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Prevalence of Malnutrition in Hospitalized Children

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Abstract

BACKGROUND/AIMS: To identify the prevalence of malnutrition among hospitalized children on admission to hospital and discharge from hospital, to supply a classification of those patients with malnutrition, and to observe their changes in nutritional conditions during their hospital stay.

MATERIALS AND METHODS: This study comprised 400 children hospitalized in the pediatrics department of our tertiary hospital between August, 2014 and May, 2015, ranging in age from one month to eighteen years. Those patients in the emergency clinic, the pediatric intensive care, those with a birth weight under 2,500 g, premature patients and foreign patients were excluded from this study. At the time of hospitalization, measurements of bodyweight, height, mid-upper arm circumference (MUAC), triceps and subscapular skinfold thickness (SST); and at the time of discharge, measurements of the bodyweight were taken. In addition, the patients' age, sex, diagnosis, and length of hospital stay were recorded.

RESULTS: The mean age of the 400 patients was 59.2±61.9 months (median age: 32 months), and 57.8% of the patients were male. According to the Gomez classification, malnutrition was identified in 37.6% of the patients. According to the Waterlow classification, malnutrition was found in 30.8% of the patients at the time of admission and 31.5% at the time of discharge. The mild malnutrition rate decreased from 21% to 20.5%, the moderate malnutrition rate increased from 5.8% to 7.2%, and the severe malnutrition rate decreased from 4% to 3.8% at discharge. Of those patients who did not have acute malnutrition at the time of hospitalization, 4.7% had developed malnutrition by discharge. According to analysis of the MUAC, triceps skinfold thickness (TST), and SST, the patients' respective malnutrition rates were 45%, 16.4%, and 16.8%. According to the MUAC values, 12% of the malnourished patients did not meet the criteria for malnutrition using the Waterlow classification. According to the TST data, 25% of the malnourished patients did not meet the criteria for the Waterlow classification of malnutrition. According to the SST values, 29% of the patients with malnutrition did not have malnutrition according to the Waterlow classification.

CONCLUSION: Children in hospitals still have high rates of malnutrition; thus, it is important to check each patient's nutritional condition at the time of admission, periodically throughout hospitalization with detailed analyses, and to begin effective treatment as soon as possible.

Keywords: Child, hospitalization, malnutrition

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INTRODUCTION

In underdeveloped and developed countries, malnutrition is a serious public health issue which primarily affects children under the age of five.[1] 5.0 million children under the age of five died in 2020, with malnutrition accounting for almost 45% of those deaths, according to a World Health Organization (WHO) report released in January, 2022.[2]

It was stated in the UNICEF 2014 report that Türkiye has a stunted child rate of 12%, a wasted child rate of 1%, and 2% of children under the age of 5 are underweight.[3] According to the 2018 data of the Population and Health Survey of Türkiye, 6% of children under the age of 5 in Türkiye are stunted, 2% are underweight and 2% are wasted.[4]

According to reports, the prevalence of malnutrition among hospitalized children varies between 19% and 80% depending on the country's degree of development.[5-10] Recognition of malnutrition and regulation of its treatment at the time of hospitalization are important in terms of lowering morbidity and mortality.[5-11]

Malnutrition in children is not formally defined in any one way. The most frequently applied anthropometric classifications over time have been those developed by Gomez et al.[12], Waterlow and the WHO.[13-14] Gomez's approach of relating weight to age and Waterlow's way of relating weight to height and height to age are the two methods for assessing nutritional status which are most well-known. The WHO standards are still in use today. These standards establish the comparison of anthropometric measures with the reference standard using scales, the most popular of which are based on percentiles and standard deviations (SD) (or z-score: the number of SDs by which the collected data deviates from its reference median).[15] Despite the fact that standard percentile curves for countries have long been used to interpret these parameters, SDS or z-values have been utilized recently since they are a better measure of how much they depart from typical children in the community.[15] However, since it takes time to measure the subjects' weights and heights and assess their z-scores or SDS values, it does not appear viable to apply this method in every instance. For years, skinfold thickness and mid-upper arm circumference (MUAC) have been used to screen for childhood malnutrition and assess compliance with nutrition programs. Caliper measurements of skinfold thickness and MUAC are useful in making rapid nutritional assessments in individuals who cannot be weighed.[16]

The current study assessed the nutritional conditions of hospitalized children and investigated the impacts of hospitalization on their nutritional conditions over time.

