload requires frequent evaluation of the body iron stores.[2] Serum ferritin is quantitative, non-invasive method for measuring body iron. The levels of serum ferritin in beta thalassemia major patients are important to ensure proper management of iron overload-associated complications.[3]

Short stature, overt/subclinic hypothyroidism, delayed puberty/hypogonadism, impaired glucose tolerance (IGT) and diabetes, hypoparathyroidism, osteopenia/osteoporosis and adrenal insufficiency are the reported major endocrine complications in patients with diagnosed BTM. The main cause of endocrine complications are excess iron accumulates in many tissues including endocrine organs such as the pituitary, pancreas, gonads and thyroid. Genetic factors, age of onset of chelation therapy and adherence to this therapy, liver dysfunction and tissue hypoxia due to chronic anemia are other factors contributing to these endocrine complications. The incidence of endocrine complications associated with beta-thalassemia major increases with increasing age. Although these complications are mostly seen in advanced adolescence and adulthood, it is also detected in children. However, data on the prevalence, distribution and age of onset of endocrine complications are heterogeneous.[4-7]

The recommended parameters for annually Endocrine screenings in pediatric and adult patients with BTM according to International Network of Clinicians for Endocrinopathies Complications in Thalassemia (ICET) guidelines are serum thyroid stimulating hormone (TSH) and free T4, serum calcium, phosphate, magnesium, alkaline phosphatase, vitamin D, and parathyroid hormone (PTH), fasting glucose/insulin and oral glucose tolerance testing (OGTT) in case of impaired fasting glucose (IFG), serum insulin-like growth factor (IGF)-I (only in patients with short stature), bone age (X-ray of wrist and hand), luteinizing hormone (LH), follicle stimulating hormone (FSH), and sex steroids (testosterone/estradiol) in the pubertal age group and dual-energy X-ray absorptiometry for evaluation of bone mineral density (BMD) in patients older than 10 years old.[8]

Most of the previously reported studies were performed on adolescents and adults, studies involving only children and adolescents are few.[6,7,9] Therefore, we aimed to determine the frequency of endocrine complications and to evaluate the factors affecting these complications in children and adolescents diagnosed with BTM.

## MATERIALS AND METHODS

A total of 58 children and adolescents followed up with the diagnosis of BTM in pediatric endocrinology and pediatric hematology outpatient clinics were included in the study [female (F)/male (M): 27/31]. BTM was diagnosed by genetically in 31 patients and by transfusion dependence and hemoglobin electrophoresis in others. Transfusions were administered monthly during infancy and subsequently at intervals of 2–4 weeks. The pretransfusion Hb level of the patients was 9–10 g/dL.

Patients were followed up every 6 months for growth and endocrine complications according to ICET (International Network of Clinicians for Endocrinopathies Complications in Thalassemia) recommendations in the endocrine outpatient clinic and data were recorded.[8] Physical was examined by the same physician (S.T.). Weight was measured using a calibrated digital scale and length measurements were made using a stadiometer fixed to the wall. The body mass index was calculated by dividing the body weight (kg) by the square of the meter of height ($m^2$).

Estimation of the child's genetic height potential (target height) is an important tool in evaluating growth disorders. Midparental height (MPH) is used for this purpose. It represents the child's expected height based on parental heights. Midparental height, was calculated for boys as [father height + (mother height + 13 cm)] / 2, for girls as [mother height + (father height-13 cm)] / 2.

Anthropometric standard deviation scores (SDS) were evaluated according to age and sex-matched norms for Turkish children.[10] Height below -2 SDS was defined as short stature. The growth velocity of the patients were calculated according to height difference at least 6-month via data in the files. According to this, growth velocity below -2 SDS was considered insufficient growth velocity.[11]

Pubertal status was evaluated according to Tanner criteria.[12] Absence of breast development until 13 years of age in girls and the absence of testicular growth (<4 mL) until 14 years of age in boys was defined as pubertal delayed.

Patients with thalassemia intermedia were excluded from the study. Written consent was obtained from the guardians of all patients.

In the follow-up of the patients, the following tests were performed according to ICET recommendations; serum TSH and free T4 (fT4), calcium, phosphate, magnesium, alkaline phosphatase (ALP), 25OH vitamin D and PTH, fasting glucose/insulin. An oral glucose tolerance test (OGTT) was performed

in case of IFG. Serum insulin-like growth factor 1 (IGF-1) and bone age (hand and wrist radiograph) were analysed in patients with only short stature. In patients with the pubertal age group were performed luteinizing hormone (LH), FSH and sex steroids (testosterone/estradiol). Follicle-stimulating hormone and luteinizing hormone values were measured by immuno-chemiluminescence (ICMA) method. Bone mineral density (BMD) was assessed with dual X-ray absorptiometry (DXA) in patients older than 10 age years. Growth hormone (GH) stimulation tests were performed on eight patients These patients had short stature, IGF-1 levels were <-2 SDS according to reference values appropriate age and sex and growth velocity were low.[11,13] Clonidine [0.15 mg/m² peroral (PO)] and glucagon (<15 kg, ½ ampoule,> 15 kg, 1 ampoule, intramuscular) were used for GH stimulation tests. For both stimulation tests for peak GH level <10 ng/dL was considered growth hormone deficiency.

FSH, LH, estradiol and/or total testosterone levels were evaluated in 15 girls and 13 male patients whose chronological age was ≥13 and ≥14 years, respectively. Gonadotropin releasin hormone (GnRH) Ferring Pharmaceuticals (LHRH) stimulation test was performed to evaluate hypothalamo-pituitary axis in three girls and four boys whose had pubertal delay. Blood samples were taken at baseline and 20, 40 and 60 min after intravenous injection of gonadorelin acetate to assess LH, FSH, estradiol/testosterone levels.

25-OH-vitamin D level 15–19 ng/mL was defined as vitamin D insufficiency and 25-OH-vitamin D level <15 ng/mL was defined as vitamin D deficiency. For vitamin D insufficiency, daily 1,000 IU vitamin D PO was administered for 6–8 weeks, while all patients with vitamin D deficiency received a single dose of 150–300 thousand units of Stoss Vitamin D replacement treatment.[14]

Low dose (1 mcg tetracosactid (Synacthen; Novartis) Adrenocorticotropropin (ACTH) stimulation test was performed in 8 patients whose serum cortisol level measured at least 2 times in the early morning was <10 mg/dL. Cortisol level was measured at baseline and at the 30th and 60th minutes after tetracosactid intravenous injection.

An oral glucose tolerance test was performed on six patients had IFG [with a dose of 1.75 g/kg (maximum 75 g) glucose)]. Serum glucose and insulin levels were measured at baseline and 60 and 120 min after oral glucose administration. IGT was defined as glucose level >140 mg/dL but also <200 mg/dL. Diabetes mellitus (DM) was diagnosed on the basis of a glucose level >200 mg/dL or a history of insulin therapy.[15] Biochemical analysis were performed using Abbott Architect C16000 and Roche cobas e601 Autoanalyser.

Bone age was determined by nondominant wrist radiograph evaluated according to Greulich and Pyle method using the same physician (S.T.). Bone mineral density (BMD) of 30 patients older than 10 age years was evaluated with dual X-ray absorptiometry (DXA) method. Z-scores of BMD of all body except the head were adjusted for bone age and sex were recorded. Z scores >-1,- 1 to -2 and <-2 and clinically significant fracture history (lower extremity long bone fracture, vertebral compression fracture, or two or more long bone fractures in the upper extremity) were accepted as normal, osteopenic and osteoporotic, respectively.[16]

The mean ferritin level of the last one year was calculated.

This study was approved by the Ethics Committee of University of Health Sciences Turkey, Diyarbakır Gazi Yaşargil Training and Research Hospital (decision number: 241)

### Statistical Analysis

SPSS 20.0 software was used for all statistical analysis. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine normal distribution. Variables showing a normal distribution were given as mean ± standard deviation, and variables without normal distribution were given as median (range). Descriptive statistics were made. Mean and standard deviation values of continuous and categorical variables were calculated. Independent sample t-test was used for continuous variables Univariate correlation analysis and Pearson correlation analysis were performed for the relationship between parameters. P-value <0.05 was considered statistically significant.

## RESULTS

The mean height Z Score was -1.52±1.42, the mean weight z score was -1.27±1.44 and the mean body mass index (BMI) Z score was -0.55±1.10. There was no statistically significant difference between the mean height Z score (-1.52±1.42), and the midparental height Z score (-0.98±0.84) in the study group (p=0.03). Endocrine complications in patients with beta thalassemia major are summarized in Table 1. 45% of the patients (n=26, F/M: 9/17) had short stature. Serum IGF-1 levels were <-2 SDS (-1.96±1.21) (30.6–441ng/mL) (according to reference values

**Table 1. Endocrine complications of the patients**

| Complication | n (%) |
|---|---|
| Short stature/GH defficiency | 26/5 (45/19%) |
| Vitamin D deficiency/insufficiency | 14/31 (24/53%) |
| Osteopenia/osteoporosis | 20/8 (34/14%) |
| Hypogonadism (F/M) | 2/2 (3.5/3.5%) |
| Pubertal delay (F/M) | 1/2 (2/3,5%) |
| Overt/subclinic hypothyroidism | 2/3 (3.5/5%) |
| Hypoparathyroidism | 2 (3.5%) |
| Impaired fasting glucose | 6 (11%) |
| Impaired glucose tolerance | 3 (5%) |
| Adrenal insuficiency | 3 (5%) |

GH: growth hormon, F/M: female/male, n: number.

of Turkish children adjusted age and sex) in 92% of patients with short stature.[13] In eight patients with short stature because of inadequate growth velocity were performed two GH stimulation test. There was inadequate response to both growth hormone stimulation tests in five of eight patients. These five patients were diagnosed with growth hormone deficiency (19%). The response to both two stimulation tests were adequate for other three patients. There was no hypothyroidism, adrenal insufficiency or any other endocrine dysfunction in all short stature cases with or without growth hormone deficiency. Pubertal status was evaluated in 15 girls aged ≥13 years. Three of 15 patients (20%) had low serum basal LH levels (LH <0.3 IU/mL) and Tanner stage 1 breast development. Gonadorelin acetate stimulation test (GnRH) was applied to these patients. Two patients had peak LH <5 IU/L and 17-beta-estradiol replacement was started with the diagnosis of possible hypogonadotropic hypogonadism. One patient with peak LH ≥5 IU/mL was accepted as delayed puberty.

Gonadal functions and pubertal status were evaluated in 13 boys aged ≥14 years. Four of these patients (30%) had low serum basal LH levels (LH <0.3 IU/mL) and tanner stage 1 puberty. In two patients who performed GnRH stimulation test were detected delayed puberty (a peak LH of ≥ 5 IU/mL and a peak testosterone level of >2 ng/mL). Parenteral testosterone was started these patients to trigger puberty. One patient had a peak LH level of <5 IU/L, and parenteral testosterone was initiated with a preliminary diagnosis of hypogonadotropic hypogonadism to this patient. One patient was diagnosed as hypergonadotropic hypogonadism due to peak LH and FSH levels of 24 and 36 IU/mL, respectively.

The mean serum vitamin D level was 13.04±6.07 ng/mL. Vitamin D insufficiency was detected in 31 patients (53%) and vitamin D deficiency was detected in 14 patients (24%). For vitamin D insufficiency, daily 1,000 IU PO (6–8 weeks) vitamin D replacement was administered. All patients with vitamin D deficiency received 150–300 thousand units of single dose vitamin D PO (Stoss treatment). While vitamin D levels of all patients who received stop therapy reached normal levels, vitamin D deficiency continued in 18.6% of the patient who received daily 1,000 IU PO vitamin D.

The mean BMD Z score adjusted for age and sex was -2.08±1.64. While 34% (13 girls, seven boys) of the patients were osteopenic, 14% (five girls, three boys) were osteoporotic. There was a negative correlation between BMD (in gr/cm²) and 25-OH-D level (r=-0.56, p=0.01).

Hypoparathyroidism was detected in two girls aged 16 and 17 years (3.4%). Hypocalcemia was not detected in the first decade of life of these patients. Calcium was 4.8 and 5.9 mg/dL, while phosphorus was 7.2 and 7.1 mg/dL and PTH was 7 and 8 pg/mL, respectively. Vitamin D levels were normal in these patients.

Two patients had overt hypothyroidism and three had subclinical hypothyroidism (normal free T4 level and increased TSH level). Anti-thyroid peroxidase antibody and anti-thyroglobulin antibody were negative in these patients. They had thyroid ultrasonography that was normal morphology and echogenicity.

The mean level of serum basal cortisol was 10.33±3.85 mg/dL. On eight patients whose had at least two basal cortisol levels <10 mg/dL early in the morning were performed a low dose (1 mcg) ACTH stimulation test. Adrenal insufficiency was detected in three of eight patients (5.1%) when a minimum peak cortisol level was used 18 mg/dL, according to ACTH stimulation test. The mean age of these patients was 14.9±3.1 years. These patients were completely asymptomatic for adrenal insufficiency.

OGTT was performed on six patients with IFG. IGT was diagnosed in three of these patients (5.1%). In this study was not determined overt DM.

The pretransfusion Hb level of the patients was 9–10 g/dL. The final mean ferritin level was 3,086±2,046 ng/mL, and the median ferritin level was 2,969 ng/mL (562–10,251). The mean transfusion year was 9.58±5.01 years. The age of initiation of iron chelation treatment was 2.21±0.3 years. The anthropometric and biochemical data of the patients are summarized in Table 2. There was no correlation between ferritin level and onset age of chelation treatment, transfusion year, anthropometric and biochemical parameters (glucose, calcium, ALP, PTH, 25 OH-D, free T4, TSH, LH, FSH, testosterone, estradiol, cortisol, IGF-1).

Thirty patients were genetically diagnosed (52%). Of these patients 19 had IVS I-110 homozygous mutation, one had IVS I-110 heterozygous mutation, three had codon del AA homozygous mutation, four had IVS I-6 IVS I-110 double heterozygous mutation, two had IVS I-110 codon eight del double heterozygous mutations and one had codon 44 heterozygous delta-beta deletions. Genetic studies was not conducted in other patients. There was no significant difference in terms of endocrine complications between patients with and without genetic diagnosis (p=0.35).

