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Anthropometric Characteristics of Turkish Cypriots and the Association Between Obesity and Comorbidities: A Cross-Sectional Study

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Abstract

BACKGROUND/AIMS: Obesity has become a serious public health problem in several countries, including North Cyprus. The aim of this study was to determine the anthropometric measurements of Turkish Cypriots and evaluate the association between obesity and comorbidities.

MATERIALS AND METHODS: Blood pressure, weight, height, and waist circumference (WC) measurements were obtained by the same physician during home visits to the participants. Socio-demographic characteristics, smoking and alcohol consumption habits, physical activity levels, dietary patterns, and previously diagnosed conditions, including type 2 diabetes, dyslipidemia, coronary heart disease (CHD), and hypertension (HT), were assessed.

RESULTS: The mean body mass index (BMI) was 26.69±5.65 kg/m² in females and 28.32±4.71 kg/m² in males. Among participants aged 18-39, the mean BMI was 25.05±6.19 kg/m² in females and 27.63±4.62 kg/m² in males. The overall prevalence of obesity was 27.4%, with rates of 24.9% among females and 30.1% among males. The prevalence of excess weight was 64.3% overall, occurring in 55.3% of females and 74.4% of males. Abdominal obesity was present in 47.4% of participants, affecting 45.5% of females and 49.5% of males. An increase in both the prevalence and the number of cases of HT, dyslipidemia, CHD, and type 2 diabetes mellitus was observed in parallel with increases in BMI and WC.

CONCLUSION: The prevalence of both general and abdominal obesity is high in North Cyprus. As BMI and WC increased, both the prevalence of comorbidities and their number increased.

Keywords: Body mass index, waist circumference, obesity, comorbidities

INTRODUCTION

Obesity is a chronic disease characterized by excessive accumulation of adipose tissue, which can reduce quality of life and is associated with comorbidities such as type 2 diabetes mellitus (T2DM), dyslipidemia, cardiovascular disease (CVD), hypertension (HT), and several types of cancer.[1,2] The prevalence of excess weight varies significantly across countries due to differences in lifestyle and dietary patterns. Factors such as the type and amount of food consumed, beverage consumption, sleep habits, alcohol consumption, medication use, level of physical activity, living conditions, and genetic predisposition are associated with excess weight. According to the World Health Organisation (WHO), adults are classified as overweight when body mass index (BMI) is 25.0-29.9 kg/m², and as obese when BMI is equal to or greater than 30.0 kg/m².[3]

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The prevalence of obesity and obesity-related diseases is increasing worldwide.[4] According to the WHO, one-third of children in Europe are obese or overweight. In the European region, the prevalence of obesity was 23% and that of excess weight was 59%.[5] Projections indicate that by 2030, the prevalence of adult obesity in the United States will reach 48.9%, while severe obesity is expected to rise to 24.2%.[6] Worldwide, adolescent obesity has quadrupled since 1990. Being overweight in childhood and adolescence is associated with an increased risk and earlier onset of some chronic diseases, such as T2DM, dyslipidemia, and HT.[2]

The risk of cardiometabolic multimorbidity increases progressively with rising BMI, ranging from ranging from approximately a twofold increase among participants who are overweight to over tenfold risk among those with severe obesity, compared to participants with a healthy BMI.[7] Participants who developed obesity before the age of 50 had a higher risk of complex multimorbidity compared with those who became obese at older ages.[4] Maintaining a stable, healthy weight and achieving weight loss in early adulthood and midlife are important for preserving quality of life during the aging process. Compared with participants who maintained a healthy weight, those with persistent obesity exhibited the highest risk of developing obesity-related diseases later in life.[8] This study aimed to assess the anthropometric measurements of Turkish Cypriots and to examine the associations between obesity and HT, T2DM, dyslipidemia, and coronary heart disease (CHD).

MATERIALS AND METHODS

Participants and Study Design

This cross-sectional study was conducted between January 21, 2025, and March 25, 2025. Ethical approval for this research was obtained from the Cyprus Science University Ethics Committee (approval number: 2025/01.012, date: 21.01.2025). Participants in this study were Turkish Cypriots residing in North Cyprus, aged 18-83 years. Participants were randomly selected from six towns (n=339) and 27 villages (n=311), taking into account the towns' population distribution. All participants were verbally informed by the physician about the aims and procedures of the study, and verbal informed consent was obtained. Participants who were pregnant or lactating, or who had a malignancy, severe cardiac failure, severe hepatic failure, or severe renal insufficiency, were excluded from the study during data collection. Participants were asked ten survey questions regarding their age, gender, dietary habits, alcohol consumption and its frequency, smoking status, engagement in physical exercise and its frequency, as well as whether they had been diagnosed with T2DM, HT, dyslipidemia, or CHD.