MATERIALS AND METHODS

This study comprised 400 children hospitalized in our tertiary hospital's pediatrics department between August 15th, 2014, and May 15th, 2015, ranging in age from 1 month to 18 years. Those patients hospitalized in the emergency department, the pediatric intensive care unit, or the neonatal intensive care unit were not included in this study. The study excluded those individuals who had a birth weight of less than 2,500 g, those who had a history of premature delivery, were foreign nationals, or those who stayed in the hospital for less than 24 hours.

The age, sex, and diagnosis of the patients were recorded. During the first 48 hours after hospitalization, measurements of body weight, height, MUAC, triceps skinfold thickness (TST), and subscapular skinfold thickness (SST), as well as body weight and height in the final 24 hours before discharge were taken. The same medical professional took these measurements using the exact same tools. The weight measurements of those patients with diarrhea or dehydration were evaluated after hydration. Children under two years old were weighed undressed using a 20 kg capacity, 5 g sensitive digital baby scale (Weewell, China), and the body weights of those children aged over two years were measured using a 100 g sensitive adult weighing scale (Uwe-PM 150, England). Children under 2 years old had their heights measured on a flat surface while lying back with their heads fixed and their feet together using a 1 m length measure sensitive to 0.1 cm, and children older than 2 years old had their heights measured in the standing position using a tape measure fixed to the wall with a 0.1 cm sensitivity.

The left elbow joint was slightly bent from the center of the olecranon notch to the acromion notch as the MUAC was measured with an inelastic band at a 1 mm grade. TST was determined using a Holtain Skinfold Caliper (Holtain Ltd., Crymch, UK) at the intersection of the acromion and olecranon notches with an accuracy of 0.2 mm. SST was determined using a Holtain Skinfold Caliper (Holtain Ltd., Crymch, UK) with the arm hanging down, just below the scapula and parallel to the edge of the bone, holding the graspable skin fold diagonal to the body with 0.2 mm accuracy.

Gomez classification, Waterlow classification, and the WHO 2006 classification were utilized so as to identify malnutrition. The patients were evaluated for acute and chronic malnutrition according to the Waterlow classification using height for age and weight for height measurements and acute malnutrition was divided into three classes, *mild*, *moderate*, or *severe*. For all patients, the length of stay was determined by including the day of hospitalization and leaving out the day of discharge. In addition to these, z-scores of body weight, height, middle arm circumference, TST, and SST values were calculated.

The indicators recommended by the WHO to determine the nutritional conditions of children aged under 5 years are height-for-age z-score, weight-for-height z-score, and weight-for-age z-score.[17]

The Centers for Disease Control and Prevention 2000 guidelines were used to compute the triceps and SST z-scores in patients older than 1.5 years.[18]

Children under the age of five had their MUAC measured. Severe malnutrition was defined as 11.5 cm or less and moderate malnutrition as between 11.5 and 12.5 cm.[19]

Statistical Analysis

For data analysis, the SPSS 15.0 for Windows application was utilized. For categorical variables, descriptive statistics are presented as numbers and percentages, and for numerical variables, as mean, SD, minimum and maximum. Using chi-square analysis, the percentage of categorical variables was compared between the groups. When the conditions were not met, the Monte Carlo Simulation was used. The Mann-Whitney U test and the Kruskal-Wallis test were utilized to compare two independent groups because the numerical variables were not regularly distributed. Values of $p<0.05$ were used as the analytical alpha level of significance.

The present study was approved by the Ethics Committee of University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital (approval number: 511, date: 26.05.2015).

The parents of the children who participated in this study provided written informed permission.

RESULTS

Of the 400 patients, 169 (42.3%) were girls and 231 (57.8%) were boys. Their mean age was 59.2±61.9 months. According to anthropometric measurements made at hospitalization, their bodyweight z-score was between -9 and 10.8 with a mean z-score of -0.39, and their height z-score was between -76 and 29.2 with a mean z-score of -0.39.

Hundred and fifty patients (37.6%) were found to be malnourished at the time of hospitalization when the patients were examined using the Gomez classification. Of all of the patients, 94 (23.5%) were mildly malnourished, 43 (10.8%) were moderately malnourished, and 13 (3.3%) were severely malnourished. The 10-18-year-old age category had the highest malnutrition rate (50%) when assessed by age categories. Gomez's classification found that the 10-18-year-old age category had the highest prevalence of moderate and severe malnutrition ($p<0.05$).