## DISCUSSION

Recently, the development of treatment options in patients with beta thalassemia has increased the survival rates. Therefore, the importance of diagnosis and treatment of endocrine complications has also increased to have a higher quality of life.

In patients with BTM, the incidence of complications increases with age (4–6). In our study, the mean age of endocrine complications was 12.6±5.16.

Blood transfusion can lead to iron overload resulting in a high incidence of endocrine abnormalities in children and adolescents. Excessive iron is deposited in most tissues and

endocrine organs are also frequently affected organs. It has already been reported that the iron overload is the major cause of endocrinopathies in thalassemia.[17]

The most common reported endocrine complications in patients with talasemia major are growth retardation, vitamin D insufficiency/deficiency and puberty problems.[6,8] In our study, the most common endocrine complications were vitamin D deficiency, growth retardation, osteopenia and pubertal delay-gonadal insufficiency, respectively. When growth retardation was included, 82% of the patients had at least one endocrine complication. All the patients whose have endocrine complications except growth retardation and osteoporosis/osteopenia were over 12 years of age.

The pathogenesis of growth retardation, which is a common complication in BTM, is heterogeneous. Chronic anemia, iron overload, malnutrition despite increased caloric requirement, chronic liver and renal insufficiency, hypothyroidism due to the accumulation of iron in various endocrine organs, delayed puberty/hypogonadism and GH deficiency are the main factors contributing to growth retardation.[9,18] In previous studies, the prevalence of growth retardation was reported to be 25%–69% and the prevalence of GH deficiency was reported to be between 8% and 54%.[5-7,9,18] In our study, growth retardation was determined to be 45% and growth hormone deficiency was determined in 8.5%. These results were similar to the literature.

**Table 2. Anthropometric and laboratory data of the patients**

| | Mean ± SDS |
|---|---|
| Age (decimal years) | 12.6±5.16 |
| Gender (F/M) | 27/31 |
| Weight Z score | -1.27±1.44 |
| Height Z score | -1.52±1.42 |
| BMI Z score | -0.55±1.10 |
| Serum Ferritin (ng/mL) | 3,086±2,046 |
| Calcium (mg/dL) | 3,086±2,046 |
| 25 OH Vitamin D (ng/mL) | 13.04±6.07 |
| PTH (pg/mL) | 49.4±36.62 |
| ACTH | 27.25±15.37 |
| Cortisol (mg/dL) | 10.33±3.85 |
| fT4 (ng/dL) | 1.18±0.28 |
| TSH (IU/mL) | 2.77±0.91 |
| Pretransfusion Hb (g/dL) | 8.2±0.9 |
| Chelation starting age (decimal years) | 2.21±0.3 |
| Years of transfusion | 9.58±5.01 |
| DXA Z score | -2.08±1.64 |
| IGF-1 Z score | -1.96±1.21 |

F/M: female/male, BMI: body mass index, DXA: dual X-ray absorptiometry, PTH: parathyroid hormone, ACTH: Adrenocorticotropin, fT4: free T4, TSH: thyroid stimulating hormone, Hb: hemoglobin, IGF-1: insulin like growth factor, SDS: standard deviation scores, n: number.

Pubertal delay/hypogonadism is a common endocrine complication that affect growth in BTM. In the previously published studies, delayed puberty/hypogonadism was reported in 12.2%–38% of women, 22.9%–67% of men and 41.6%–80% of pediatric patients.[18-21] In our study, delayed puberty-hypogonadism was detected in 3 (20%) of 15 female patients and four (30%) of 13 male patients. In a study, Low et al.[22] reported that only 32% of 41 BTM patients whose had completed the age of 14 years entered puberty spontaneously. In another study, Bronspiegel-Weintrob et al.[23] reported that entered puberty in time in the 90% of the patients that chelation therapy was started before 10 years of age. In addition, only 38% of the patients whose started chelation treatment late were entered puberty spontaneously.

The prevalence of vitamin D deficiency and insufficiency is also high in the general population. In Turkey, although it may change with age, gender, and the seasons prevalence of vitamin D deficiency/insufficiency in children and adolescents was reported to be 8%–61%.[24] Even so the prevalence of vitamin D deficiency/insufficiency in children with BTM is expected to be higher compared to the general population due to insufficient hydroxylation in the liver and to chelation therapy, which increases excretion of vitamin D.[4] In this study the prevalence of vitamin D deficiency and insufficiency together was calculated as approximately 77.5%. This rate is higher than general population. The prevalence of vitamin D deficiency and insufficiency are ranged from 12% to 37% and 47.8% to 69.8% respectively, in the literatüre.[25,26] The prevalence of vitamin D deficiency and insufficiency that the most common complication in our study, was 24% (n=14) and 53% (n=31), respectively. Our results were similar to previous reports.

Pediatric and adolescent BTM population have already experienced compliance problems to transfusion/chelation therapy.[4-7] In this population probably is expected also the lack of compliance to long-term Vitamin D PO therapy. While vitamin D levels arrived normal levels in all patients receiving stop therapy, vitamin D insufficiency continued in 18.6% of patients administering long-term oral vitamin D. Therefore, stss treatment of vitamin D should be preferred for treatment of vitamin D deficiency/insufficiency due to lack of compliance long-term Vitamin D PO therapy in these patients.

There was no co-relation between vitamin D and ferritin levels in our study, similar to the previous reports.[4,25,26]

Osteoporosis is a common problem in BTM. Increased iron load, cortical thinning due to bone marrow expansion, adverse effects of chelating agents on calcium and phosphorous absorption, hypogonadism, hypoparathyroidism and decreased IGF-1

level (positive effect on IGF-1 osteoblasts) increase the risk of osteoporosis in these patients.[27]

Bone pain and bone fracture owing to osteoporosis are important factors affecting the morbidity of these patients. In the literature, the prevalence of osteoporosis and osteopenia in BTM has been reported to be between 22.2% and 50.7%.[19,20] In our study, 20 patients (34%) were osteopenic (13 girls, seven boys) and eight patients (13.6%) were osteoporotic (five girls, three boys).

Hypothyroidism is a complication mostly seen after the second decade. Primary hypothyroidism due to iron accumulation in the thyroid gland is more common in BTM. In previous studies were reported that the prevalence of overt hypothyroidism and subclinical hypothyroidism ranged from 4.2% to 18.8% and 2.12% to 22.8%, respectively.[4-6] In our study, primary hypothyroidism was detected in two patients (3.4%) and subclinical hypothyroidism was found in three patients (5.1%). All of our patients were older than 12 years. In our study hypothyroidism prevelance was lower than the literature. This condition can be explained by the lower mean age of our study population.

In hypoparathyroidism that a rare complication in BTM patients, parathyroid hormone release is suppressed and bone resorption is increase because of iron accumulation in the parathyroid gland. The prevelance of this complication that affecting both sexes equally is reported as 3.6% to 22.5%.[7,8] Overt hypoparathyroidism was detected in 2 patients in our study. The mean age of overt hypoparathyroidism is reported 16.9 to 19 years in the literature.[7-9] Our patients were 16 and 17 years old. In a study from our country included of 45 patients with thalassemia major hypoparathyroidism was not reported.[4] However, subclinical hypoparathyroidism (PTH levels are decreased, calcium and phosphore are normal) are more common than in overt hypoparathyroidism in patients with BTM.[7,8] Subclinical hypoparathyroidism was not detected in our study.

Adrenal insufficiency is a rare but life-threatening complication in patients with BTM and is usually detected at older ages. Adrenal insufficiency prevelance has been reported to be between 15.5% and 61% in different studies.[28,29] Adrenal insufficiency prevelance was detected 5.1% in our study. In our study the mean age of patients had adrenal insufficiency was 14.9±3 years. The heterogeneity of the tests used for diagnosis and of the average age of the study populations can explain the wide prevelance range in the literature and the low prevelance rate in our study. The mean age of our study population was 12.6±5.16 years.

For the diagnosis of adrenal insufficiency in patients with BTM, it is necessary to evaluate cortisol levels at least once a year. Kortisol level below 10 mgr/dL suggest suspicious adrenal insufficiency, while cortisol level below 3 mgr/dL support the diagnosis of adrenal insufficiency. Low-dose ACTH stimulation test was performed only for patients whose had early morning low cortisol levels (eight patients) in our study. We detected adrenal insufficiency in three of eight patients (5.1%). All of these patients were asymptomatic for adrenal insufficiency. We planned to give glucocorticoid treatment before stressful events, surgeries and severe diseases to these patients.

Impaired glucose tolerance (IGT) and DM are well-known complications in BTM patients. These complications were reported in older ages and less frequently.[30] In these cases initially are increased insulin resistance rather than decreased insulin secretion. Decreased insulin secretion appears in the later period as a late finding of iron accumulation in the pancreas.[25] In previous studies, the prevalence of IGT and DM was reported to be between 2%–13%, 4% to 19.4%, respectively.[20,30,31] In our study, three patients were diagnosed with impaired glucose tolerance (IGT) (5.1%) but was not detected overt DM. Hepatitis C virus infection, starting chelation therapy in advanced age, high ferritin level, advanced age, frequency of transfusion, family history of diabetes and high liver iron concentration have been reported as the main causal factors for DM in these patients.[30-34] Over 10 years old children with BTM should be monitored regularly for IFG, IGT and overt DM.

Proper chelation of iron overload could improve the quality of life of these patients and decrease the endocrine and cardiac complications.[3] In our patients, deferasirox was used as iron chelator. Chelation was started when the ferritin levels exceeded 1,000 ng/mL and the patient was 2 years old. Most patients were on a regular transfusion regimen and were using regular chelator. The most important factors affecting serum ferritin levels are regular use of chelation therapy, infections, age and geographic differences. In a study by Bandyopadhyay et al.[35] was shown that mean serum ferritin was 1,750 ng/mL in 1–5 years age group, and this increased to 3,650 ng/mL in 11–15 years older patients. Cunningham et al.[36] reported that mean serum ferritin level of beta thalassemia patients, in North America to be 1,696 ng/mL. In our study, mean serum ferritin level was 3,086±2,046 ng/mL. However, Choudhry et al.[37] reported mean serum ferritin levels to be 6,723 ng/mL in India. Although iron overload is considered leading cause of endocrinopathies in BTM patients, are not showed significant relation between serum ferritin and endocrinopathies in most of the studies in literature.[4,9,18-20] In our study in accordance with the literature, we were not determined any correlation between endocrine complications and level of ferritin and the starting age to chelation therapy. Therefore, it is not correct to predict and evaluate endocrine complications based on ferritin level. Although serum ferritin is quantitative, non-invasive method for measuring body iron, it is not an optimal indicator of iron status and may be insufficient to show tissue iron accumulation in patients with BTM. More precise methods such as T2*MRI and liver iron concentration (LIC) may be used instead ferritin. However, it is a fact that it should not be

forgotten that serum ferritin levels can give an idea in terms of irregular follow-up of the patient.[3,38]

## CONCLUSION

As a result, in this study although the major advances in treatment increase the life expectancy of patients with BTM, endocrine problems continue to adversely affect the quality of life of these patients. Monitoring of patients with BTM in terms of endocrine complications, regardless of ferritin level, is essential to improve the quality of life of these patients.

## MAIN POINTS

- Despite advances for treating major thalassemia, endocrine complications seen in these patients are still common.
- These data provide information about the frequency and distribution of endocrine complications in children and adolescents with thalassemia major.
- These data provide information about the approach to endocrine complications.
- The quality of life of these patients increases significantly with the early diagnosis and appropriate treatment of endocrine complications.

### ETHICS

**Ethics Committee Approval:** This study was approved by the Ethics Committee of University of Health Sciences Turkey, Diyarbakır Gazi Yaşargil Training and Research Hospital (decision number: 241).

**Informed Consent:** Written consent was obtained from the guardians of all patients.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: S.T., H.S., Design: S.T., H.S., Data Collection and/or Processing: S.T., H.S., Analysis and/or Interpretation: S.T., H.S., Literature Search: S.T., H.S., Writing: S.T., H.S., Critical Review: S.T., H.S.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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# The Effect of Nurse-Nurse Collaboration Level on Job Satisfaction

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## Abstract

**BACKGROUND/AIMS:** Nurse-nurse collaboration has an effect on job satisfaction and reducing the intention to resign by strengthening the professional image of nursing and developing a harmonious working environment in which collaboration can occur. The aim of this study was to investigate the effect of the level of collaboration between nurses on their job satisfaction.

**MATERIAL AND METHODS:** This is a cross-sectional descriptive study using the self-reporting surveys of 362 nurses. The data were collected by the Minnesota Satisfaction Questionnaire (MSQ) and Nurse-Nurse Collaboration Scale (NNCS). The Kruskal-Wallis and Mann-Whitney U tests, Pearson's product moment correlation, and regression analysis were used in the statistical analysis of the data.

**RESULTS:** The mean NNCS and MSQ scores of the nurses were 2.78±0.44 (1–4) and 3.10±0.63 (1–5), respectively. According to the results of the statistical analysis, a significant, positive and moderate relationship was found between the overall NNCS and its subscales and the overall MSQ and its subscales ($p<0.001$).

**CONCLUSION:** Nurse-nurse collaboration is one of the important factors affecting job satisfaction among nurses. Collaboration and job satisfaction of nurses are affected by various factors, including educational level, clinic at which they work, duration of professional experience, availability of people to support them in the work environment, and presence of problems experiences with other staff. Increasing the levels of collaboration will reduce the individual and organizational negative effects of job dissatisfaction.