Antropometric Measurements

The waist circumference (WC) was measured using a non-elastic measuring tape at the midpoint between the last palpable rib and the iliac crest. The participants' height was measured without shoes using a stadiometer, and their weight was measured without shoes while wearing light clothing using a calibrated Omron BF511 weighing scale. Participants' weight, WC, and height were measured by the physician, and BMI was subsequently calculated based on these measurements.

Blood Pressure Measurement

After at least five minutes of seated rest, each participant's blood pressure (BP) was measured twice by a physician using a calibrated automated Omron sphygmomanometer, and the mean of the two readings was used as the recorded BP value.

Definitions

All participants were classified according to WC and BMI. Based on WC, optimal WC was defined as <80 cm for females and <94 cm for males; suboptimal WC was defined as 80-87 cm for females and 94-101 cm for males; abdominal (central) obesity was defined as WC ≥88 cm for females and ≥102 cm for males. BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Adults were classified as underweight if their BMI was under 18.5 kg/m^2, healthy (normal) weight if their BMI ranged from 18.5 to 24.99 kg/m^2, overweight (but not obese) if their BMI ranged from 25.0 to 29.99 kg/m^2 and obese if their BMI was equal to or greater than 30.0 kg/m^2. Excess weight was defined as a BMI equal to or greater than 25.0 kg/m^2.[3] HT was defined as a systolic BP (SBP) equal to or exceeding 140 mmHg, a diastolic BP (DBP) equal to or exceeding 90 mmHg, or the presence of both.[9]

Statistical Analysis

Categorical data were summarized as frequencies (n) and percentages (%), while continuous variables were expressed as mean ± standard deviation, along with minimum and maximum values. The normality of data distribution was assessed using the Kolmogorov-Smirnov test. For normally distributed data, the Independent Samples t-test was used to compare two groups, whereas one-way analysis of variance was applied for comparisons involving more than two groups. When significant differences were detected, post-hoc Tukey's tests were performed to identify the source of the differences. Statistical significance was set at $p<0.05$. All statistical analyses were conducted using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Within the study population, 53.1% (n=345) of participants were female and 46.9% (n=305) were male. In terms of age distribution, 34.6% (n=225) were aged 18-39 years, 36.5% (n=237) were aged 40-59 years, and 28.9% (n=188) were aged 60-83 years. Among female participants, 33.6% were aged 18-39, 35.4% were aged 40-59, and 31.0% were aged 60-83, whereas among male participants, 35.7% were aged 18-39, 37.7% were aged 40-59, and 26.6% were aged 60-83. The mean age of all participants was 48.14±16.13 years, with mean ages of 47.95±16.44 years for males and 48.31±15.87 years for females. The association between age group and gender was not statistically significant ($p>0.05$; Table 1).

65.7% of the participants had a diet primarily based on animal products. This rate was 59.7% among females and 72.5% among males. Consumption of animal-based diets was significantly more prevalent among males than among females ($p<0.05$). 69.8% of the participants were non-smokers. 35.7% of male participants and 25.2% of female participants were smokers. When stratified by gender, the prevalence of non-smokers was significantly higher than that of current smokers ($p=0.002$). 49.4% of the participants did not consume alcohol. 65.8% of females and 30.8% of males did not consume alcohol. 6.1% of females and 21.3% of males consumed at least two shots (70 mL) of alcohol on at least two days per week. The frequency of alcohol consumption among females decreased gradually, and females consumed statistically significantly less alcohol than males ($p<0.05$). 71.7% of participants, 72.4% of males, and 71.0% of females reported no physical exercise. 29.0% of females and 27.6% of males were engaged in physical activity. There was a statistically significant relationship between physical activity level and gender ($p<0.05$) (Table 2).

A healthy weight was observed in 35.7% of the participants, while 36.9% were classified as overweight and 27.4% as obese. With increasing age, the prevalence of healthy weight decreased, whereas the prevalence of overweight and obesity increased significantly ($p<0.05$). Specifically, the prevalence of overweight was 31.6% amoung participants aged 18-39 years, 36.7% among those aged 40-59 years, and 41.5% among those aged 60-83 years. Obesity prevalence was 22.2%, 24.9%, and 36.7% in the respective age groups.

Overall, 64.3% of participants were classified as having excess weight. Among females, the prevalences of obesity, overweight, and excess weight were 24.9%, 30.4%, and 55.3%, respectively. Among males, the corresponding prevalences were 30.1% for obesity, 44.3% for overweight, and 74.4% for excess weight. Male participants had a significantly higher BMI than female participants ($p<0.05$).