The Waterlow classification determined that 123 patients (30.8%) were malnourished when they were admitted. Of all the patients, 84 were mildly malnourished, 23 were moderately malnourished, and 16 were severely malnourished. Acute malnutrition was detected in 80 (20%) patients, acute malnutrition in 43 (10.8%) patients with a chronic background, and chronic malnutrition in 87 (21.8%) patients. The age groups with the highest malnutrition at admission were 6-10 years (34%) and 10-18 years (37.2%) (Table 1).

For patients under the age of five years, the WHO growth norms were used to produce z-scores (weight for age, height for age, and weight for height). Thirty-two patients (12.7%) were underweight, and 20 patients (8%) were severely underweight, as determined by the WHO's z-score criteria. Twenty-eight (11.1% of the patients) were categorized as wasted and 37 (14.7%) as stunted using the WHO's z-score criteria (Table 2).

When the patients' levels of chronic malnutrition were assessed at the time of hospitalization, mild malnutrition was found in 98 patients (24.5%), moderate in 16 (4%), and severe in 16 (4%). In the 0-2-year age category, the prevalence of chronic malnutrition was highest (39.3%; $p=0.421$) (Table 3).

According to the Waterlow classification, 126 (31.5%) of the patients were malnourished at their time of discharge. Of all the patients, 82 were mildly malnourished, 29 moderately malnourished, and 15 severely malnourished. Acute malnutrition was found in 79 (19.8%) patients, acute malnutrition on a chronic basis in 47 (11.8%), and chronic malnutrition in 82 (20.5%). The age range of 10 to 18 years (41%) had the highest level of malnutrition at the time of discharge (Table 4).

The length of hospital stay in all patients ranged from 1 to 141 days, with a mean hospital stay of 8.3±10.5 days. When evaluated according to the Gomez classification system, the duration of hospitalization was 6.35±4.98 days in those patients without malnutrition, 9.44±16.47 days in those with mild malnutrition, and 10.85±12.00 days in patients with moderate malnutrition. It was 15.80±15.45 days in patients with severe malnutrition. There was a statistically significant relationship between the degree of malnutrition and the length of hospital stay. Patients with

Table 1. Frequency of acute malnutrition detected during hospitalization and its distribution by age groups

Age (years) (n)	Severe, n (%)	Moderate, n (%)	Mild, n (%)	Total, n (%)
0-2 (n=191)	8 (4.2)	9 (4.7)	34 (17.8)	51 (26.7)
2-6 (n=78)	1 (1.3)	6 (7.7)	18 (23.1)	25 (32.1)
6-10 (n=53)	3 (5.7)	2 (3.8)	13 (24.5)	18 (34)
10-18 (n=78)	4 (5.1)	6 (7.7)	19 (24.4)	29 (37.2)
Total (n=400)	16 (4.0)	23 (5.8)	84 (21)	123 (30.8)

Table 2. Distribution of malnutrition according to the WHO standard definitions of underweight, wasted, and stunted for children by age

	Weight-for-age z-score			Height-for-age z-score			Weight-for-height z-score		
	<-2 and ≥-3, n (%)	<-3, n (%)	Total, n (%)	<-2 and ≥-3, n (%)	<-3	Total, n (%)	<-2 and ≥-3, n (%)	<-3, n (%)	Total, n (%)
0-2 years (n=191)	5 (2.6)	15 (7.8)	20 (10.4)	15 (7.8)	16 (8.4)	31 (16.2)	8 (4.2)	10 (5.2)	18 (9.4)
2-5 years (n=60)	7 (11.7)	5 (8.3)	12 (20)	3 (5)	3 (5)	6 (10)	6 (10)	4 (6.6)	10 (16.6)
(n=251)	12 (4.7)	20 (8)	32 (12.7)	18 (7.1)	19 (7.6)	37 (14.7)	14 (5.55)	14 (5.55)	28 (11.1)

WHO: World Health Organization.

Table 3. Frequency of chronic malnutrition detected during hospitalization and its distribution by age groups

Age (years) (n)	Severe, n (%)	Moderate, n (%)	Mild, n (%)	Total, n (%)
0-2 (n=191)	8 (4.2)	9 (4.7)	58 (30.4)	75 (39.3)
2-6 (n=78)	2 (2.6)	2 (2.6)	17 (21.8)	21 (27)
6-10 (n=53)	1 (1.9)	1 (1.9)	8 (15.1)	10 (18.9)
10-18 (n=78)	5 (6.4)	4 (5.1)	15 (19.2)	24 (30.7)
Total (n=400)	16 (4.0)	16 (4)	98 (24.5)	130 (32.5)

severe malnutrition had the longest lengths of hospital stay (p<0.05) (Table 5).