**Keywords:** Nursing, collaboration, communication, job satisfaction

## INTRODUCTION

Health services are offered in various settings that require health professionals to collaborate.[1] The word collaboration originates from the Latin word 'collaborate', which means working together for a common goal.[2] In the context of nursing, collaboration is defined as "a relational process between colleagues who share similar professional values, philosophy, socialization, and experience".[3] Collaboration is a common decision-making and communication process among healthcare professionals. This process requires advanced skills related to trust, respect, self-awareness, and conflict resolution, as well as constructing non-hierarchical relationships based on knowledge and expertise in which power is shared.[4] Intra-professional collaboration is a complex, interpersonal and occupational factor that does not spontaneously occur. Nursing is a profession that requires teamwork focusing on achieving safe results for patients and nurses.[5] Nurse-nurse collaboration is an essential component

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of high-quality health care and patient safety.[6,7] Inadequate communication and collaboration in care planning can lead to job dissatisfaction, medical errors, preventable injuries, economic losses, and even deaths.[7-10]

Collaboration and job satisfaction in health services are vital for maximizing the potential of human resources.[11] Colleague solidarity affects the quality of care, healthy work environments, patient safety, intention to resign, and job satisfaction.[12-15] Job satisfaction is a multi-dimensional broad concept covering employees' perceptions of their jobs with different aspects, the degree of how much they love their jobs, job characteristics, and work environment.[16] Job satisfaction is defined as the harmony between individual's needs and expectations and their work experience.[17] Effective inter-professional relationships will strengthen the professional voice and image of nursing, while contributing to the adequate supervision and mentoring practices of newly graduated nurses and ensuring the sharing of information and development of a harmonious working environment in which future collaboration can emerge.[7,13,18]

Collaboration is a fundamental strategy for improvement, problem solving, and innovation in the health system,[19] and nurses are the key to the effective functioning of this system. Thus, it is extremely important to increase the job satisfaction levels of nurses to provide effective nursing care, improve patients' perceptions of quality of care, improve relationships with patients and achieve sufficient nursing workforce.[11] For this purpose, a new culture of collaboration should be developed, combining the unique strengths of each discipline with the goal of high-quality patient care.[20]

In the literature, there are only a limited number of studies on nurse-nurse collaboration.[10,21-26] In Turkey, no study was found that determined the effect of nurse-nurse collaboration on job satisfaction. Therefore, the current study investigated the effect of the level of collaboration between nurses on their job satisfaction.

### Research Questions

1. What is the collaboration and job satisfaction levels of nurses?

2. Are there differences between the level of nurse-nurse collaboration and job satisfaction and the introductory characteristics of nurses?

3. Is there a relationship between nurse-nurse collaboration and the job satisfaction?

## MATERIALS AND METHODS

### Study Design and Sample

This descriptive and relationship-seeking study was conducted with 362 nurses working at a training and research hospital (500–1,000 beds) and a public hospital (500–1,000 beds) in Turkey. The sample response rate was 60.6%. A higher percentage of respondents could not be reached due to institutional and individual reasons (working hours, being on leave, etc.). The data were collected through face-to-face interviews with nurses who signed the consent form after being informed about the study in line with the principle of voluntariness. Individuals who did not respond to all the items in the scales and those that did not agree to participate were excluded from the study.

### Data Collection Tools

An introductory form, the Nurse-Nurse Collaboration Scale (NNCS) and the Minnesota Satisfaction Questionnaire (MSQ) were used as data collection tools.

### Introductory Information Form

Introductory information form consists of 14 questions prepared by the researchers considering the literature to obtain information about the nurse's age, gender, gender, age, marital status, educational status, working style, total working years in the institution and profession, satisfaction with the unit they are in, and willingness to choose the nursing profession.

### The Nurse-Nurse Collaboration Scale (NNCS)

NNCS was originally developed by Dougherty and Larson[21] and the validity and reliability study of the Turkish version was undertaken by Durmuş and Yıldırım[22]. The scale consists of 26 items based on a four-point Likert type (strongly disagree-1 point, strongly agree-4 points) under the following five subscales: problem solving (three items), communication (five items), shared process (five items), coordination (three items), and professionalism (10 items). An increase in the total score obtained from the scale indicates that communication between nurses is good. The Cronbach $\alpha$ reliability coefficient was found to be significant, being higher than 0.93 for the overall scale and higher than 0.70 for the subscales (0.75, 0.71, 0.80, 0.78, and 0.93 for problem solving, communication, shared process, coordination, and professionalism, respectively). For this study, the Cronbach's alpha value was calculated to estimate the internal consistency and showed a value of 0.93. The Cronbach $\alpha$ reliability coefficient was found for the subscales (0.85, 0.77, 0.83, 0.86, and 0.91 for problem solving, communication, shared process, coordination, and professionalism, respectively). The cut-off point of the scale was determined as 2.5.

### The Minnesota Satisfaction Questionnaire (MSQ)

The MSQ developed by Dawis and his colleagues and adapted to Turkish by Baycan[27], is a five-point Likert-type instrument consisting of items that reveal intrinsic and extrinsic satisfaction factors. The general satisfaction score is calculated by dividing the sum of the points obtained from the items by 20. The intrinsic satisfaction score is obtained by dividing the sum of

the points obtained from the items that constitute the intrinsic factors (items 1, 2, 3, 4, 7, 8, 9, 10, 11, 15, 16, and 20) by 12 while the extrinsic satisfaction score is found by dividing the sum of the scores obtained from the items containing extrinsic factors (items 5, 6, 12, 13, 14, 17, 18, and 19) by 8. The Cronbach $\alpha$ reliability coefficient was found to be significant 0.90 for the overall scale. For this study the Cronbach's alpha value was calculated to estimate the internal consistency and showed a value of 0.91.

### Data Collection

The data started to be collected after obtaining the necessary permission from the relevant institution, and the study was conducted between September and November 2018. The data were collected by the face-to-face interview technique. Each interview took 5 to 10 minutes.

### Statistical Analysis

The data were analyzed using the SPSSWIN 21.0 statistical program (IBM, SPSS Inc.). The statistical significance level was set at $p<0.05$. In the analysis of the data, descriptive analyses (number, percentage, mean, and standard deviation) were used to determine the personal and professional characteristics of the nurses (age, gender, education, units at which nurses worked, duration of occupational experience, support from other staff, problems with other staff). Parametric (independent samples t-test) or non-parametric (Kruskal-Wallis and Mann-Whitney U) tests were used to compare the measurements obtained from the NNCS and MSQ subscales according to the personal and professional characteristics of the participants. A post-test analysis was undertaken using the Duncan technique. Finally, correlation and regression analysis were used to determine the predictive power of the NNCS scale for the MSQ scale score. Regression analysis assumptions were confirmed before analysis. There is a linear relationship between dependent and independent variables and continuous variables, deliver no significant outliers, residual (error) were significant, almost normally distributed. After the assumptions, the regression model was established after the conditions were met and simple linear regression analysis was performed in SPSS.[28]

### Ethical Considerations

Written permission was obtained for the research from the Non-Interventional Clinical Research Ethics Committee of Balıkesir University (decision number: 2018/141, date: 25.07.2018). To conduct the research, institutional permission was also received from the institutions where the study will be conducted. The permission for the use of the scales was obtained by email.

## RESULTS

Of the nurses participating in the study, 82.6% (n=299) were women, 63.8% (n=231) were married, 58.0% (n=210) had bachelor's degrees, 95.3% (n=345) worked at the public hospital, 57.2% (n=207) had an income lower than the average national product, 82.9% (n=300) had a rotating work schedule (day and night shifts), 87.3% (n=316) stated that they were satisfied with the institution at which they worked, and 77.1% (n=279) commented that they willingly chose their profession.

The mean total NNCS score of the nurses was 2.78 (0.44). The highest and lowest mean subscale scores were observed in the professionalism and problem-solving subscales, respectively (Table 1). The mean total MSQ score was calculated as 3.1 (0.63), and the mean score of the intrinsic satisfaction subscale was 3.3 (0.63), which was higher than that of the extrinsic satisfaction subscale (Table 1).

In this study, some demographic and professional characteristics of the nurses were analyzed based on their mean scores from the two scales, and inter-group comparisons were undertaken (Table 2). During the analysis, a statistically significant difference was observed in the nurses' scores between the NNCS problem solving subscale and having problems with collaboration; between the communication subscale and professional experience and having problems in communication and collaboration in the workplace; between the shared process subscale and education level, workplace, and receiving support and experiencing problems in communication and collaboration in the workplace; and lastly between the professionalism subscale and overall scale and receiving support in communication and collaboration in workplace ($p<0.05$). Similarly, there was a significant difference in the nurses' scores between the MSQ intrinsic satisfaction subscale and receiving support and experiencing problems in communication and collaboration in the workplace, and between the extrinsic satisfaction subscale and the clinic at which the nurses worked ($p<0.05$).

The nurses' total scores in the scales were analyzed using the Kolmogorov-Smirnov normality test and found to be normally

**Table 1. NNCS and MSQ mean scores (n=362)**

| Subscales | Mean (SD) | Min-max value |
|---|---|---|
| Problem solving | 2.67 (0.62) | 1–4 |
| Communication | 2.72 (0.51) | 1–4 |
| Shared process | 2.76 (0.51) | 1–4 |
| Coordination | 2.85 (0.61) | 1–4 |
| Professionalism | 2.89 (0.53) | 1–4 |
| **NNCS total** | 2.78 (0.44) | 1–4 |
| Intrinsic satisfaction | 3.30 (0.63) | 1–5 |
| Extrinsic satisfaction | 2.81 (0.75) | 1–5 |
| MSQ general satisfaction | 3.10 (0.63) | 1–5 |

NNCS: Nurse-Nurse Collaboration Scale, MSQ: Minnesota Satisfaction Questionnaire, SD: standard deviation, min:minimum, max: maximum, n: number.

**Table 2. Comparison of the NNCS and MSQ mean scores according to the sociodemographic characteristics of nurses (n=362)**

| Characteristics | | NNCS | | | | | | MSQ | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Problem solving | Communication | Shared process | Coordination | Professionalism | NNCS total | Intrinsic satisfaction | Extrinsic satisfaction | MSQ total |
| Education | Associate degree[1] (n=135) | 2.66 (0.58) | 2.72 (0.48) | 2.84 (2.42) | 2.87 (0.54) | 2.93 (0.45) | 2.80 (0.34) | 3.31 (0.67) | 2.77 (0.82) | 3.09 (0.67) |
| | Bachelor's degree[2] (n=210) | 2.71 (0.62) | 2.73 (0.52) | 2.73 (0.54) | 2.84 (0.64) | 2.88 (0.58) | 2.78 (0.49) | 3.31 (0.61) | 2.85 (0.70) | 3.13 (0.60) |
| | Postgraduate degree[3] (n=17) | 2.23 (0.80) | 2.57 (0.53) | 2.51 (0.68) | 2.80 (0.66) | 2.81 (0.48) | 2.58 (0.50) | 3.19 (0.71) | 2.58 (0.77) | 2.95 (0.69) |
| | **Test statistics (KW)** | 0.053 | 0.155 | **0.050***(1-3) | 0.767 | 0.661 | 0.107 | 0.624 | 0.394 | 0.560 |
| Units at which nurses worked | Clinics[1] (n=106) | 2.74 (0.61) | 2.74 (0.49) | 2.81 (0.51) | 2.89 (0.65) | 2.89 (0.57) | 2.81 (0.46) | 3.30 (0.68) | 2.89 (0.73) | 3.13 (0.65) |
| | Emergency[2] (n=32) | 2.63 (0.49) | 2.63 (0.36) | 2.57 (0.49) | 2.81 (0.50) | 2.83 (0.41) | 2.69 (0.30) | 3.42 (0.62) | 3.10 (0.68) | 3.29 (0.54) |
| | Operating theatre[3] (n=19) | 2.45 (0.61) | 2.58 (0.79) | 2.53 (0.57) | 2.73 (0.59) | 2.63 (0.50) | 2.58 (0.48) | 3.50 (0.57) | 3.08 (0.65) | 3.33 (0.59) |
| | Intensive care[4] (n=205) | 2.65 (0.65) | 2.75 (0.50) | 2.78 (0.50) | 2.85 (0.60) | 2.93 (0.52) | 2.79 (0.44) | 3.27 (0.62) | 2.69 (0.77) | 3.04 (0.64) |
| | **Test statistics (KW)** | 0.273 | 0.479 | **0.029***(1-2) | 0.767 | 0.193 | 0.102 | 0.375 | **0.004***(2-4) | 0.60 |
| The duration of occupational experience | ≤10 years (n=190) | 2.66 (0.62) | 2.78 (0.48) | 2.80 (0.50) | 2.89 (0.62) | 2.93 (0.52) | 2.81 (0.44) | 3.32 (0.64) | 2.81 (0.78) | 3.12 (0.65) |
| | ≥ 11 years (n=172) | 2.68 (0.63) | 2.65 (0.52) | 2.71 (0.52) | 2.81 (0.59) | 2.85 (0.54) | 2.74 (0.44) | 3.28 (0.63) | 2.80 (0.72) | 3.09 (0.62) |
| | **Test statistics (MU)** | 0.534 | **0.021** | 0.183 | 0.181 | 0.633 | 0.198 | 0.689 | 0.925 | 0.727 |
| Support from other staff | Nurse[1] (n=284) | 2.69 (0.59) | 2.74 (0.49) | 2.78 (0.47) | 2.88 (0.57) | 2.91 (0.51) | 2.80 (0.42) | 3.33 (0.63) | 2.81 (0.73) | 3.12 (0.63) |
| | Physician[2] (n=35) | 2.68 (0.78) | 2.71 (0.63) | 2.80 (0.62) | 2.87 (0.83) | 2.96 (0.65) | 2.80 (0.59) | 3.41 (0.59) | 2.96 (0.80) | 3.23 (0.63) |
| | Supervisor nurse-manager[3] (n=25) | 2.54 (0.74) | 2.58 (0.46) | 2.67 (0.64) | 2.62 (0.65) | 2.69 (0.60) | 2.62 (0.48) | 3.04 (0.62) | 2.57 (0.86) | 2.85 (0.63) |
| | Other4 (n=18) | 2.44 (0.66) | 2.58 (0.48) | 2.48 (0.63) | 2.68 (0.57) | 2.79 (0.49) | 2.60 (0.38) | 2.98 (0.66) | 2.74 (0.80) | 2.88 (0.64) |
| | **Test statistics (KW)** | 0.222 | 0.211 | **0.047***(1-4, 2-4) | 0.172 | **0.021***(1-3, 2-3) | **0.004***(1-3, 1-4, 2-3, 2-4) | **0.020***(1-3, 1-4, 2-3, 2-4) | 0.351 | 0.057 |