The overall prevalence of abdominal obesity was 47.4%. Age-specific prevalence rates were 29.3% in the 18-39 age group, 48.1% in the 40-59 age group, and 68.1% in the 60-83 age group. A significant inverse association was observed between age and optimal WC, and abdominal obesity increased significantly with advancing age ($p<0.05$). In contrast, no statistically significant association was found between WC and gender ($p>0.05$). The prevalence of abdominal obesity was 49.5% among males and 45.5% among females (Table 3).

The mean height of female participants was 159.80±6.45 cm. When participants were stratified by age group, mean heights were 162.04±6.11 cm (18-39 years), 161.30±5.86 cm (40-59 years), and 155.66±5.50 cm (60-83 years). The mean height of male participants was 174.35±7.79 cm. Corresponding mean heights were 176.65±6.94 cm in the 18-39 age group, 174.59±7.50 cm in the 40-59 age group, and 170.93±8.13 cm in the 60-79 age group. A statistically significant difference in height was observed between genders: males were taller than females ($p<0.05$). The difference between age groups was statistically significant ($p<0.05$). Post-hoc analyses indicated significant differences in height between the 18-39 and 40-59 age groups, as well as between the 40-59 and 60-83 age groups. Height decreased progressively with age ($p<0.05$ for all comparisons). The mean body weight of female participants was 68.05±14.71 kg, whereas that of male participants was 85.91±15.45 kg. Male participants had significantly higher values than female participants ($p<0.05$). Mean BMI and WC increased with age in both female and male participants. The overall mean BMI among female participants was 26.69±5.65 kg/m². When stratified by age group, mean BMI values were 25.05±6.19 kg/m² for those aged 18-39

Table 1. Demographic characteristics of participants

Age groups	Female (n=345, 53.1%)		Male (n=305, 46.9%)		Total		Statistics
	n	%	n	%	n	%	χ^2; p
18-39	116	33.6	109	35.7	225	34.6	1.565; 0.457[1]
40-59	122	35.4	115	37.7	237	36.5	
60-83	107	31.0	81	26.6	188	28.9	
Total	345	110.0	305	100.0	650	100.0	
	Mean ± SD	**Min-max**	**Mean ± SD**	**Min-max**	**Mean ± SD**	**Min-max**	
Age	48.31±15.87	18-82	47.95±16.44	18-83	48.14±16.13	18-83	

[1]Pearson's chi-square test (χ^2).
SD: Standard deviation, Min-max: Minumum-maximum.

Table 2. Lifestyle of participants

		Female (n=345, 53.1%)	Male (n=305, 46.9%)	Total	Statistics
		n (%)	n (%)	n (%)	χ^2; p
Food consumption	**Plant-based diet**	139 (40.3)	84 (27.5)	223 (34.3)	**0.000**[2]*
	Animal-based diet	206 (59.7)	221 (72.5)	427 (65.7)	
Smoking habits	**Current smoker**	87 (25.2)	109 (35.7)	196 (30.2)	**0.002**[2]*
	Non-smoker	258 (74.8)	196 (64.3)	454 (69.8)	
Alcohol consumption	**Never**	227 (65.8)	94 (30.8)	321 (49.4)	85.360; **0.000**[1]*
	Once a week or less	97 (28.1)	146 (47.9)	243 (37.4)	
	More than 2 shots (70 mL) at least 2 days a week	21 (6.1)	65 (21.3)	86 (13.2)	
Physical activity	**Walking, jogging, swimming or cycling for 30-45 minutes 2-3 days a week**	55 (16.0)	21 (6.9)	76 (11.7)	17.050; **0.000**[1]*
	30-45 minutes of brisk walking, running, swimming, or cycling at least 4-5 days a week	45 (13.0)	63 (20.7)	108 (16.6)	
	Not doing any physical activity	245 (71.0)	221 (72.4)	466 (71.7)	
	Total	345 (100.0)	305 (100.0)	65 (100.0)	

[1]Pearson's chi-square test (χ^2), [2]Fisher's exact test; *p<0.05.