When the length of hospital stay was analyzed according to the Waterlow classification, it was 7.28±6.37 days in those patients without malnutrition and 9.49±16.98 days in those with chronic malnutrition and 11.44±12.98 days in patients with chronically acute malnutrition. When compared according to this classification, hospital stay was longer in those patients with acute malnutrition in a chronic background, but this difference was not statistically significant (p>0.05) (Table 5).

The mean MUAC was 16.20±4.38 cm in all patients. The mean MUAC was 5.66±2.28 cm (median: 5 cm) in those patients with malnutrition and 5.70±2.93 cm (median: 5 cm) in those without malnutrition (p=0.342). According to the MUAC values, 23% of the malnourished patients did not meet the criteria for malnutrition according to the Gomez classification, and 12% did not meet the malnutrition criteria using the Waterlow classification (Table 5).

The mean TST was 8.14±3.97 mm in all patients, 15.87±3.50 mm (median: 5 mm) in those patients with malnutrition, and 16.46±4.94 mm (median: 5 mm) in those without malnutrition (p=0.827) (Table 6). According to the TST data, 20% of the malnourished patients did not meet the criteria for the Gomez classification of malnutrition and 25% did not meet the criteria for the Waterlow classification of malnutrition.

The mean SST was 5.68±2.67 mm in all patients, 8.08±3.11 mm (median: 8 mm) in those patients with malnutrition, and 8.18±4.52 mm (median: 7 mm) in those without malnutrition (p=0.072) (Table 6). According to the SST data, 24% of the patients with malnutrition did not have malnutrition according to the Gomez classification, and 29% did not have malnutrition according to the Waterlow classification.

Table 4. Frequency of acute malnutrition detected at discharge from the hospital and its distribution by age groups

Age (year) (n)	Severe, n (%)	Moderate, n (%)	Mild, n (%)	Total, n (%)
0-2 (n=191)	7 (3.6)	8 (4.1)	34 (17.8)	49 (25.5)
2-6 (n=78)	2 (2.5)	9 (11.5)	19 (24)	30 (38)
6-10 (n=53)	2 (3.7)	3 (5.5)	10 (19)	15 (28.2)
10-18 (n=78)	4 (5)	9 (12)	19 (24)	32 (41)
Total (n=400)	15 (3.8)	29 (7.2)	82 (20.5)	126 (31.5)

Table 5. Length of hospital stay by the severity of malnutrition

	Length of hospital stay (days)		
Gomez	**Mean ± SD**	**Min.-max.**	**p**
Normal	6.35±4.98	1-41	0.012
Mild	9.44±16.47	1-141	
Moderate	10.85±12.00	1-63	
Severe	15.80±15.45	2-51	
	Length of hospital stay (days)		
Waterlow	**Mean ± SD**	**Min.-max.**	**p**
Normal	7.28±6.37	1-41	0.241
Acute	7.54±6.81	1-36	
Chronic	9.49±16.98	1-141	
Chronic-acute	11.44±12.98	1-63	

SD: Standard deviation, Min.: Minimum, max.: Maximum.

Table 6. Malnutrition frequency according to mid-upper arm circumference, triceps, and subscapular skinfold thickness data

	Triceps skinfold thickness				Subscapular skinfold thickness			
	Moderate malnutrition		Severe malnutrition		Moderate malnutrition		Severe malnutrition	
	n	%	n	%	n	%	n	%
1.5-2 years (n=34)	7	20.59	4	11.76	8	23.53	3	8.82
2-6 years (n=78)	7	9.21	6	7.89	13	16.88	1	1.30
6-10 years (n=53)	7	13.21	1	1.89	5	9.43	0	0.00
10-18 years (n=78)	4	5.13	4	5.13	1	1.28	10	12.82
	Mid-upper arm circumference				Mid-upper arm circumference			
	Severe malnutrition				Moderate malnutrition			
	n		%		n		%	
0-2 years (n=191)	56		29.47		47		24.74	
2-5 years (n=60)	5		8.20		5		8.20	

DISCUSSION

Despite the development of new methods for the evaluation of nutrition and treatment methods in the last 30 years, malnutrition has remained an important health problem. Malnutrition which already exists in a child when hospitalized can get worse by not monitoring their nutritional status.[7,8,20] The purpose of the current study was to evaluate the situation at our hospital in order to draw attention to this crucial issue.