**Table 2. Continued**

| Characteristics | | NNCS | | | | | | MSQ | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Problem solving | Communication | Shared process | Coordination | Professionalism | NNCS total | Intrinsic satisfaction | Extrinsic satisfaction | MSQ total |
| Problems with other staff | Nurse[1] (n=216) (n=48) | 2.45 (0.62) | 2.52 (0.50) | 2.61 (0.57) | 2.69 (0.60) | 2.74 (0.53) | 2.60 (0.45) | 3.30 (0.80) | 2.71 (0.91) | 3.06 (0.78) |
| | Physician[2] (n=166) | 2.67 (0.64) | 2.72 (0.45) | 2.76 (0.47) | 2.91 (0.61) | 2.93 (0.45) | 2.80 (0.41) | 3.22 (0.62) | 2.72 (0.76) | 3.02 (0.63) |
| | Supervisor nurse-manager[3] (n=63) | 2.65 (0.59) | 2.79 (0.58) | 2.73 (0.55) | 2.78 (0.68) | 2.88 (0.64) | 2.77 (0.50) | 3.36 (0.60) | 2.93 (0.67) | 3.19 (0.57) |
| | Other[4] (n=85) | 2.80 (0.58) | 2.78 (0.52) | 2.86 (0.50) | 2.89 (0.52) | 2.92 (0.57) | 2.85 (0.44) | 3.42 (0.57) | 2.94 (0.69) | 3.23 (0.58) |
| | **Test statistics (KW)** | **0.040***(1-2, 1-4) | **0.020***(1-2, 1-3, 1-4) | **0.045***(1-4) | 0.198 | 0.103 | 0.026 | 0.198 | 0.115 | 0.124 |
| | **Total (n=362)** | 2.67 (0.62) | 2.72 (0.51) | 2.76 (0.51) | 2.85 (0.61) | 2.89 (0.53) | 2.78 (0.44) | 3.30 (0.63) | 2.81 (0.75) | 3.10 (0.63) |

*: Mann-Whitney U test, [1,2,3,4]: subcategories to demographic characteristics, NNCS: Nurse-Nurse Collaboration Scale, MSQ: Minnesota Satisfaction Questionnaire, n: number.

distributed (p>0.05). The relationships between the two scales were examined using Pearson's product-moment correlation analysis. According to the results of the statistical analysis performed for this purpose, the overall NNCS scale and its subscales had a significant, positive and moderate relationship with the overall MSQ and its subscales (Table 3).

In this study, the predictive power of the level of collaboration between nurses in job satisfaction was investigated. For this purpose, regression analysis was done and the results ($F_{NNCS-MSQ}$ = 55.601) were found to be statistically significant at the p<0.001 level (Table 4). The results of regression analysis being significant show that the relationship between the NNCS and MSQ score was linear and statistically significant.

When Table 4 is examined, it is seen that the level of collaboration between the nurses was a significant predictor of their overall job satisfaction [R=0.366, $R^2$=0.131, F (1.360)=55.601, p<0.001]. It can be stated that 13.1% of the total variance related to general job satisfaction could be explained by the level of nurse-nurse collaboration. According to the results of the regression analysis, the regression equation for predicting job satisfaction is as follows:

MSQ General Satisfaction = (1.654) + (0.523) x NNCS total

## DISCUSSION

There are only a limited number of studies investigating nurse-to-nurse collaboration in Turkey.[23,25] In these studies, it has been shown that nurses in Turkey are in collaboration with their colleagues above the expected minimum level, but this is still not sufficient for nursing profession. Similarly, this study determined that the level of nurse-nurse collaboration was moderate, and the highest level of collaboration was observed in professionalism and the lowest in problem solving. The problem-solving ability of nurses plays an important role in detecting and solving problems, increasing their job satisfaction, strengthening their communication ability, increasing the satisfaction of individuals receiving health care, and increasing the quality of care. Therefore, it is important to strengthen the problem-solving skills of nurses. Some researchers have shown that most nurses have positive perceptions and attitudes toward collaboration and they have high scores in communication and professionalism subscales.[26,29,30] In contrast, Petersen et al.[31] reported that there was inadequate collaboration and communication between nurses, and concrete information and professional identities were replaced by prejudices.

In this study, differences were found in the nurses' total scores of collaborations according to their personal and professional characteristics. While this study revealed no significant difference in the level of collaboration according to the educational status of the nurses, Durmuş et al.[23] reported that nurses with

**Table 3. Relationship between the measurements obtained from the Nurse-Nurse Collaboration Scale and the Minnesota Satisfaction Questionnaire (n=362)**

| Scales/sub scales | MSQ general satisfaction r;p | Intrinsic satisfaction r;p | Extrinsic satisfaction r;p |
|---|---|---|---|
| NNCS total | 0.366* 0.000 | 0.382* 0.000 | 0.287* 0.000 |
| Problem solving | 0.301* 0.000 | 0.269* 0.000 | 0.293* 0.000 |
| Communication | 0.273* 0.000 | 0.295* 0.000 | 0.203* 0.000 |
| Shared process | 0.289* 0.000 | 0.331* 0.000 | 0.191* 0.000 |
| Coordination | 0.327* 0.000 | 0.350* 0.000 | 0.245* 0.000 |
| Professionalism | 0.263* 0.000 | 0.282* 0.000 | 0.198* 0.000 |

P-values of the statistically significant correlation coefficients are shown in bold.

NNCS: Nurse-Nurse Collaboration Scale, MSQ: Minnesota Satisfaction Questionnaire, r: Pearson's correlation coefficient, *p<0.001, n: number.

**Table 4. Results concerning the effect of nurse-nurse collaboration on job satisfaction**

**Dependent variable: MSQ General Satisfaction Score**

| Independent variables | β | SEB | SDβ | t | p-value |
|---|---|---|---|---|---|
| Constant | 1.654 | 0.198 | | 8.364 | 0.000 |
| NNCS total | 0.523 | 0.070 | 0.366 | 7.457 | 0.000 |

$R=0.366/R^2=0.134$/adjusted $R^2=0.131$, $F_{(1,360)}=55.601$, p=0.000.

NNCS: Nurse-Nurse Collaboration Scale, MSQ: Minnesota Satisfaction Questionnaire, SE: standard error, SD: standard deviation.

bachelor's degrees had higher scores in problem solving, coordination, professionalism, and collaboration compared to those with associate degrees. Concerning the unit at which the nurses worked, the shared process subscale scores were higher in those that worked at clinics than those working at other units of the hospital. In contrast, Durmuş et al.[23] found a difference in all subscales according to the departments at which the nurses worked. The shared process subscale score may have been higher in clinics since the functioning, procedures, and processes differ in each unit of the hospital, and nurse-nurse collaboration is even more important in clinics for the proper functioning of the system. In this study, the mean communication subscale score of the nurses with less than 10 years of professional experience was higher than those with experience of 11 years or more. As the duration of professional experience increases, it is expected to see an increase in the mean communication subscale score; therefore, this opposite result may be related to the nurses experiencing a higher level of burnout with the increasing number of working years.

Nurses are expected to collaborate with patients, colleagues, and other members of the healthcare team not only for the benefit of patients but also for the satisfaction of healthcare providers.[19] Nurse-nurse collaboration necessitates understanding and knowledge on how nurses perceive each other and what factors promote good collaboration. The relationship between nurse-nurse collaboration is an essential factor for a healthy work environment. The hospital workforce environment has been recognized as an important factor for nurse satisfaction and patient care quality and inadequate communication and lack of collaboration continue to disempower nurses and hinder improvement of workforce conditions.[32] It is stated that the relationship between nurse-nurse collaboration and nurses' job satisfaction should be investigated since it is a less studied subject and nurse insufficiency is an important issue in modern health services.[33] It has also been suggested a significant positive linear and moderate relationship between the overall nurse collaboration and job satisfaction and it can be stated that 13.1% of the total variance related to general job satisfaction could be explained by the level of nurse-nurse collaboration. Collaboration variable is an important predictor of job satisfaction variable, but it is important to repeat the measurements in larger samples and with different models because the low effect level was determined according to the determination

coefficient determined in the regression analysis. Studies have shown that nurse-nurse collaboration and colleague solidarity affect nurses' job satisfaction.[24-26,34] Almost et al.[35] determined that a conflict management style using collaboration and reconciliation has a direct and positive effect on nurse job satisfaction, while Purpora and Blegen[15] showed that the peer relationship scores were significantly correlated with nurses' job satisfaction. Being productive in the workplace and helping colleagues positively affect the performance in the workplace, whereas intra-professional hostility, poor colleague support, and lack of helpful behavior cause serious psychological stress and low job satisfaction.[36] According to the results of the current research, good increased collaborative practices can provide a higher level of job satisfaction among nurses. The study is an important result in that it shows that the level of nurse-nurse collaboration affects the job satisfaction of nurses and can guide the planning of interventions that will increase job satisfaction. With the introduction of nurse assistants in Turkey, further research and arrangements on intra-professional collaboration will be required in the following years.

### Limitations of the Study

There are some limitations in this study. Research results, located in the Marmara region of Turkey is valid for two hospital staff nurses and the answers to the questions on the forms depended on the nurse's own statements. It is recommended that in-depth studies on nurse-nurse collaboration and influencing factors should be investigated in larger and different samples.

## CONCLUSION

According to the results of this research, the level of nurse-nurse collaboration is one of the important factors affecting nurses' job satisfaction. Collaboration and job satisfaction among nurses are also affected by some personal and professional factors, such as educational status, workplace, duration of professional experience, support in the work environment, and problems in the work environment. Increasing the level of collaboration between nurses will reduce the negative effects of individual and organizational factors on their job dissatisfaction. In this regard, the following recommendations are made: improving shared goals among nurses, creating organizational policies that will support collaboration and increase the interaction between nurses working in different units and sectors, increasing the time nurses spend together, creating democratic work environments, emphasizing collaboration and communication skills during nursing education, increasing intra-professional collaboration as well as interprofessional collaboration of administrative nurses, creating healthy work environments to support intrinsic satisfaction, and developing outcome measures to evaluate collaboration.

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## MAIN POINTS

- The highest and lowest mean subscale scores were observed in the professionalism and problem-solving subscales, respectively.
- The mean score of the internal satisfaction subscale is higher than the external satisfaction subscale.
- Professional experience time affects communication. Those with more than 11 years of experience have higher average communication sub-scale.
- Getting support from physicians in the workplace affects process sharing, professionalism and the level of nurse-nurse collaboration and supports intrinsic motivation.
- The level of nurse-nurse collaboration is one of the important factors affecting nurses' job satisfaction.

### ETHICS

**Ethics Committee Approval:** Ethics committee approval (Balıkesir University Clinical Trials Ethics Committee, decision no: 2018/141 date: 25.07.2018) and institutional permissions were obtained.

**Informed Consent:** The participants were informed about the study verbally and in writing, and their written consent to participate was obtained.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: A.K., Ö.D., Design: A.K., Ö.D., S.K., Supervision: A.K., Data Collection and/ or Processing: A.K., Ö.D., S.K., Analysis and/ or Interpretation: Ö.D., Literature Search: A.K., Ö.D., S.K., Writing: A.K., Ö.D., S.K., Critical Review: A.K., Ö.D., S.K.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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# Evaluation of Cultural Competence of Nurses Working in Hospitals on the Syrian Border

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## Abstract

**BACKGROUND/AIMS:** This study was conducted to examine the cultural competencies of nurses working in hospitals located on the Syrian border.

**MATERIAL AND METHODS:** The descriptive study was conducted in Suruc, Akcakale, Harran and Ceylanpınar State Hospitals on the Syrian border between July and August 2020. The population of the study comprises 302 nurses working in hospitals, 245 of whom agreed to participate in the study. A sociodemographic information form and cultural competence scale for nurses created after literature review was used for data collection.

**RESULTS:** The mean scores for a cultural competence scale, cultural skills subdimension, cultural knowledge subdimension, and cultural sensitivity subdimension of the participating nurses were 74.95±13.50, 45.18±8.43, 22.32±4.23, and 7.44±1.68, respectively. The nurses' cultural competence levels were found to be above average.

**CONCLUSION:** Cultural competence should be a priority in the provision of healthcare, and planning for developing this qualification among healthcare workers is essential. Cultural competence education should be included in the training programs for nurses.

**Keywords:** Cultural competence, nurses, Syrian border

## INTRODUCTION

Various factors, such as economic changes, environmental crises, and globalization, force many people to leave their country and willingly or forcefully migrate or seek asylum to other countries. These circumstances have created multicultural population structures comprising individuals, families, and groups from different cultures and subcultures worldwide.[1]

Since Turkey is located on routes of migration, it has experienced mass migration because of conflicts occurring in surrounding countries.[2] Civilians in Syria, which borders Turkey, have left their country and taken refuge in neighbouring countries because of the state of the Syrian regime and internal conflicts in the country since 2011. Turkey is the first of many countries where Syrians took refuge.[3] As of 2020, 3,585,209 Syrians live in Turkey under temporary protection.[4]

Health is a relative concept that varies according to countries and their cultures. The increasingly multicultural structure of societies and the need to provide culture-specific care significantly influence the practice of nursing.[5] In a world with increasing cultural diversity, the importance of intercultural nursing is increasing. Cultural competence in healthcare corresponds to the cultural needs of patients.[6] Cultural competence for nurses

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is the adoption of the necessary knowledge, skills, approaches, and personal attitudes to ensure to provide services and care in accordance with the cultural characteristics of their patients.[5] For providing effective and adequate healthcare, nurses must be aware of and understand the cultures of their patients.[7] Nurses cultural competence are familiar with cultural experiences and their own personalities, apply sociocultural knowledge to nursing care and provide individualised patient care. The provision of culturally appropriate care has become a necessity for reasons such as increased cultural diversity, increasing openly exhibited identities, growing trend of home care, and inequalities in the provision of healthcare.[8] The relevant literature has emphasized the lack of cultural competence in the care of patients from different cultures as a problem. Cultural conflict is considered the result of an ethnocentric focus leading to lack of cultural competence, misunderstanding, lack of trust and obstacles against effective communication and positive relationship formation.[7] Nurses must have cultural enthusiasm, cultural awareness, cultural knowledge, and experience to provide culturally appropriate care.[5]

One study found that nurses had a moderate level of cultural awareness, but exhibited low levels of cultural knowledge and skills in patient encounters.[9] In a study conducted among nursing students, the students were found to have a low level of cultural competence.[10] A review of the literature revealed that limited studies have examined intercultural nursing care in Turkey, although some studies have examined the perspectives of nursing and midwifery students on patient care.[11,12] This study is crucial because it helps nurses in providing appropriate holistic care to patients from different cultures, gaining an understanding of the intercultural approach, and learning how to manage such situations.[13] Therefore, this study was conducted to examine the cultural competence of nurses working in hospitals on the Syrian border.