years, 26.45±5.43 kg/m² for those aged 40-59 years, and 28.84±4.66 kg/m² for those aged 60-83 years. The overall mean BMI among male participants was 28.32±4.71 kg/m². Corresponding mean BMI values were 27.63±4.62 kg/m² in the 18-39 age group, 28.59±4.88 kg/m² in the 40-59 age group, and 28.74±4.39 kg/m² in the 60-83 age group. A statistically significant difference in mean BMI was observed between genders ($p<0.05$). Mean BMI was lower in females than in males. In addition, a statistically significant difference in BMI was observed across age groups ($p<0.05$). Post-hoc analysis indicated that mean BMI differed significantly between the 18-39 and 40-59 age groups, between the 18-39 and 60-83 age groups, and between the 40-59 and 60-83 age groups ($p<0.05$ for all comparisons). The mean WC among female participants was 86.73±13.84 cm. When stratified by age group, the mean WC values were 80.05±14.62 cm for those aged 18-39 years, 86.89±11.80 cm for those aged 40-59 years, and 93.79±11.49 cm for those aged 60-83 years. The mean WC among male participants was 102.03±12.38 cm. Corresponding mean WC values were 97.55±12.49 cm in the 18-39 age group, 103.53±11.71 cm in the 40-59 age group, and 105.95±11.40 cm in the 60-83 age group. Mean WC differed significantly between sexes and across age groups ($p<0.05$), with males exhibiting higher WC than females. In addition, mean WC increased significantly with advancing age (Table 4).

HT was identified in 15.5% of participants with a healthy weight compared with 59.6% of those with obesity. Dyslipidemia was present in 11.2% of participants with a healthy weight and 41.0% of those with obesity. T2DM was observed in 5.6% of participants with a healthy weight and 20.2% of those with obesity, while CHD was identified in 3.4% of participants with a healthy weight and 7.9% of those with obesity. HT was detected in 13.0% of participants with optimal WC in 56.2% of those with abdominal obesity. Dyslipidemia was found in 8.7% of participants with optimal WC and 39.3% of those with abdominal obesity. T2DM was present in 3.8% of participants with optimal WC and 19.2% of those with abdominal obesity. CHD was observed in 1.9% of participants with optimal WC and in 6.8% of those with abdominal obesity (Table 5).

In the study, the mean BMI of participants without any of the following conditions (HT, dyslipidemia, CHD, or T2DM) was 25.63±4.57 kg/m². The mean BMI increased progressively with the number of coexisting conditions: 29.42±5.60 kg/m² in participants with one condition, 29.75±4.92 kg/m² in participants with two conditions, and 30.29±4.78 kg/m² in participants with three or more conditions. A statistically significant difference in mean BMI was observed across these groups ($p<0.05$). Post-hoc analyses showed that participants with no comorbidities differed significantly from those with one, two, or three comorbidities ($p<0.05$ for all comparisons), whereas no statistically significant differences were observed among those with one to three comorbidities. Among female participants, the mean BMI was 24.64±4.83 kg/m² in those without comorbidities, 29.07±5.90 kg/m² in those with one comorbidity, 29.15±5.10 kg/m² in those with two comorbidities, and 30.82±4.84 kg/m² in those with three comorbidities. Mean BMI increased progressively with comorbidity burden, and these differences were statistically significant ($p<0.05$). Post-hoc comparisons indicated that females without comorbidities had significantly lower

Table 3. Antropometric characherictics of the participants according to their age groups and gender

		BMI (kg/m²)			Total
		Healthy weight	Overweight	General obesity	
		n (%)	n (%)	n (%)	n (%)
Age groups	18-39	104 (46.2)	71 (31.6)	50 (22.2)	225 (100.0)
	40-59	87 (36.7)	91 (38.4)	59 (24.9)	237 (100.0)
	60-83	41 (21.8)	78 (41.5)	69 (36.7)	188 (100.0)
	Total	232 (35.7)	240 (36.9)	178 (27.4)	650 (100.0)
Statistics χ^2; p		28.854; **0.000**[1]*			
Gender	Female	154 (44.6)	105 (30.4)	86 (24.9)	345 (100.0)
	Male	78 (25.6)	135 (44.3)	92 (30.1)	305 (100.0)
	Total	232 (35.7)	240 (36.9)	178 (27.4)	650 (100.0)
Statistics χ^2; p		26.488; **0.000**[1]*			
		WC (cm)			Total
		Optimal	Suboptimal	Abdominal obesity	
		n (%)	n (%)	n (%)	n (%)
Age groups	18-39	116 (51.6)	43 (19.1)	66 (29.3)	225 (100.0)
	40-59	66 (27.8)	57 (24.1)	114 (48.1)	237 (100.0)
	60-83	26 (13.8)	34 (18.1)	128 (68.1)	188 (100.0)
	Total	208 (32)	134 (20.6)	308 (47.4)	650 (100.0)
Statistics χ^2; p		82.249; **0.000**[1]*			
Gender	Female	124 (35.9)	64 (18.6)	157 (45.5)	345 (100.0)
	Male	84 (27.5)	70 (23.0)	151 (49.5)	305 (100.0)
	Total	208 (32)	134 (20.6)	308 (47.4)	650 (100.0)
Statistics χ^2; p		5.638; 0.060[1]			