In our study, according to the Waterlow classification, the acute malnutrition rate at the time of hospitalization was 30.8%, with 20% acute malnutrition, 10.8% acute on chronic malnutrition, and 21.8% chronic malnutrition.

The rates for the same patient groups at discharge were 19.8% for acute malnutrition, 11.8% for acute on chronic malnutrition, and 20.5% for chronic malnutrition. The malnutrition rate for these patients at the time of discharge was 31.5%.

In comparison to demographic surveys carried out with children in our nation, the prevalence of malnutrition was higher in our study.[3,4] This was owing to the fact that the majority of the patients in our study were young children from low-income, crowded homes who were admitted to hospitals due to chronic illnesses or infectious disorders which served as a precursor to the development of malnutrition. Given that the study's host hospital was a tertiary care facility, it was only normal for the nutritional status of the patient profile to suffer as a result of the admission of patients who were generally more severe and complex.

In research carried out in developed countries, the frequency of malnutrition was 13.3% in Canada, 19% in the Netherlands, and 5-27% in Australia.[5,6,9] In studies conducted in countries with low socioeconomic status, the frequency of hospital malnutrition was 39% in Thailand, and 35.2% in Brazil, which are higher than out rates.[7,10]

In the studies on malnutrition in hospitals conducted in our country, Genel et al.[21] found the acute malnutrition rate to be 21.3%, the chronic malnutrition rate to be 24.2%, and the acute on chronic malnutrition rate to be 11.9%. In 511 pediatric patients between the ages of 1 month and 18 years, according to the Waterlow classification, Kapçı et al.[11] found that 23.9% had acute malnutrition, 21.5% had chronic malnutrition, and 7.3% had acute on chronic malnutrition. Güleç et al.[22] found that the acute malnutrition rate was 20.4%, the chronic malnutrition rate was 19.2%, and the acute on chronic malnutrition rate was 7.7% in children aged 1-36 months in our hospital in 2011. With similar results to the literature, we can conclude that malnutrition has not been adequately detected and it is still not sufficiently prevented. According to Topal and Tolunay[23], the rate of acute malnutrition was 35.3%, chronic malnutrition was 14.6%, and acute malnutrition combined with chronic malnutrition was 9.8%. In a multicenter study conducted in 2015 in 37 hospitals, including our hospital, in 26 cities where children from 1 month to 18 years participated, the acute malnutrition rate was found to be 11.2% and the chronic malnutrition rate was found to be 16.6%.[24]

The cause for these disparate outcomes might be attributed to the various patient profiles which hospitals accept for admission, variations in the study methodology, and socioeconomic disparities among countries and regions.

In accordance with the Gomez classification system, severe malnutrition was found in 3.3% of the patients in our study, moderate malnutrition was found in 10.8%, and mild malnutrition was found in 25.3% of the patients. In research conducted in Adana by Topal and Tolunay[23], the prevalence of severe malnutrition was 5.4%, moderate malnutrition was 11.2%, and mild malnutrition was 20.2%. As according to Güleç et al.[22] examination of 260 patients in İstanbul using the Gomez classification, the prevalence of mild malnutrition were 32%, moderate malnutrition was 9.2%, and severe malnutrition was 6.1%. Our rates of severe and mild malnutrition were lower than those found in other studies.

According to previous studies, one key risk factor for malnutrition is an underlying chronic condition. According to Beşer et al.[24], underlying disease incidence was 47.5%. Another study conducted in Thailand[7] discovered that 64% of people had an underlying chronic illness. Fifty-three (43%) out of 123 patients in our study who had acute malnutrition at hospitalization and 34 (39%) out of 87 patients who had chronic malnutrition had an underlying chronic illness. Our findings also indicate that a major risk factor for malnutrition is an underlying chronic illness.

Mild malnutrition developed in 6.1% and moderate malnutrition in 0.7% of the patients who were admitted to the hospital without malnutrition. Moderate malnutrition developed in 5.9% of patients with mild malnutrition and severe malnutrition developed in 8.6% of patients with moderate malnutrition when they were hospitalized. Also, at discharge, the mild malnutrition rate decreased from 21% to 20.5%, the moderate malnutrition rate increased from 5.8% to 7.2%, and the severe malnutrition rate decreased from 4% to 3.8%.