## MATERIALS AND METHODS

This descriptive study was conducted in Suruc, Akcakale, Harran and Ceylanpınar State Hospitals on the Syrian border between July and August 2020. No sampling method was used for sampling. The study population comprised 302 nurses working in hospitals, and the sample involved 245 of the nurses (81%) who agreed to participate in the study. The sociodemographic information form and cultural competence scale for nurses were used for data collection. The data collection forms were completed by the nurses in approximately 10 min. The forms were filled by the nurses in a face-to-face setting. The personal information form comprised 14 questions acquiring information on age, gender, education, marital status, employment status, department, duration, area of residence, knowledge of a foreign language, and any previous experience of intercultural education.

### Cultural Competence Scale for Nurses

The cultural competence scale for nurses, which were validated by Gözüm et al.[14], comprised 20 items and three subdimensions (i.e., cultural skills, cultural knowledge, and cultural sensitivity). These subdimensions determine the nurses' cultural knowledge, skills, and sensitivity levels. It is a five-item Likert-type scale with answers ranging from "strongly disagree" indicated by 1 to "strongly agree" indicated by 5. The lowest and highest possible scores on the scale are 20 and 100, respectively. The Cronbach's alpha coefficient of the scale was 0.96. A high score on the scale indicates that nurses have high cultural qualifications.[14] The Cronbach's alpha coefficient of the study was 0.95.

### Statistical Analysis

SPSS 22.0 package was used for evaluating the data. The descriptive statistics (i.e. numbers, percentages, and mean) were used in data analysis. The t-test was used for normally distributed data; the analysis of variance was used in independent groups; and Kruskal-Wallis analysis was used for nonconforming values. In statistical comparisons, the alpha level of the error was considered significant at $p<0.05$.

The ethical approval was obtained from the Ethics Committee of Clinical Research at Harran University's Faculty of Medicine (date and no: 30.03.2020/7) and the Provincial Directorate of Health. Consent was obtained from the participants of the study.

## RESULTS

The study included 52.2% male nurses; 85.7% of the nurses had an Associate or Bachelor's degree; and 44.1% had been working as nurses for less than a year. The average age of the nurses was 26.51±4.24 years (Table 1).

According to the results, 57.1% of the nurses agreed that patient care should be culture specific; 56.9% stated that they offered culture-specific care to their patients; 69.8% had heard the concept of cultural competence; 74%.[3] expressed that cultural competence was a necessity for patient care; 87.3% stated that they had provided care to patients from different cultures; and 73.1% stated that they had used a different language when caring for patients (Table 2).

The overall mean score of the cultural competence scale for nurses was 74.95±13.50, with mean scores for the cultural skill, cultural knowledge, and cultural sensitivity subdimensions being 45.18±8.43, 22.32±4.23, and 7.44±1.68, respectively.

A significant difference was noted between the scores of nurses working in managerial positions and the service levels for the cultural skill subdimension of the scale ($p<0.05$). Moreover, no significant difference was noted between the mean scores of the cultural competence scale and its subdimensions based on the

**Table 1. Sociodemographic characteristics of nurses (n=245)**

| Sociodemographic characteristics of individuals | | Number | Percentage |
|---|---|---|---|
| **Age** | 18–27 | 117 | 47.8 |
| | 26–44 | 128 | 52.2 |
| **Gender** | Female | 140 | 57.1 |
| | Male | 105 | 42.9 |
| **Education** | High school | 27 | 11.0 |
| | University | 210 | 85.7 |
| | Graduate | 8 | 3.3 |
| **Year of employment in this profession** | Less than 1 year | 108 | 44.1 |
| | 1–5 | 92 | 37.6 |
| | 6–30 | 45 | 18.4 |
| **Your position in the unit** | Service nurse | 209 | 85.3 |
| | Leading nurse | 36 | 14.7 |
| **Where do you work** | Suruc | 87 | 35.5 |
| | Akcakale | 51 | 20.8 |
| | Ceylanpınar | 65 | 26.5 |
| | Harran | 42 | 17.1 |

n: number.

**Table 2. Nurses' perspectives on culture-specific patient care and cultural competence**

| | | Number | Percentage |
|---|---|---|---|
| **Do you think patient care should be culture specific?** | Yes | 140 | 57.1 |
| | No | 105 | 42.9 |
| **Do you believe you provide culture-specific patient care?** | Yes | 148 | 56.9 |
| | No | 97 | 37.3 |
| **Have you ever heard of the concept of cultural competence?** | Yes | 171 | 69.8 |
| | No | 74 | 302 |
| **Do you think cultural competence is a necessity for patient care?** | Yes | 182 | 74.3 |
| | No | 63 | 25.7 |
| **Have you provided patient care for individuals from different cultures?** | Yes | 214 | 87.3 |
| | No | 31 | 12.7 |
| **Do you use any language other than Turkish when you care for patients?** | Kurdish | 81 | 33.1 |
| | Arabic | 48 | 19.6 |
| | Kurdish-Arabic | 50 | 20.4 |
| | No | 66 | 26.9 |

age, gender, education status, and duration of employment of the nurses (Table 3).

The mean scores of the cultural competence scale and all its subdimensions were significantly higher for the nurses who stated that nursing care should be culture specific, provided culture-specific care, had heard of cultural competence before and considered cultural competence necessary for patient care ($p<0.05$) (Table 4).

The mean scores of the cultural competence scale and its subdimensions of cultural skills and knowledge were significantly higher for nurses who had provided care to patients from different cultures and had used languages other than Turkish while providing care ($p<0.05$) (Table 4).

## DISCUSSION

Most nurses participating in the study stated that cultural competence is a necessity for patient care. Moreover, the nurses'

**Table 3. Comparisons between Cultural Competence Scale for nurses and different variables**

| Sociodemographic characteristics of individuals | | Cultural skills | Cultural knowledge | Cultural sensitivity | Total score |
|---|---|---|---|---|---|
| Age | 18–27 | 44.38±8.87 | 22.27±4.24 | 7.35±1.81 | 74.01±14.10 |
| | 26–44 | 45.91±7.97 | 22.37±4.24 | 7.53±1.56 | 75.82±12.91 |
| | | t=-1.421 p=0.157 | t=-0.187 p=0.852 | t=-0.798 p=0.426 | t=-1.044 p=0.297 |
| Gender | Female | 45.54±8.60 | 22.42±4.34 | 7.49±1.71 | 75.45±13.80 |
| | Male | 44.70±8.21 | 22.20±4.09 | 7.39±1.66 | 74.29±13.11 |
| | | t=-0.769 p=0.443 | t=0.404 p=0.686 | t=0.469 p=0.639 | t=0.666 p=0.506 |
| Education | High school | 43.77±9.62 | 21.07±5.07 | 7.11±2.00 | 71.96±15.95 |
| | License | 45.18±8.27 | 22.40±4.09 | 7.47±1.65 | 75.06±13.17 |
| | Graduate | 50.00±7.52 | 24.37±4.27 | 8.00±1.19 | 82.37±11.18 |
| | | KW=2.066 p=0.356 | KW=2.650 p=0.266 | KW=1.670 p=0.434 | KW=2.325 p=.313 |
| Year of employment in this profession | Less than 1 year | 44.96±8.66 | 22.25±4.55 | 7.45±1.81 | 74.66±14.31 |
| | 1–5 | 45.32±8.50 | 22.55±3.90 | 7.54±1.60 | 75.42±13.05 |
| | 6–30 | 45.42±7.88 | 22.04±4.13 | 7.24±1.55 | 74.71±12.61 |
| | | F=0.068 p=0.935 | F=0.249 p=0.780 | F=0.473 p=0.624 | F=0.087 p=0.917 |
| Your position in the unit | Service nurse | 44.68±8.43 | 22.14±4.26 | 7.43±1.73 | 74.26±13.60 |
| | Leading nurse | 48.08±7.92 | 23.38±3.95 | 7.52±1.42 | 79.00±12.32 |
| | | t=-2.252 p=0.025 | t=-1.636 p=0.103 | t=-0.303 p=0.762 | t=-1.955 p=0.052 |

levels of cultural competence were found to be satisfactory. Other studies in the literature emphasize that raising the level of cultural competence is crucial for patient care and eliminating of inequalities in healthcare.[15,16] Similar to the findings of the present study, Beer and Chipp[17] reported nurses' cultural qualification levels were high (70.2±7.2). The same study reported that the levels of cultural sensitivity, skills, and knowledge were high, which was similar to the findings of this study.[17] However, another study demonstrated that cultural competence in nursing was unsatisfactory, which contradicts the findings of this study.[7] Nurses must have cultural skills, knowledge, and sensitivity to provide culturally appropriate care to their patients. Therefore, nurses must strive to understand their patients' beliefs regarding health and their worldviews.[5] The results of this study revealed that nurses' levels of cultural competence, knowledge, skills, and sensitivity are high. More than 50% of the nurses who participated in the study stated that they had provided culture-specific care, that nursing care should be culture specific, that cultural competence is necessary for patient care, and that they had heard of cultural competence before. These results support the conclusion of this study.

In this study, as the level of education of nurses increased, the mean cultural competence scores increased as well. However, the difference between them was not found to be statistically significant. A study reported a correlation between nurses' levels of education and their cultural understanding and competence.[18] In a study with nurses in hemodialysis services, Mahabeer[15] identified a meaningful correlation between the level of education and cultural competence. Another study demonstrated that as the level of education increases, healthcare decisions are increasingly influenced by culture.[13] The results of this study are important because they demonstrate the necessity of including cultural competence in both nursing students' educational curriculum and in-service training of nurses.

Nurses with a longer duration of employment have a higher level of cultural competence. However, no significant difference was noted between the duration of employment and the level of cultural competence. In a study by Hart and Mareno[19], no relationship was noted between nursing experience and cultural knowledge in their study. A study by Noble et al.[20] identified a correlation between professional experience and cultural competence.

This study found that the levels of cultural competence, cultural knowledge, skills, and sensitivity of nurses who had cared for individuals from different cultures were higher. Similarly,

| Table 4. Comparison between Cultural Competence Scale for nurses and other variables | | | | |
|---|---|---|---|---|
| | Cultural skills | Cultural knowledge | Cultural sensitivity | Total score |
| **Do you think patient care should be culture specific?** | | | | |
| Yes | 47.94±7.53 | 23.60±3.88 | 7.83±1.57 | 79.37±12.21 |
| No | 41.50±8.19 | 20.62±4.09 | 6.93±1.70 | 69.06±12.92 |
| | t=6.374 p=0.001 | t=5.787 p=0.001 | t=4.28 p=0.001 | t=6.379 p=0.001 |
| **Do you believe you provide culture-specific patient care?** | | | | |
| Yes | 47.62±7.85 | 23.53±3.95 | 7.77±1.65 | 78.93±12.68 |
| No | 41.45±7.93 | 20.48±3.99 | 6.95±1.61 | 68.89±12.46 |
| | t=5.991 p=0.001 | t=5.880 p=0.001 | t=3.781 p=0.001 | t=6.097 p=0.001 |
| **Have you ever heard of the concept of cultural competence??** | | | | |
| Yes | 46.24±8.26 | 22.80±4.13 | 7.70±1.63 | 76.75±13.22 |
| No | 42.87±8.40 | 21.27±4.28 | 6.89±1.66 | 71.03±13.34 |
| | t=2.952 p=0.003 | t=2.670 p=0.008 | t=3.554 p=0.001 | t=3.132 p=0.002 |
| **Do you think cultural competence is a necessity for patient care?** | | | | |
| Yes | 46.72±7.79 | 23.04±3.92 | 7.70±1.61 | 77.47±12.57 |
| No | 40.73±8.67 | 20.23±4.41 | 6.71±1.68 | 67.68±13.54 |
| | t=5.106 p=0.001 | t=4.738 p=0.001 | t=4.141 p=0.001 | t=5.224 p=0.001 |
| **Have you provided patient care for individuals from different cultures?** | | | | |
| Yes | 45.87±8.029 | 22.67±3.99 | 7.52±1.61 | 76.07±12.76 |
| No | 40.41±9.69 | 19.90±5.05 | 6.90±2.05 | 67.22±15.99 |
| | t=3.439 p=0.001 | t=3.487 p=0.001 | t=1.938 p=0.114 | t=3.490 p=0.001 |
| **Do you use any language other than Turkish when you care for patients?** | | | | |
| Yes | 46.31±7.86 | 22.72±3.94 | 7.56±1.65 | 76.60±12.62 |
| No | 42.10±9.20 | 21.25±4.79 | 7.12±1.74 | 70.48±14.83 |
| | t=3.549 p=0.001 | t=2.424 p=0.016 | t=1.856 p=0.065 | t=3.209 p=0.002 |

Meydanlıoğlu et al.[21] conducted a study with university students from health departments and reported a significant difference in the intercultural sensitivity of individuals who did and did not co-exist with individuals from different cultures. Furthermore, a study by Bulduk et al.[22] found the cultural sensitivity levels of those who interact with individuals from other cultures to be significantly different.

Other studies in the literature indicate that the levels of cultural competence among nurses and nursing students are high.[21-24] In this study, the results were anticipated to indicate a high level of cultural competence in nurses. The high level of cultural competence among nurses improves the health outcomes of patients they care for and their families, institution where they work, and the society as a whole. It further enhances the professional appreciation for their institution.