[1]Pearson's chi-square test (χ^2), [2]Fisher's exact test; *p<0.05.
BMI: Body mass index, WC: Waist circumference.

mean BMI values than those with one, two, or three comorbidities ($p<0.05$ for all comparisons). Among male participants, the mean BMI was 26.86±3.90 kg/m² in those without any comorbidities, 29.79±5.29 kg/m² in those with one comorbidity, 30.47±4.68 kg/m² in those with two comorbidities, and 29.85±4.75 kg/m² in those with three or more comorbidities. Differences among the three groups were statistically significant ($p<0.05$). According to the results of the post-hoc analysis, participants without comorbidities had significantly lower mean BMI than those with one, two, or three comorbidities ($p<0.05$). Overall, an increase in mean BMI was associated with a greater number of comorbidities in both female and male participants, and this relationship was statistically significant ($p<0.05$) (Table 6).

In the study, the mean WC of participants without any of the following comorbidities: HT, dyslipidemia, CHD, or T2DM, was 88.14±13.97 cm. Among participants with one of these conditions, the mean WC was 99.70±14.73 cm; among those with two comorbidities, it was 100.94±12.68 cm; and among participants with at least three comorbidities, the mean WC increased to 103.95±11.64 cm. The differences in mean WC across these groups were statistically significant ($p<0.05$). Post-hoc comparisons indicated that the mean WC of participants without comorbidities was significantly lower than that of participants with one, two, or three comorbidities ($p<0.05$ for all comparisons). Among female participants, the mean WC was 81.03±12.31 cm in those without comorbidities, 92.83±12.92 cm in those with one comorbidity, 94.65±11.39 cm in those with two comorbidities, and 98.16±9.49 cm in those with three comorbidities. A progressive increase in mean WC was observed with increasing comorbidity burden; these differences were statistically significant

Table 4. Mean height, mean weight, mean BMI and mean WC of the participants according to their age groups, and gender

	Gender	Age groups								Statistics F; p[1]
		18-39		40-59		60-83		Total		
		Mean ± SD	Min-max	Mean ± SD	Min-max	Mean ± SD	Min-max	Mean ± SD	Min-Max	
Height (cm)	Female	162.04±6.11	148-179	161.30±5.86	144-178	155.66±5.50	143-169	159.80±6.45	143-179	
	Male	176.65±6.94	157-192	174.59±7.50	145-192	170.93±8.13	148-187	174.35±7.79	145-192	
	Total	169.12±9.79[a]	148-192	167.75±9.43[a]	144-192	162.24±10.15[b]	143-187	166.63±10.16	143-192	**0.000[1]***
Statistics p[2]								**0.000[2]***		
Weight (kg)	Female	66.07±17.90	39.5-148	68.30±13.66	44.5-109	69.90±11.58	45-106	68.05±14.71	39.5-148	
	Male	85.98±14.96	55.5-127	87.24±16.28	61-160	83.92±14.88	56-132	85.91±15.45	55.5-160	
	Total	75.72±19.28	39.5-148	77.49±17.71	44.5-160	75.94±14.80	45-132	76.43±17.50	39.5-160	0.500[1]
Statistics p[2]								**0.000[2]***		
BMI (kg/m²)	Female	25.05±6.19	15.2-50	26.45±5.43	16-42.5	28.84±4.66	18-43	26.69±5.65	15.2-50	
	Male	27.63±4.62	18.2-40.3	28.59±4.88	21-52	28.74±4.39	18.7-43.7	28.32±4.71	18.2-52	
	Total	26.30±5.63[a]	15.2-50	27.49±5.27[b]	16-52	28.80±4.53[c]	18-43.7	27.45±5.29	15.2-52	**0.000[1]***
Statistics p[2]								**0.000[2]***		
WC (cm)	Female	80.05±14.62	50-132	86.89±11.80	66-123	93.79±11.49	62-123	86.73±13.84	50-132	
	Male	97.55±12.49	72-132	103.53±11.71	84-150	105.95±11.40	83-136	102.03±12.38	72-150	
	Total	88.53±16.18[a]	50-132	94.96±14.39[b]	66-150	99.03±12.92[c]	62-136	93.91±15.22	50-150	**0.000[1]***
Statistics p[2]								**0.000[2]***		

[1]One-way ANOVA [Tukey's multiple comparisons test, (mean ± SD)], [2]Independent Samples t test; *p<0.05.
Groups labeled with the same letter (a-c) were not significantly different from one another.
p[1]: Difference among three groups in age groups.
p[2]: Difference between two groups in gender.
BMI: Body mass index, WC: Waist circumference, SD: Standard deviation, Min-max: Minumum-maximum, ANOVA: Analysis of variance.