Although it was observed that 107 (86.9%) of 123 patients who were found to have acute or acute on chronic malnutrition during hospitalization continued to have malnutrition at discharge, the malnutrition of 16 (13%) patients improved. Of the patients who did not have acute malnutrition at the time of hospitalization, 4.7% had developed malnutrition by their discharge time.

When we examined the few studies showing the effects of hospitalization on nutritional status, it was seen that malnutrition developed in 24% out of 148 patients who did not have any previous malnutrition in a study in Thailand, and it was shown in another study in England that 23% of the patients underwent nutritional deterioration.[7,20] Ibraheam Kazem et al.[25] found that moderate malnutrition developed in 21% of patients with mild malnutrition during hospitalization, and mild malnutrition developed in 7.2% of patients without malnutrition at admission. It was found that mild malnutrition increased from 12.9% to 15%, moderate malnutrition increased from 14% to 15.6%, and severe malnutrition increased from 6.8% to 7.8% at the time of discharge from the hospital.

The reason why hospitalization posed less risk of malnutrition in our study compared with these other studies might be that there were more patients with moderate and severe malnutrition in other studies compared with our study.

In a study conducted in Türkiye in 2015 comprising 37 centers and 1,513 patients, the prevalence of malnutrition and the length of hospital stays were assessed. It was discovered that patients with malnutrition had longer hospital stays.[24] Similarly, according to Topal and Tolunay[23], those patients with malnutrition spent a longer time in hospital.

The mean LOS was found to be 8.3 days in the present study. When the relationship between LOS and nutritional status was evaluated, the mean LOS was 6.35 days in those patients without malnutrition according to the Gomez classification system, 9.44 days in those with mild malnutrition and 10.85 days in patients with moderate malnutrition, and 15.80 days in patients who had severe malnutrition. This demonstrates that patients with malnutrition spent more time in the hospital than those without malnutrition, and that the length of hospitalization increased as malnutrition severity progressed ($p<0.05$). When the patients were categorized using the Waterlow classification, those who had chronic acute malnutrition stayed in the hospital the longest (11.44 days). Our findings support those in the literature, which revealed that malnutrition lengthened hospital stay.

The present study shows that when treating the primary illness, the assessment of nutritional status is insufficient and hospital-related malnutrition is frequently disregarded. It has been found that a lack of nutritious food can cause problems with growth, development, and health recovery, as well as the effectiveness of medications. This can lead to prolonged hospitalizations and increased mortality and morbidity rates.[23]

As a result, different anthropometric tools for evaluating malnutrition have been suggested. MUAC was recommended because it is an easy, practical, low cost, rapid nutritional assessment method which may be used in patients whose age, height, or weight are not known, and so it can reduce the burden on healthcare workers in emergency situations.[16,26,27]

MUAC is related to arm muscle mass and subcutaneous fat. In undernourished children exhibiting clinical indications of edema, muscle wasting may not be accurately reflected by weight-based indices, potentially producing false-positive or false-negative findings and MUAC more accurately reflects in young children because infants and young children have smaller muscles than adults and MUAC changes little in the first years of life.[26,28] In our study, the frequency of malnutrition under the age of two was 54.2% according to MUAC measurements, and 10.4% of the patients were underweight, and 9.4% were wasted according to the WHO z-score criteria.

According to the MUAC values for those under 5 years, 12% of the malnourished patients did not meet the criteria for malnutrition using the Waterlow classification. The current study showed that MUAC reflects malnutrition in young children better than the other classifications as has been previously reported in the literature.[29,30]

Skinfold thickness measurements are widely used to assess body fat because the measurements are non-invasive, simple and they are sensitive to changes in nutritional status. The two most frequently taken skinfold measurements are at the triceps and subscapular sites.[31] In children, skinfold thickness may be a helpful screening variable. Nevertheless, its precision may be questionable in those children who have severe muscle wasting.[32] In our study, according to the results of TST and SST measurements, malnutrition was detected most frequently at the age of 1.5-2 years, with a total rate of 32.3%. Although TST and SST are good methods to assess body fat as opposed to other anthropometric measurements, they are not adequate indicators of undernutrition.[11]

CONCLUSION

In summary, in this study, the frequency of malnutrition was determined in children according to age groups both at the time of admission to the hospital and at the time of discharge. The frequency of malnutrition is increasing gradually due to insufficient recognition of malnutrition and inadequate treatment during hospitalization. Patients who are malnourished have difficulties receiving treatment, stay longer in hospital and their length of stay increases as their level of malnutrition increases. The development of malnutrition throughout hospitalization in children who do not have malnutrition at the time of hospitalization shows the importance of the assessment of nutritional status. The nutritional status of patients should be assessed with more detailed analyses because checking only the percentiles of a patient's height and weight is not a determining criterion in malnutrition. Another significant issue which attracted attention during this investigation was the lack of a simple and highly accurate calculation method which could be used in all age groups.