The level of cultural sensitivity in nurses was considerably high in this study. However, a study by Suk et al.[25] indicates that school nurses had a low mean score for cultural sensitivity. The nurses in this study had a high level of cultural sensitivity, which may indicate a high awareness of cultural competence.

## CONCLUSION

In conclusion, we found that the nurses' cultural competence levels were above average. The inclusion of training on cultural evaluation in undergraduate and postgraduate programs for nursing is recommended to improve the levels of cultural competence and cultural evaluation skills of nurses.

## MAIN POINTS

- Cultural competence should be a priority in the provision of healthcare.

- Planning is essential to develop this competence among health professionals.
- Cultural competence education should be included in the training programs for nurses.

## ETHICS

**Ethics Committee Approval:** Ethics committee approval was obtained from the Noninvasive Clinic Ethics Committee of the Medical Faculty at Harran University (date: dated 30.03.2020, no: 7).

**Informed Consent:** Consent was obtained from the participants.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: S.H., F.E., Design: S.H., F.E., Data Collection and/or Processing: S.H., F.E., Analysis and/or Interpretation: S.H., F.E., Literature Search: S.H., F.E., Writing: S.H., F.E., Critical Review: S.H., F.E.

## DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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# Evaluation of Nursing Students' Peripheral Intravenous Catheter (Insertion/Placement) Attempts with Simulator

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## Abstract

**BACKGROUNDS/AIMS:** this study aimed to evaluate the steps of peripheral intravenous catheter (PIVC) insertion through a computer-assisted simulator (virtual intravenous simulator) and determine the errors made in first-year nursing students.

**MATERIALS AND METHODS:** It is predicted that the results obtained in this study will make the necessary arrangements in occupational skills training in the short term and making PIVC application safer for the future graduates in the long term. This descriptive study was evaluated with a descriptive design (survey) of PIVC insertion training in the nursing education program. The data were collected at the Vocational Skills Training Laboratory of Nursing Principles. PIVC placement skills were obtained using the feedback evaluation reports created by the "virtual intravenous simulator" and analyzed with descriptive statistical methods.

**RESULTS:** It has been determined that students made critical and non-critical errors in the PIVC placement. These results are important with regard to the development of the training of PIVC placement.

**CONCLUSION:** Gaining competence at the level of "demonstrates, performs" in PIVC insertion practice, which is one of the basic skills, can contribute to safe care after graduation.

**Keywords:** Intravenous catheter placement, simulation, skills training in nursing, skills training methods, virtual intravenous simulator

## INTRODUCTION

Global transformations driven by socio-economic factors, technological developments in the healthcare system and community expectations have made it necessary to change the nursing education process.[1]

Nursing is an applied profession that requires the merger of theoretical knowledge with application skills in a proper and meaningful way. Nursing education requires detailed and comprehensive knowledge in many areas. Today, the limited clinical application areas, the shortened hospital stays of patients, medical errors, patient safety and legal regulations within the complex structure of the healthcare system have affected the practical training of students. When educational system-based causes are added to the above stated issues, it is not always possible for students to gain appropriate clinical experience because they spend less time in the clinical setting.[2,3] However, despite these restrictions, it is expected that graduates can perform all the applications of the nursing profession in a complete and correct manner. For this reason, using technical equipment and hardware enabling simulation training in laboratory settings where nursing students can experience nursing practices before working with the patient, and where they can be

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taught the necessary skills training, has become a recommended teaching method. Simulation-based learning has become a key component in the teaching of nursing competencies to nursing students who are trained in the ever-changing healthcare system, and who must meet emerging needs in health care.[4,5] Computer-generated virtual simulations are a specific type of computer program that mimics real life clinical scenarios, and students apply healthcare service skills with virtual patients in a reality-based manner.[6] Virtual simulations have become one of the most effective training methods that allows students to practice repeatedly without harming the patient. This gives students the opportunity to make mistakes and to learn the right method, in a safe learning environment; virtual simulations help students gain cognitive and psychomotor skills.[7]

Alinier classified training-oriented medical simulation tools based on the Knows, Knows How, Shows how, and action levels in the assessment of skill/competence/performance, of the learner according to Miller's (1990) pyramid. Based on this classification, "Virtual Reality (VR) simulators were evaluated at the level of Knows How level 2 in terms of the learner. Additionally, they were assessed at Shows How level 3 in a high level of processing power and performance. Jung, et al.[8] (2011) identified VR simulators as the technological tools that provide touch-based feedback. Due to these features, the disadvantage of VR simulators is that they require high levels of processing power and are expensive. Their advantage is that they support self-learning and give feedback on the student's performance.[8,9]

The Nursing Principles class, which includes education in basic practice skills, communication strategies and initial pharmacological principles and practices, is the first class in which students are taught basic skills. One of the invasive procedures taught in this class that creates anxiety and fear of failure in students is placing peripheral intravenous catheters (PIVC).[10] Training in PIVC placement is an extremely important application in nursing education. The PIVC placement skill, which is used for various applications such as intravenous (IV) fluid therapy, IV drug application or taking blood samples, is a difficult skill to acquire and can cause many complications if not done properly. In a recent analysis, it was found that the failure rate of PIVC placement ranged from 35% to 50%, and the main reason for this is the premature removal of the catheter. The early removal of PIVCs is associated with complications such as phlebitis (15.4%), infiltration (23.9%), catheter occlusion (18.8%), the catheter falling out of place (6.9%) and catheter-related infection (0.2%). It was reported that a factor causing this problem is the lack of knowledge and skills of the nurses applying the catheters.[11] One of the proposed solutions for reducing the failure rate and reducing complications is to enhance the nurses' training in PIVC placement. It was reported that the improved development of the nurses' skills in this area and their increased confidence in their performance in relation to this skill have resulted in fewer complications.[12] In the quasi-experimental study by Dinç and Erdil[13] with 60 patients receiving total parenteral nutrition and having PIVC, they reported that the training given to nurses was successful in reducing complications related to PIVC insertion procedures. Similarly, in the study investigating the effect of education on the rate of and the understanding of risk factors for intravascular catheter-related infections and including 44 doctors, 17 interns, and 52 nurses, it was found that training was very effective in reducing catheter-related infections.[14]

Training in PIVC application skills can be done in laboratory environments using traditional plastic arm models with traditional methods. But nowadays, the use of modern technological computer-based intravenous simulators is becoming increasingly widespread. In a study with 46 nurses, it was found that the number of failed attempts to place PIVC in patients was significantly lower in the participants who received simulation-based training, as opposed to participants who received traditional training ($p=0.043$). Additionally, reported complications were lower among the simulation-based educated nurses (21% vs. 33%), but this result was not regarded as statistically significant.[15] In a randomized controlled study with nurses working in the internal medicine and surgical departments, it was shown that the training program using a computer-based simulator significantly increased the knowledge, skills and confidence of nurses in the application of PIVC.[16]

It has been determined that PIVC practitioners in particular have a lack of knowledge and skills related to patient evaluation, area selection for the catheter insertion, catheter selection and insertion, catheter fixation, length of duration and definition of complications and treatment, and that more effective training is needed in these matters.[17] Any study examining the teaching of PIVC insertion skills of nursing students with VR simulators present in few nursing programs due to the high cost could not be reached in Turkey. Considering the relevant literature, it was required to determine critical and non-critical errors were made by students at which steps of PIVC insertion skills by using VR simulators. Defining incorrect steps in PIVC insertion with VR simulators will learn outcomes in improving the education process by using PIVC insertion instructions with basic arm simulators that are cost-effective and commonly used in the short term. It can be predicted that PIVC insertion skills will be improved in graduates or novice nurses who acquire this sensitive application skill in the long term.

This study aimed to evaluate the use of computer-assisted simulator (virtual intravenous simulator or VR) in teaching PIVC insertion in the first-year nursing students and to determine the incorrect steps.

### Questions of The Study

Do first-year nursing students correctly perform intravenous catheter placement procedures? Which mistakes are first-year nursing students most likely to make during intravenous catheter placement?

## MATERIAL AND METHODS

In this study, the PIVC insertion training in nursing education program was evaluated with a descriptive research design (survey). The research was carried out within the scope of the Nursing Principles course in the spring semester at a foundation university in Istanbul. The nursing occupational skills laboratory contains simple patient care models, the tools and equipment required in the training of each skill, and advanced simulation-based tools. Every 10–14 students in the laboratory work together with a teaching staff.

### Study Sample

All of the first-year nursing students (n=47) formed the sample of this study. The sample size was calculated as 42 students based on alpha 0.05 error margin and 95% confidence interval to reach 80% power. As a result, no sample selection was made and all students were included in the sample.

### Data Collection

The data were obtained from the feedback reports of the "virtual intravenous simulator" which was used to teach the students the PIVC placement skill.

### Virtual Intravenous Simulator

The Adult Virtual IV Simulator Self-Directed Training System was developed by company. The Adult Virtual IV Simulator Self-Directed Training System works as follows:

(1) Username and password must be entered for login.

(2) There are 150 event scenarios based on training purposes (in the hospital, pre-hospital, military care).

(3) The event scenarios include medicines ordered by the physician and nursing interventions in drug applications.

(4) Each scenario lesson includes videos and graphics covering pre-processing, preparation, and post-processing stages. These steps are applied by the student.

(5) At the end of the procedure, the system provides a feedback report on the correct application areas, such as correct selection of equipment, successful placement, hematomas, pain score, needle angle, time suitability, and an evaluation score based on 100 points. The performance duration and the results of all students are identified by the computer.

The teaching staff responsible for vocational skills presented the PIVC skills training first in theory, and then in the laboratory, in accordance with the skill checklist given to the students beforehand. The students repeated the procedure on the simple arm simulator until they reached the necessary skill level. Afterwards they practiced the same technique with a 3D visualization, and then for the second time with the computer assisted Virtual Intravenous Simulator under the supervision of a responsible teaching staff member. The practices and evaluations of this training process are excluded from the research data. The Research Data were collected 15 days after the training, where each nursing student themselves re-implemented the PIVC placement process with the 3D computerized Virtual Intravenous Simulator under the "poisoning scenario"; the feedback reports (Table 1) which were analyzed and scored on the basis of 100 points by the computer were recorded, and the data were collected.

### Statistical Analysis

The data were analyzed by descriptive statistical methods. Descriptive statistics, number, percentage were used for statistical analysis by Statistical Package for Social Science 25.0 (IBM Corp.; Armonk, NY, USA) package program.

### Ethical Considerations

Written permission was obtained from the Head of the Nursing Department since the nursing program was a descriptive study or survey in teaching PIVC insertion in the study. Students who participated in the study were informed about the study and verbal consent was obtained.

## RESULTS

When the students are examined by gender, 80.85% are women and their average age is 19.11±1.4. The economic situation of 63.82% of students is equal to income and expense. Additionally, 4/5 of the student work (Table 2).

Data regarding the PIVC placement skill in the study are presented below according to the feedback report of the Virtual Intravenous Simulator (Table 3).

The highest scores regarding the steps assessed in the intravenous catheter placement procedure of the nursing students were achieved in the following categories: completion of the procedure at the right and appropriate time 100% (n=47), entering the vein after the patient has been warned 97.9% (n=46) and verifying the identity of the patient 93.6% (n=44).

The steps that the students made the most errors in were removing the catheter needle correctly after the vein has been entered 70.2% (n=33), using the tape to record the initials, date and time when applying the catheter 61.7% (n=29), choosing the right catheter size 51.1% (n=24) and ensuring catheter safety 51.1% (n=24).

In the study, the analysis of the variables was not made due to the limited proportion of students in their sociodemographic characteristics. In this research, it was especially focused on determining which PIVC placement skills steps were made. It is suggested to investigate the effect of variables in different and more samples.

## DISCUSSION

One of the most difficult skills taught in nursing education is PIVC placement. For this reason, students work very hard to develop this skill. Students are more anxious about failing at PIVC placement particularly in clinics, as they are worried about causing pain to the patients. If a student fails to perform PIVC placement correctly, he or she will experience difficulties, such as lack of self-confidence, and an unsuccessful clinical skill performance. For this reason, it is critical for students to gain these skills in vocational skills laboratories, improve their skills and gain confidence in this matter, to reduce their worries when applying the procedure to patients in the clinic environment. However, most nurses are expected to acquire this invasive procedural skill with little formal training and limited practice.[18] According to the results of the Infusion Nurses Society IV Safety Practice (2013) (n=345) it was reported that 57% or less of nursing students received PIVC placement training and only 71% of those nurses received additional training in the workplace after graduating from nursing school.[19] Lyons and Kasker[20] reported that because many nurses are only receiving limited training during orientation, they are experiencing stress during PIVC placement, which causes inadequate patient care. One of the causes of PIVC related complications is due to lack of knowledge, skills and confidence among nurses. In the literature it is stated that the inability to insert into the peripheral vein affects infiltration formation[21] and if the skill of the person placing the catheter is insufficient, infiltration risk is increased.[22] In this study, it was seen that students made both critical and non-critical mistakes. The only step the students carried out without any errors was "the completion of the procedure at the right and appropriate time". Not choosing the right catheter size,[23] not ensuring catheter safety (no proper stabilization)[24] are among the effective causes of phlebitis formation. Errors in entering the vein and advancing the catheter in it, and not positioning it in the appropriate area[25] are factors that cause both phlebitis and infiltration. Similarly, not observing the aseptic technique is among the factors that result in the formation of catheter-related infections. When studies conducted are examined, it is seen that there is a lack of knowledge and skills regarding the placement of the PIVC, the choice and placing of the catheter, the fixation of the catheter, the choice of the appropriate vein, the evaluation of the patient and the definition of complications and treatment.[26,27] In this study, it is seen that the students made the same mistakes and results are compatible with said studies. In individual short face-to-face interview after the procedure, when the students were asked what the reasons for the mistakes may be, their feedback was: *"that they do not need to pay attention to the age and sex of the patient in the virtual environment and that*

**Table 1. Intravenous catheter application competence list**

| |
|---|
| **Events related to catheterization** |
| 1.Correct catheterization<br>2.Venipuncture |
| **Steps in which critical errors occur** |
| 1. Completion of the procedure at the right and appropriate time<br>2. Taking the correct standard precautions<br>3. Correct use of the tape where the date, time and initials of the person applying the catheter are recorded<br>4. Correct detection of the catheter<br>5. Correct removal of the catheter needle<br>6. Washing and observing the vein correctly with liquid<br>7. Attempting placement in the right area<br>8. Not contaminating the area<br>9. Accurate and complete preparation of materials (equipment)<br>10. Notifying the patient and entering the vein<br>11. Verifying the identity of the patient |
| **Steps in which non-critical errors occur** |
| 1. Determining the application zone (distal to periphery) correctly<br>2. Informing the patient at the right time<br>3. Inserting the catheter from the correct angle<br>4. Proper application of infusion<br>5. Providing catheter safety<br>6. Choosing the right catheter size<br>7. Right palpation of the vein<br>8. Preventing hemorrhage by applying pressure to the entrance zone |
| The IV catheter application steps are listed in the form of the feedback report of the simulator, not in the order of execution and not in the order of the intervention steps. |

**Table 2. The Sociodemographic characteristics of the students**

| Characteristics | | Mean-SD | Min-max |
|---|---|---|---|
| **Age** | | 19.11±1.4 | 19–21 |
| | | **n** | **%** |
| **Gender** | Female | 38 | 80.85 |
| | Male | 9 | 19.15 |
| **Economic condition** | Income and expense are equal | 30 | 63.82 |
| | Income higher than expense | 9 | 19.15 |
| | Income lower than expense | 8 | 17.03 |
| **Employment status** | Working | 9 | 19.15 |
| | Not working | 38 | 80.85 |

SD: standard deviation, n: number.