Table 5. Prevalence of HT, dislipidemia, CHD, and T2DM

		HT		Dyslipidemia		T2DM		CHD	
		n	%	n	%	%	%	n	%
BMI (kg/m²)	Healthy weight	36	15.5	26	11.2	13	5.6	8	3.4
	Overweight	90	37.5	69	28.8	30	12.5	7	2.9
	Obesity	106	59.6	73	41.0	36	20.2	14	7.9
	Total	232	35.7	168	25.8	79	12.2	29	4.5
WC (cm)	Optimal WC	27	13.0	18	8.7	8	3.8	4	1.9
	Sub optimal WC	32	23.9	29	21.6	12	9.0	4	3.0
	Abdominal obesity	173	56.2	121	39.3	59	19.2	21	6.8
	Total	232	35.7	168	25.8	79	12.2	29	4.5

HT: Hypertension, CHD: Coronary heart disease, T2DM: Type 2 diabetes mellitus, BMI: Body mass index, WC: Waist circumference.

Table 6. Association between comorbidity and mean BMI and WC by gender

		Mean BMI (kg/m²)					
		Gender					
		Female		Male		Total	
		Mean ± SD	Min-max	Mean ± SD	Min-max	Mean ± SD	Min-max
Comorbidity	No	24.64±4.83[a]	15.2-44	26.86±3.90[a]	18.2-40.3	25.63±4.57[a]	15.20-44
	1 comorbidity	29.07±5.90[b]	17-50	29.79±5.29[b]	18.7-52	29.42±5.60[b]	17-52
	2 comorbidities	29.15±5.10[b]	17.5-40	30.47±4.68[b]	23.1-40.5	29.75±4.92[b]	17.5-40.5
	At least 3 comorbidities	30.82±4.84[b]	21.2-43	29.85±4.75[b]	23-43.7	30.29±4.78[b]	21.2-43.7
	Total	26.69±5.65	15.2-50	28.32±4.71	18.2-52	27.45±5.29	15.2-52
Statistics	F; p	**25.651; 0.000**[1]*		**12.434; 0.000**[1]*		**11.510; 0.000**[1]*	
		Mean WC (cm)					
		Gender					
		Female		Male		Total	
		Mean ± SD	Min-max	Mean ± SD	Min-max	Mean ± SD	Min-max
Comorbidity	No	81.03±12.31[a]	50-123	96.90±10.51[a]	72-130	88.14±13.97[a]	50-130
	1 comorbidity	92.83±12.92[b]	62-132	107.04±12.94[b]	83-150	99.70±14.73[b]	62-150
	2 comorbidities	94.65±11.39[b]	66-120	108.35±9.88[b]	92-136	100.94±12.68[b]	66-136
	At least 3 comorbidities	98.16±9.49[b]	78-116	108.77±11.16[b]	89-132	103.95±11.64[b]	78-132
	Total	86.73±13.84	50-132	102.03±12.38	72-150	93.91±15.22	50-150
Statistics	F; p	**35.584; 0.000**[1]*		**24.326; 0.000**[1]*		**48.088; 0.000**[1]*	

[1]One-way ANOVA [Tukey's multiple comparisons test, (mean ± SD)]; *p<0.05.
Groups labeled with the same letter (a-b) were not significantly different from one another.
BMI: Body mass index, WC: Waist circumference, SD: Standard deviation, ANOVA: Analysis of variance.

(p<0.05). Post-hoc analyses further demonstrated that females without comorbidities had significantly lower mean WC than those with one, two, or three comorbidities (p<0.05 for all comparisons). Among male participants, the mean WC was 96.90±10.51 cm in those without comorbidities, 107.04±12.94 cm in those with one comorbidity, 108.35±9.88 cm in those with two comorbidities, and 108.77±11.16 cm in those with three comorbidities. The differences among the groups were statistically significant (p<0.05). Post-hoc comparisons showed that males without comorbidities had significantly lower mean WC values compared with those with one or more comorbidities (p<0.05 for all comparisons; Table 6).