MAIN POINTS

- The assessment of nutritional status is important.
- Hospital-related malnutrition is commonly ignored when treating the primary illness because nutritional status screening is insufficient.
- Malnutrition lengthens the hospital stay and increases mortality and morbidity.
- As evaluating merely a patient's height and weight percentiles is not a defining factor in malnutrition, the nutritional condition of patients should be evaluated with more in-depth investigations.
- The problem is the absence of an easy-to-use, almost ideal calculation method which can be used on all age groups.

ETHICS

Ethics Committee Approval: The present study was approved by the Ethics Committee of University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital (approval number: 511, date: 26.05.2015).

Informed Consent: The parents of the children who participated in this study provided written informed permission.

Authorship Contributions

Surgical and Medical Practices: R.K., N.U., Concept: R.K., N.U., A.M.U., Design: R.K., N.U., A.M.U., Supervision: R.K., N.U., A.M.U., Data Collection and/or Processing: R.K., N.U., A.M.U., Analysis and/or Interpretation: R.K., N.U., Literature Search: R.K., N.U., A.M.U., Writing: R.K., N.U., Critical Reviews: R.K., N.U., A.M.U.

DISCLOSURES

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REFERENCES

1. Katoch OR. Determinants of malnutrition among children: A systematic review. Nutrition. 2022; 96: 111565.
2. World Health Organization (WHO). Child Mortality (Under 5 years); WHO: Geneva, Switzerland. Avilable online: https://www.who.int/news-room/fact-sheets/detail/levels-and-trends-in-child-under-5-mortality-in-2020
3. Sayılarla Dünya Çocuklarının Durumu, UNICEF, 2014 www.unicef.org/sowc
4. Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü. 2018 Türkiye Nüfus ve Sağlık Araştırması Hacettepe Üniversitesi Nüfus Etütleri Enstitüsü, T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, TÜBİTAK, Ankara: 2019.
5. Joosten KF, Zwart H, Hop WC, Hulst JM. National malnutrition screening days in hospitalised children in The Netherlands. Arch Dis Child. 2010; 95(2): 141-5.
6. Groleau V, Thibault M, Doyon M, Brochu EE, Roy CC, Babakissa C. Malnutrition in hospitalized children: prevalence, impact, and management. Can J Diet Pract Res. 2014; 75(1): 29-34.
7. Saengnipanthkul S, Chongviriyaphan N, Densupsoontorn N, Apiraksakorn A, Chaiyarit J, Kunnangja S, et al. Hospital-acquired malnutrition in paediatric patients: a multicentre trial focusing on prevalence, risk factors, and impact on clinical outcomes. Eur J Pediatr. 2021; 180(6): 1761-7.
8. Ferreira HS, França AO. Evolution of nutritional status in hospitalized children. J Pediatr (Rio J). 2002; 78(6): 491-6.
9. O'Connor J, Youde LS, Allen JR, Baur LA. Obesity and under-nutrition in a tertiary paediatric hospital. J Paediatr Child Health. 2004; 40(5-6): 299-304.
10. Pileggi VN, Monteiro JP, Margutti AV, Camelo JS Jr. Prevalence of child malnutrition at a university hospital using the World Health Organization criteria and bioelectrical impedance data. Braz J Med Biol Res. 2016; 49(3): e5012.
11. Kapçı N, Akçam M, Koca T, Dereci S, Kapcı M. The nutritional status of hospitalized children: Has this subject been overlooked? Turk J Gastroenterol. 2020; 26(4): 351-5.
12. Gomez F, Galvan RR, Cravioto J, Frenk S. Malnutrition in infancy and childhood, with special reference to kwashiorkor. Adv Pediatr. 1955; 7: 131-69.
13. Waterlow JC, Buzina R, Keller W, Lane JM, Nichaman MZ, Tanner JM. The presentation and use of height and weight data for comparing the nutritional status of groups of children under the age of 10 years. Bull World Health Organ. 1977; 55(4): 489-98.