*they just want to finish the process", "that they feel like they are conducting a virtual process while ensuring catheter safety and thus put safety in the background", "that they think it is sufficient for them to succeed in entering the vein and that they forget about the other steps after that" and "that it seems unimportant because it is not a real patient".* Additionally, the students stated that learning with the simulator "is fun, motivating and exciting, and realized the importance of being more careful than basic arm simulators."

When it is considered that it is difficult to teach/learn basic nursing skills and especially PIVC placement, it can be said that the trainers should continue to develop methods that will allow the students to perform these skills precisely and accurately. For students in the 21st Century in nursing education it is necessary to provide (a) self-learning packages through multimedia e-learning curriculum components; (b) integration of simulation-based technologies that provide the training of invasive procedural skills and sufficient feedback until all errors

**Table 3. Distribution of students' PIVC placement skills by their success rate**

| | Successful | | Unsuccessful | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| **Events related to catheterization** | | | | | | |
| 1. Correct catheterization (no folding of the catheter, placement of the catheter in one try) | 40 | 85.1 | 7 | 14.9 | 47 | 100 |
| 2. Vein puncture (entrance) (advancing along the vein, finding the right vein, correct determination of catheter entry angle, vein fixation, correct needle holding) | 43 | 91.5 | 4 | 8.5 | 47 | 100 |
| **Steps in which critical errors occur** | | | | | | |
| 1. Completion of the procedure at the right and appropriate time | 47 | 100 | 0 | 0 | 47 | 100 |
| 2. Taking the correct standard precautions (wearing gloves, preparation of the area with the correct antiseptic, cleansing at the right time) | 39 | 83 | 8 | 17 | 47 | 100 |
| 3. Use of the tape where the date, time and initials of the person applying the catheter are recorded | 18 | 38.3 | 29 | 61.7 | 47 | 100 |
| 4. Detection of the catheter | 43 | 91.5 | 4 | 8.5 | 47 | 100 |
| 5. Correct removal of the catheter needle | 14 | 29.8 | 33 | 70.2 | 47 | 100 |
| 6. Cleansing and observing the vein correctly with liquid | 31 | 66 | 16 | 34 | 47 | 100 |
| 7. Attempting the placement in the right area | 37 | 78.7 | 10 | 21.3 | 47 | 100 |
| 8. Not contaminating the area | 41 | 87.2 | 6 | 12.8 | 47 | 100 |
| 9. Proper and complete removal of materials (equipment) | 37 | 78.7 | 10 | 21.3 | 47 | 100 |
| 10. Notifying the patient and entering the vein | 46 | 97.9 | 1 | 2.1 | 47 | 100 |
| 11. Verifying the identity of the patient | 44 | 93.6 | 3 | 6.4 | 47 | 100 |
| **Steps in which non-critical errors occur** | | | | | | |
| 1. Determining the application zone (distal to periphery) correctly | 29 | 61.7 | 18 | 38.3 | 47 | 100 |
| 2. Informing the patient at the right time | 39 | 83.0 | 8 | 17.0 | 47 | 100 |
| 3. Inserting the catheter from the correct angle | 36 | 76.6 | 11 | 23.4 | 47 | 100 |
| 4. Proper application of infusion | 43 | 91.5 | 4 | 8.8 | 47 | 100 |
| 5. Providing catheter safety | 23 | 48.9 | 24 | 51.1 | 47 | 100 |
| 6. Choosing the right catheter size | 23 | 48.9 | 24 | 51.1 | 47 | 100 |
| 7. Right palpation of the vein | 27 | 57.4 | 20 | 42.6 | 47 | 100 |
| 8. Preventing hemorrhage by applying pressure to the entrance zone | 37 | 78.7 | 10 | 21.3 | 47 | 100 |

n: number.

are eliminated and the student becomes competent enough to conduct the procedure; (c) collaborative experiential learning environments where students can share their knowledge and experiences and (d) a robust curriculum of meaningful and comprehensive learning tests to confirm that the curriculum is effective in transferring new knowledge and skills.[28] In this study, theoretical information, a simple simulator and a computer-assisted simulator were used to teach the PIVC placement skill. After 15 days, the skill steps of the students based on the PIVC placement skill simulator feedback reports were evaluated. However, the students only carried out one step without error, while they made mistakes in all others. This can be explained in particular by the fact that the PIVC placement skill is the hardest skill to gain, and that students forgot some steps after 15 days. Also, the simulator carefully assesses each step. Simultaneously, as students have stated, working with a virtual sensor and not a real patient may have also caused some steps to be skipped. These results also indicate that students should repeat the practice to sharpen their skills. In a randomized controlled trial conducted by Engum et al.[29], with 163 nursing and medical students to compare effectiveness of computer-assisted IV simulators with traditional method in intravenous catheter insertion under laboratory conditions, both methods were reported to be similar in terms of gaining experience. Additionally, because of the study, the authors recommended that both methods should be used together. In a randomized controlled trial conducted by Wilfong et al.[15], with 42 nurses to compare the effectiveness of a computer-assisted IV simulator with traditional method in intravenous catheter insertion training, it was stated that those using the traditional method inserted the catheter using fewer catheters. However, it was reported that the traditional method group established the vascular access at a better level. In a randomized controlled experimental study by Sotto et al.[30], to compare the efficacy of the computer-assisted simulator (Laerdal Virtual I.V. simulator) with the traditional method in medical students, it was stated that the intravenous catheter insertion success scores of those using the computer-assisted simulator were higher than the other group.

In a laboratory study by Schoening et al.[28], they stated that multiple repetition makes students feel comfortable and improves learning. For this reason, it is thought that it is necessary for the students to continue to learn on their own to ensure the permanence of the skill, which is taught within a limited time. Similarly, it is necessary to support students because they do not use critical thinking and problem-solving skills in the laboratory. It can be said that this result is important in helping pre-graduate students improve their skills; self-assessments are also important to prepare for actual post-graduation clinical practice. However, these findings are limited to IV simulator performance data.

### Limitations of the Study

This study was conducted in a single center and in a small sample group. Therefore, the study findings should not be generalized all nursing students.

## CONCLUSION

Given that students were making critical and non-critical mistakes in training of PIVC insertion, it was determined that the students needed more practice under the supervision of their trainers. The students realized that they needed to do this skill very cautious. In the same way, it can be said that the application of PIVC insertion should continue to be taught to the students in each lesson until graduation. To ensure self-learning, learning packages must be prepared and the students should be encouraged to work in the occupational skills laboratory to improve this skill. Additionally, students should be given the opportunity to perform this practice in clinical settings and learning setting should be provided to them.

In the clinics, the students should be observed by the trainers, and the trainers should intervene when the students are using the wrong practices. This can prevent students from learning the wrong methods. Measures should be taken to improve the students' clinical skills and competence, as well as to improve critical thinking skills and self-confidence. Because errors by nursing professionals can have dreadful results, the necessary efforts and time required for effective vocational skills training should must be made, and the training process should be assessed continuously. VR simulators can be used for both teaching and evaluating skills in nursing curricula. Additionally, orientation training should be continuously supported for newly hired graduates.

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## MAIN POINTS

- This study was determined that the students needed a more intravenous catheter insertion practice under the supervision of their trainers.
- This study was determined that the nursing students PIVC insertion should continue to in each lesson until graduation
- It was determined in which steps the nursing students made mistakes when PIVC insertion

### ETHICS

**Ethics Committee Approval:** This study was approved by İstanbul Sabahattin Zaim University Ethics Committee, 2016/84772076/8.

**Informed Consent:** Written permission was obtained from the Head of the Nursing Department since the nursing program was a descriptive study or survey in teaching PIVC insertion in the study. Students who participated in the study were informed about the study and verbal consent was obtained

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: O.A., D.Y., Design: O.A., D.Y., Supervision: O.A., D.Y., Data Collection and/or Processing: O.A., D.Y., Analysis and/or Interpretation: A.S., C.O., Literature Search: A.S., C.O., Writing: A.S., C.O., Critical Review: A.S., C.O.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

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CASE REPORT

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# An Unexpected Finding on Echocardiography in a Patient with Fatigue: A Two-Centimeter Papillary Fibroelastoma

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## Abstract

Cardiac papillary fibroelastomas (CPFs) are rare primary cardiac tumors. The majority of these tumors are located on valvular surfaces. Although most patients are asymptomatic, some patients may be complicated by stroke, myocardial infarction and even sudden cardiac death. The diagnosis of CPFs can be very challenging.

An 83-year-old male patient presented to the outpatient clinic with the complaint of fatigue and a 2 cm lesion with soft tissue echo pattern was detected in the left atrium. Among differential diagnosa of the lesion based on both echocardiogram and cardiac magnetic resonance images (MRIs) were thrombus, myxoma, Lambl's excrescence and vegetation. Pathological examination after prompt surgery revealed papillary fibroelastoma. We planned to present this case with both echocardiographic and MRI findings.

**Keywords:** Heart, neoplasms, mitral valve

## INTRODUCTION

The incidence of primary cardiac neoplasms is rare and the most common three tumors are myxomas, lipomas and papillary fibroelastomas in order of decreasing frequency. Cardiac papillary fibroelastomas (CPFs) may be found on the endocardial tissues, with a predilection for valve structures. Clinical presentation of CPFs can vary with majority of patients being asymptomatic with incidental findings on echocardiography. Tumors on both left and right sides of the heart can present with embolic events because of their fragility and high affinity for platelet aggregation.

Echocardiography is the major cardiac imaging modality for the diagnosis of cardiac tumors, but the diagnosis based upon imaging modalities is not definitive most of the time. Cardiac masses differ in size and shape making it difficult to diagnose a tumor versus a thrombus based on imaging findings and clinical presentation. The sensitivity and specificity are around 90% when using transthoracic echocardiography for the diagnosis of CPF especially if tumor size is more than 2 mm.[1] We present a patient who underwent echocardiographic examination that revealed a mass in close proximity to mitral valves, which turned out to be CPF after surgery.

## CASE PRESENTATION

An 83-year-old male patient admitted to cardiology outpatient clinic with the complaint of fatigue. His medical history

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revealed long lasting primary hypertension, chronic obstructive pulmonary disease and benign prostatic hyperplasia. He was on valsartan 160 mg tb 1x1, aspirin 75 mg tb 1x1, tamsulosin 0.4 mg cps 1x1, and inhaled bronchodilators. On physical examination, the sole pathological finding was 2/6 ejection type systolic murmur that was heard over aortic area. Blood pressure was normal. ECG was normal. On echocardiogram (GE Vivid S5, GE Healthcare, USA), aortic valves were calcified and Doppler findings were compatible with mild aortic stenosis, mitral valves, left ventricular ejection fraction and pericardium were all normal and a 2.0x2.5 cm round-shaped, well-circumscribed, highly mobile, echogenic solitary mass was realized in the left atrium with close proximity to mitral valves (Figure 1). With continuous wave Doppler imaging, mean mitral valve gradient was 4.0 mmHg indicating an obstruction of the left ventricular inflow. Differential diagnose were primary cardiac tumors, thrombus, vegetation and secondary cardiac tumors. Patient's chest X-ray and thoracoabdominal computerized tomography (CT) scan were found to be normal. Blood biochemistry including tumor markers were normal. For more detailed imaging of the mass, transesophageal echocardiogram was done at another hospital that could not reveal further information, so cardiac magnetic resonance imaging (MRI) was planned. Cardiac MRI was not done properly and prematurely stopped since the patient could not tolerate the procedure, and thus, contrast medium could not be injected and tissue characterization could not be done. However, MRI (Siemens Aera, 1.5T, Germany) showed a 1.8x2.0 cm nodular mass attached to the laterobasal portion of posterior mitral valve leaflet with a broad base (Figure 2). Since the mass was obstructing left ventricular inflow and the presence of risk of stroke surgical intervention was planned. The patient was operated by heart surgeons with minimally invasive approach. Through right thoracotomy the mass attached to posterior mitral valve leaflet was excised. The pathological examination revealed cardiac papillary fibroelastoma (CPF) with narrow, elongated and branching papillary fronds consisting of central avascular collagen and variable elastic and collagenous connective tissue, surrounded and covered by acid mucopolysaccharide which were lined by endothelial cells (Figure 3). The patient was discharged from the hospital 5 days after the surgery.