DISCUSSION

In many countries, height and weight data are based on self-reported measurements. It is well established that self-reported height tends to be overestimated, whereas self-reported weight is often underestimated compared with objectively measured values.[10] In the present study, participants' height, weight, and WC were measured by the same physician using a standardized scale and a measuring tape to ensure consistency and minimize measurement bias. The mean height of female participants was 159.8 cm, while the mean height of the 18-39-year age group was 162 cm. According to data from Worlddata.info, mean female height among individuals aged 18-25 varies between countries. Cross-national differences in height have been well documented and are influenced by genetic, nutritional, and environmental factors. Detailed country-specific height data are publicly available, and are therefore not presented in this study.[11]

In our study, the mean height of male participants was 174.3 cm, whereas the mean height among those aged 18-39 years was 176.6 cm. According to data from Worlddata.info for the 18-25 age group, the average male height varies considerably across countries. These international differences in male stature have been widely reported in the literature and are influenced by genetic, nutritional, and environmental factors. Therefore, detailed country-specific height data are not presented in this study but are referenced elsewhere.[11]

In our study, the mean BMI of females residing in Northern Cyprus was 26.6 kg/m². Among those aged 18-39 years, the mean BMI was 25.0 kg/m². In Southern Cyprus, the closest neighboring region, the reported mean BMI for females was 26 kg/m².[12] According to data from Worlddata.info, mean BMI values among females aged 18-25 years show substantial variation across countries. These cross-national differences in BMI have been well documented and are influenced by lifestyle, socio-economic, and environmental factors. Therefore, detailed country-specific BMI data are not presented in this study; instead, they are provided in the cited references.[11]

In our study, mean BMI was 28.3 kg/m² among males and 27.6 kg/m² among those aged 18-39 years. In Southern Cyprus, the closest neighboring region, the reported mean BMI for males was 27.7 kg/m².[12] According to data from Worlddata.info, mean BMI values among males aged 18-25 years vary widely across countries. These international differences in BMI have been widely reported and are influenced by lifestyle, nutritional, and socio-economic factors. Therefore, detailed country-specific BMI data are not presented in this study; instead, they are referenced.[11]

According to the WHO obesity report 2022, approximately 16% of adults aged 18 years and older were classified as obese worldwide. However, obesity prevalence varies substantially across regions, with higher rates reported particularly in the Eastern Mediterranean and American regions. In our study, the overall prevalence of obesity was 27.4%, which is considerably higher than the global average reported by the WHO. This finding is consistent with data from countries in the same geographical and cultural region, including South Cyprus, where the prevalence of obesity has been reported as 23.6%. These results suggest that North Cyprus follows a regional pattern of elevated obesity prevalence, underscoring the growing public health burden of obesity.[13]

In our study, the prevalence of obesity was 30.1% in males and 24.9% in females. In our country, this difference may be partly attributed to higher alcohol consumption and a more animal-based diet among males than among females. When evaluated by gender, obesity prevalence varies across countries, with higher rates observed among males in some countries and among females in others. For example, higher obesity prevalence among males has been reported in countries such as Spain, Germany, Slovakia, Poland, Greece, Croatia, Hungary, Malta, and Cyprus. In contrast, higher prevalence among females has been documented in countries, including Nigeria, Ukraine, Iran, Türkiye, Libya, Iraq, Saudi Arabia, Egypt, Brazil, Kenya, Indonesia, and Ethiopia.[13] In our study, the overall prevalence of excess weight was 64.3%, with a prevalence of 55.3% amoung females and 74.4% amoung males. According to the WHO obesity report 2022, the prevalence of excess weight in the European region was 59%, affecting 54% of females and 63% of males.[5]

The prevalence of overweight and obesity increased with age. According to the WHO obesity report 2022, excess weight in the European Union was least prevalent among participants aged 16-24 years (20.3%), while the highest prevalence was observed among those aged 65-74 years (63.6%).[5] In a French study, the prevalence of obesity and excess weight increased progressively across age groups, with obesity and excess weight reported as 9.2% and 23.2%, respectively, in the 18-24 age group; 13.8% and 35.2% in the 25-34 age group; 16.7% and 44.0% in the 35-44 age group; 18.4% and 50.7% in the 45-54 age group; 19.2% and 57.2% in the 55-64 age group; and 19.9% and 57.3% among participants aged 65 years and older.[14] Similarly, in our study, both obesity and excess weight increased with age: in the 18-39 age group, the prevalence of obesity was 22.2% and excess weight was 53.8%; in the 40-59 age group, obesity prevalence was 24.9% and excess weight was 63.3%; and in the 60-79 age group, obesity was 36.7% and excess weight was 78.2%.