14. World Health Organization. The use and interpretation of anthropometry: report of a WHO Expert Committee. WHO; Geneva, 1995.
15. Figueroa Pedraza D, Menezes TN. Characterization of anthropometric assessment studies of Brazilian children attending daycare centers. Rev Paul Pediatr. 2016; 34(2): 216-24.
16. Ata A, Taskın DG. The role of upper middle arm circumference in the detection of malnutrition in diabetic children. Zeynep Kamil Med J. 2023; 54(2): 102-5.
17. World Health Organization. WHO child growth standards: length/ height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva, Switzerland: World Health Organization; 2006. Link: https://www.who.int/publications/i/item/924154693X
18. Addo OY, Himes JH. Reference curves for triceps and subscapular skinfold thicknesses in US children and adolescents. Am J Clin Nutr. 2010; 91(3): 635-42.
19. Fiorentino M, Sophonneary P, Laillou A, Whitney S, de Groot R, Perignon M, et al. Current MUAC Cut-Offs to Screen for Acute Malnutrition Need to Be Adapted to Sex and Age: The Example of Cambodia. PloS One. 2016; 11(2): e0146442.
20. Pichler J, Hill SM, Shaw V, Lucas A. Prevalence of undernutrition during hospitalisation in a children's hospital: what happens during admission? Eur J Clin Nutr. 2014; 68(6): 730-35.
21. Genel F, Atlıhan F, Bak M, Targan Ş, Paytoncu Ş, Fidan F, et al. Prevalence of Anemia and Malnutrition in Hospitalized Patients. Turkiye Klinikleri J Pediatr. 1997; 6(4): 173-7
22. Güleç SG, Urgancı N, Polat S, Yağar G, Hatipoğlu N. Evaluation of malnutrition in hospitalized children under three years old. Med Bull Sisli Etfal Hosp. 2011; 45(4): 124-9
23. Topal A, Tolunay O. Effect of malnutrition on length of hospital stay in children. Turk Arch Pediatr. 2021; 56(1): 37-43.
24. Beser OF, Cokugras FC, Erkan T, Kutlu T, Yagci RV; TUHAMAR Study Group. Evaluation of malnutrition development risk in hospitalized children. Nutrition. 2018; 48: 40-7.
25. Ibraheam Kazem A, Kadhum Hassan A, Mea A. Effect of hospitalizationon the nutritional status of under five children. The Medical Journal of Basrah University. 2011; 29(1): 51-6.
26. Briend A, Mwangome MK, Berkley JA. Using Mid-Upper Arm Circumference to Detect High-Risk Malnourished Patients in Need of Treatment. In: Preedy V, Patel V. Editors. Handbook of Famine, Starvation, and Nutrient Deprivation. Springer: Cham; 2019.p.705-21.
27. Dalglish SL, Seni Badou M, Sirat A, Abdullahi O, Adalbert MFE, et al. Combined protocol for severe and moderate acute malnutrition in emergencies: Stakeholders perspectives in four countries. Matern Child Nutr. 2020; 16(2): e12920.
28. Marshall SK, Monárrez-Espino J, Eriksson A. Performance of mid-upper arm circumference to diagnose acute malnutrition in a cross-sectional community-based sample of children aged 6-24 months in Niger. Nutr Res Pract. 2019; 13(3): 247-55.
29. Grellety E, Golden MH. Weight for height and mid upper arm circumference should be used independently to diagnose acute malnutrition: Policy implications. BMC Nutr 2016; 2: 10
30. Tadesse AW, Tadesse E, Berhane Y, Ekström EC. Comparison of Mid-Upper Arm Circumference and Weight-for-Height to Diagnose Severe Acute Malnutrition: A Study in Southern Ethiopia. Nutrients. 2017; 9(3): 267.
31. Soylu M, Şensoy N, Doğan İ, Doğan N, Mazıcıoğlu MM, Öztürk A. Four-site skinfolds thickness percentiles of schoolchildren and adolescents in Turkey. Public Health Nutr. 2021; 24(16): 5414-25.
32. Mehta NM, Corkins MR, Lyman B, Malone A, Goday PS, Carney LN, et al. Defining pediatric malnutrition: a paradigm shift toward etiology-related definitions. JPEN J Parenter Enteral Nutr. 2013; 37(4): 460-81.