**Figure 1.** Doppler imaging findings

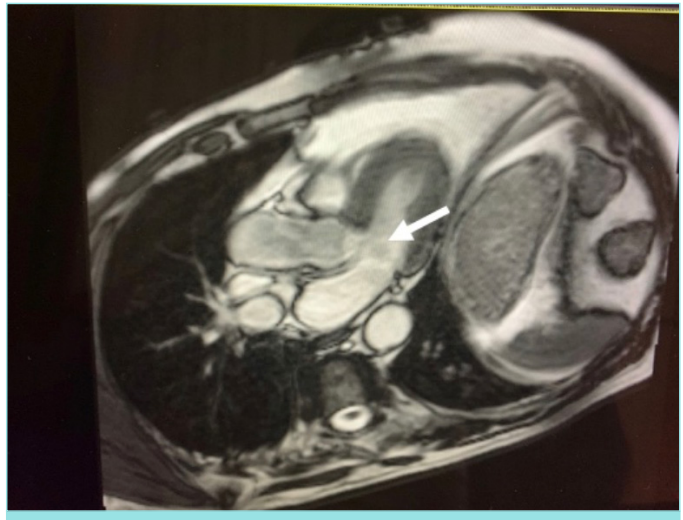

**Figure 2.** MRI findings
MRI: Magnetic resonance imaging

## DISCUSSION

Primary cardiac tumors are rare with an incidence of <0.1%. Around 75% of them are benign and CPF is the most common of the primary valvular tumors.[2] Appearance of CPFs resembles sea anemones and their size vary from 0.2 to 7 cm. More than 80% originate from valvular surfaces with the most commonly affected valve being the aortic valve.[3]

Risk factors of CPFs are unknown and diagnosis is reached en passant by echocardiography. Echocardiogram usually reveals a mobile, pedunculated or sessile mass, which flickers into the cardiac chambers. On cMRI, CPF typically appears as a small, round, homogeneous mass, usually bound to valvular structures and signal intensity is isotense on T1 and hyperintense or isotoense on T2-weighted fast spin echo

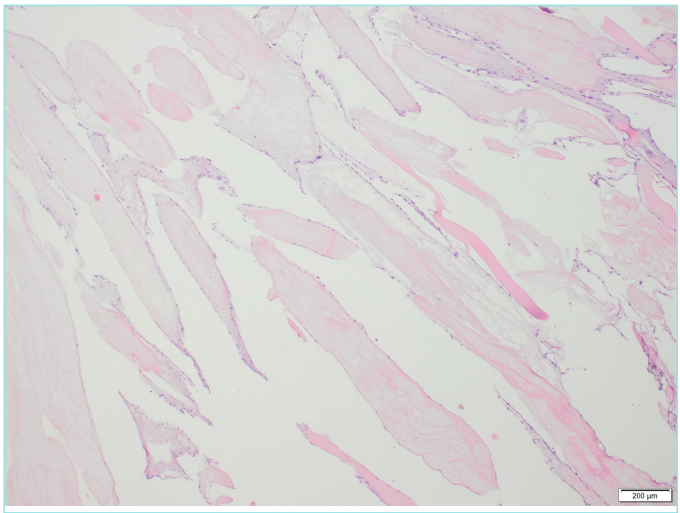


**Figure 3.** Pathological examination

images. However, T1 and T2 weighted images reflect their fibroelastic composition with uniform intermediate signal intensity similar to myocardium. Steady-state free-precession (SSFP) cine is also useful for the mobility of the mass. CPFs present as low signal, well-circumscribed mobile valve nodule on SSPF with peri-tumoral flow artefact on MRI.[3-5] Vegetation is associated with valve destruction unlike CPFs with typically spared valve function.

Most CPFs are asymptomatic or associated with vague symptoms as in our patient but systemic embolization is frequent because more than 95% of CPFs are located on the left side of the heart and they are fragile and have high affinity for platelet aggregation.[1,3]

Among differential diagnosa of CPFs are other cardiac tumors, vegetations and thrombus. The tumors, in general, are rarely present on valves. Thrombus can be differentiated by an irregular or lobulated shape, laminated appearance, microcavitations and absence of a pedicle.[6] With cMRI, fat-saturation sequences may help differentiate fibroelastomas from lipomas.[3] cMRI with gadolinium can also be used to distinguish thrombi from tumor.[7] Furthermore, cMRI provides an unrestricted spatial approach, high temporal resolution (30–50 ms) and noninvasive tissue characterization. cMRI, however, may have limitations for evaluating small (<10 mm) and mobile masses like fibroelastomas.[8] Unfortunately, our patient could not tolerate MRI procedure so we could not benefit from its advantages.

In conclusion, we presented a patient with unexpected mobile mass in left atrium which turned out to be CPF. Whatever the histopathological nature of mobile mass in heart chambers is, it is important to act fast and reach true diagnosis before a detrimental complication occurs. In this study, we could reach the final diagnosis after prompt surgical resection of the mass despite the use of advanced imaging modalities.

## MAIN POINTS

- Echocardiographic examination even in patients with subtle symptoms is important and necessary.
- Whatever the histopathological nature of mobile mass in heart chambers is, it is important to act fast and reach true diagnosis before a detrimental complication occurs.
- Management of cardiac masses especially in the elderly is very challenging. In this study, we could reach the final diagnosis after prompt surgical resection of the mass despite the use of advanced imaging modalities.

### ETHICS

**Informed Consent:** It was obtained.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: R.M.B., Design: R.M.B., Data Collection and/or Processing: R.M.B. Analysis and/or Interpretation: R.M.B., Ç.Z., S.B., Ö.T., M.M., Literature Search: R.M.B., Ç.Z., S.B., Ö.T., M.M.,Writing: R.M.B.

### DISCLOSURES

**Conflict of Interest:** The authors have no conflicts of interest to declare.

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CASE REPORT

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# Herpes Zoster Induced Shoulder Paresis: Case Report

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## Abstract

While neuropathic pain is commonly seen after herpes zoster infection, zoster-induced paresis is a rare complication. In the literature, there are only a few case reports of segmental motor paresis (SMP) with muscle weakness that has developed after herpes zoster infection. Postherpetic neuralgia is a chronic pain syndrome that can last for years and is often treatment-resistant, can lead to physical and social disabilities and psychological disorders. This case is presented to emphasize extremity weakness –which may rarely develop with neuralgia after herpes zoster– and its treatment.

**Keywords:** Postherpetic neuralgia, atrophy, shoulder pain, physical therapy

## CASE REPORT

A 59-year-old female patient applied to our hospital with complaints of pain, burning and rash on her left shoulder that had started eight weeks ago (Figure 1). Treatment was started with the diagnosis of zoster and the rash regressed with treatment. Afterwards, she was referred to our outpatient clinic with continuing complaints of motion limitation, burning, and weakness in the left shoulder. In the physical examination of the patient the following findings were reported: bilateral cervical rotations were restricted, left shoulder abduction was 100 degrees, left shoulder flexion was 90 degrees, left shoulder rotations were painful and restricted with an internal rotation of 20 degrees and an external rotation of 25 degrees. Muscle strength of the left upper extremity was 3/5 in the proximal region and normal (5/5) in the distal. Biceps and brachioradial tendon reflexes were decreased. C5–C6 dermatome had dysesthesia. There was a 2 cm atrophy in the right deltoid compared with the left deltoid. In the right upper extremity, magnetic resonance imaging (MRI) revealed acromioclavicular joint hypertrophy, tendinopathy on the supraspinatus and effusions in subacromial, subdeltoid and subchorocoid bursas. In the cervical MRI, there were severe osteodegenerative changes in the vertebrae and multiple bulging disks and disc degeneration, while an annular rupture at the C5–C6 level with a shallow disc protrusion effacing the ventral subarachnoid space was also observed (Figure 2). However, none of the findings could have caused prominent nerve root compression at any level. There was no abnormality in hemogram, serology and biochemical tests. In electromyography (EMG), sensory conduction examination revealed that the left first finger median nerve response amplitude was lower than the right and rate of conduction was slow, while motor conduction examination revealed prolonged distal latency of the median nerve. In the needle EMG test, active denervation was found at resting state inthe deltoid and biceps muscles which are innervated from the upper brachial trunk (n.axillaris and n.musculocutaneous), indicating acute neurogenic involvement.

For neuropathic pain, the patient was given pregabalin 75 mg/day as 1x1 initially, which was increased up to 3x1. An appropriate physical therapy and rehabilitation program was applied to the patient for 1 week: a standard 10-min cold pack

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application, ultrasound (1 w/cm$^2$) for 5 min to the left shoulder electric stimulation to the left deltoid muscle for 20 min, and Transcutaneus Electrical Nerve Stimulation (TENS) application to the left shoulder every session. For the range of motion of the joint, a shoulder continuous passive motion (CPM) device was used. The patient's complaints alleviated after stretching, strengthening and range of motion exercises for the shoulders. By the end of treatment, the patient's pain was greatly reduced, her left shoulder abduction was 160 degrees, flexion was 170 degrees, while the internal and external rotations were both up to 30 degrees. The muscle strength in the left upper extremity had increased to 4/5. The patient became independent in daily activities.

## DISCUSSION

Herpetic rash recovers within treatment about 2–4 weeks, but the pain often persists even after the rash has healed. This pain is defined as postherpetic neuralgia (PHN). It is a chronic pain syndrome that can last for years and is often treatment-resistant, can lead to physical and social disabilities and psychological disorders.[1-3] It has been reported that 11%–15% of patients who apply to pain clinics are patients with PHN.[3,4]

The severity of paresis is usually correlated with electrophysiological abnormalities in patients with postherpetic neuralgia. Herpes zoster-related motor paralysis has been reported in 0.5%–5% of cases and is mostly in the form of cranial nerve involvement.[4,5] Segmental paralysis is more common in the neck and upper extremity, while it is rarer in the lower extremity.[4] Typically, paresis develops in the proximal region of the extremities. In the upper extremity, the muscles within the C5–C7 segments are usually affected.[5,6] Although the paresis typically begins in the proximal region, it can progress to the distal area and may also become diffuse. Paresis usually develops 2 weeks after skin lesions are observed. In cases where the patient applies to the physician after the acute painful period ends and skin lesions are unidentifiable, misdiagnoses may occur, especially in association with the patient's age, possible chronic disorders or medications.[7] In this study, pathological electrophysiological changes of the upper trunk of the left brachial plexus were observed. The goal of treatment in postherpetic paresis is to provide analgesia and prevent motor deficit to protect the patient from outcomes such as motion restriction, joint contractures, muscle atrophy and weakness. Oral or intravenous antiviral therapy given especially in the early period may stop the progression of the disease.[8-10] In this study, antiviral treatment had been given in the early period. In addition to systemic drugs; physical therapy and rehabilitation practices play an important role for treating such patients. The success rate of this combined treatment is very high, especially if the patient is diagnosed early. The prognosis of postherpetic paresis is generally good. More than half of the patients show almost complete recovery; however, the recovery period can take up to 2 years.[7,8]

New anticonvulsants, such as lamotrigine and gabapentin, are believed to stabilize the neuronal membranes through their effects on sodium channel function. Gabapentin has been shown to be an effective and safe option for treatment in PHN. There are side effects such as dizziness and drowsiness. Prophylactic use demonstrates better results than late use due to the prevention of central sensitization.[1,3]

**Figure 1.** Herpetic rash before treatment.

**Figure 2.** MRI findings T2 flair.
MRI: magnetic resonance imaging.

In addition to pharmacologic treatment, physical therapy is an essential part of treatment which are used to create a therapeutic reaction in the tissue. The physiological effect of cold is reactive vasodilatation after sudden vasoconstriction. It relieves inflammation and is more effective in the acute phase. The analgesic effect of cold may be due to reflex muscle relaxation, cutaneous counter irritant effect, or the slowing of nerve conduction. Cold application reduces muscle tone and reduces muscle spasm.[10,11] TENS application is thought to provide analgesia with the combination of effects such as those associated with the gate-control theory, endogenous opiates, local vasodilatation and acupuncture-like effects.[12] The clinical ultrasonography (US) frequency is 0.8–1. MHz and it is usually performed at a dose of 0.5–2.0 w/cm$^2$, in pulsed or continuous form. The pulsed form produces less heat and its action is associated with effects such as cavitation and standing waves. The US is indicated for periarticular and chronic inflammatory pathologies.[10,12]

The findings of this case show that postherpetic neuralgia should be considered a diagnosis in patients with painful shoulder complaints with a history suggestive of herpes zoster; especially in elderly patients with chronic diseases, those who are on multiple medications, and also patients who are immunosuppressed. Considering that the patient may apply for treatment after the skin lesion has passed, which may lead to significant difficulties in diagnosis, we believe that physicians should be aware of the clinical and electromyography findings of such patients and the problems faced in diagnosis. Our aim with the current case report was to address these problems and to draw attention to the fact that severe shoulder pain may be associated with postherpetic neuralgia.

## MAIN POINTS

- Postherpetic neuralgia should be considered a diagnosis in patients with painful shoulder complaints with a history suggestive of herpes zoster and it can be treated with medical and physical therapy.

### ETHICS

**Informed Consent:** There is informed consent of patient for this case report.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Concept: S.K., Design: S.K., Literature Search: D.C., Writing: D.C., Critical Review: S.K., D.C.

### DISCLOSURES

**Conflict of Interest:** The authors declare no conflict of interest.

**Financial Disclosure:** The authors declare that this study received no financial support.

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## Erratum

In the article by Menekli et al., entitled "**The Relationships between the Pain Beliefs and Coping Strategies of Palliative Care Patients**" (Cyprus J Med Sci 2021; 6(3): 201-207. DOI: 10.5152/cjms.2021.3023) that was published in the 2021/3 (September) issue of Cyprus Journal Medical Sciences, the name ethics committee approval number had mistyped. Upon the written request from the authors, the correction was implemented.

Menekli T, Doğan R, Ercе Ç, Atik D. The Relationships between the Pain Beliefs and Coping Strategies of Palliative Care Patients. Cyprus J Med Sci. 2021; 6(3): 201-207.

The aforementioned manuscript can be accessed through the following link:

10.5152/cjms.2021.3023

The error and the correction in the article have been demonstrated as follows:

**Error**

**Ethics Committee Approval:** Ethical committee approval was received from the İnönü University Noninvasive Clinical Research Ethics Committee (approval number: 56150952/050.04-316).

**Correction**

**Ethics Committee Approval:** Ethics committee approval was received from the İnönü University Noninvasive Clinical Research Ethics Committee (approval number: 2019/36-04).