Bodyweight is influenced by poor nutritional choices, overeating, genetic predisposition, cultural factors, and metabolism. Obesity prevalence varies considerably across countries due to differences in lifestyle and dietary patterns. Factors such as the type and quantity of food consumed, alcohol and sugary-sweetened beverage intake, physical activity level, genetics, sleep habits, medication use, and living environment are all associated with excess body weight. In our study, 72.5% of male participants and 59.7% of female participants predominantly consumed an animal-based diet. Alcohol consumption and obesity are among the leading risk factors for chronic liver disease and liver cancer,[15] whereas tobacco use is a major lifestyle-related risk factor for premature mortality.[8] In this study, 21.3% of male participants and 6.1% of female participants reported consuming at least two servings of alcohol on at least two days per week. Additionally, 35.7% of males and 25.2% of females were identified as smokers. Physical activity is recommended for both the prevention and treatment of obesity and is associated with a reduced risk of CVD, cancer, and all-cause mortality. Moderate to high levels of physical activity are associated with a 21% lower risk of all-cause mortality and a 24% lower risk of CVD-related mortality among adults with obesity.[16] In our study, 72.4% of male and 71.0% of female participants reported not engaging in any form of physical exercise.

Observational studies have shown that obesity is associated with a reduction of 3 to 8 years in disease-free life expectancy.[17] Excess body weight is associated with an increased risk of cardiometabolic diseases (CMDs), and this association cannot be fully explained by shared genetic factors or early-life environmental influences. However, positive lifestyle habits may attenuate the risk of CMDs associated with elevated BMI.[18] Even in the absence of current obesity, a history of excess body weight has been associated with an increased risk of CMDs, with SBP and triglyceride levels mediating this relationship. Maintaining a stable and healthy body weight and achieving weight reduction during early adulthood and midlife play a crucial role in promoting better quality of life as individuals age. Compared with participants who remained at a healthy weight, those who were persistently obese exhibited the highest risk of developing obesity-related diseases in later life. Moreover, transitions between non-obese and obese states, in either direction, were associated with an increased risk of long-term health disorders.[8]

The risk of T2DM increases with rising body weight. A study involving more than 21,000 adult participants from the National Health and Nutrition Examination Survey (NHANES) reported that the prevalence of T2DM increased from 8% among participants with normal weight to 43% among those with morbid obesity.[19] In our study, T2DM was observed in 5.6% of participants with a healthy weight and in 20.2% of those with obesity. Additionally, T2DM was present in 3.8% of participants with optimal WC, compared with 9.0% and 19.2% among those with abdominal obesity.

Findings from the Framingham Heart Study indicated that obesity accounted for 78% of cases of primary HT in males and 65% in females.[20] Across adult populations, an approximately linear relationship has been observed between BMI and BP, and weight loss has been shown to reduce BP in most participants with HT.[21] A weight reduction of 5.1 kg has been associated with decreases of 4.44 mmHg in SBP and 3.57 mmHg in DBP.[22] Conversely, weight gain increases the risk of primary HT; an increase of 1.7 kg/m^2 in BMI has been associated with a 1-mmHg rise in SBP.[23] In our study, HT was identified in 15.5% of participants with a healthy weight, 37.5% of those who were overweight, and 59.6% of those with obesity.

Obesity adversely affects lipid metabolism. It is associated with increased levels of low-density lipoprotein (LDL) cholesterol, very-LDL cholesterol, triglycerides, and decreased levels of high-density lipoprotein cholesterol.[24] In our study, dyslipidemia was identified in 11.2% of participants with a healthy weight and in 41.0% of those with obesity. Obese participants have a 1.6-fold higher risk of developing CHD than those of healthy weight.[25] In a study conducted in South Korea, Choi et al.[26] reported that a reduction in BMI was associated with decreased risk of CHD among young adults. Additionally, a 4 kg/m^2 increase in BMI has been shown to correspond to a 26% increase in the odds of CHD.[27] Data from the NHANES, encompassing mortality records for 2.3 million American adults, demonstrated that obesity was significantly associated with increased risk of death from CHD and

other cardiovascular conditions.[28] Although BMI may influence CHD risk indirectly through intermediate factors such as HT, dyslipidemia, and T2DM, current evidence indicates that obesity is an independent risk factor for CHD.[27] In our study, CHD was observed in 3.4% of participants with a healthy weight and in 7.9% of those with obesity. Furthermore, overweight and obesity are associated with substantial reductions in life expectancy. Increasing BMI is associated with a progressively higher risk of coexistence of multiple cardiometabolic conditions, ranging from approximately a twofold increase among overweight participants to more than a tenfold increase among those with severe obesity, relative to participants with normal BMI.[7]

In our study, increases in both BMI and WC were linked with a higher prevalence of, and a greater number of, obesity-related comorbidities. The prevalence of HT, T2DM, CHD, and dyslipidemia was higher among participants with excess body weight than among those with healthy weight. The mean BMI was 25.66 kg/m² among participants without HT, T2DM, CHD, or dyslipidemia; 29.38 kg/m² among those with one comorbidity; 29.77 kg/m² among those with two comorbidities; and 30.2 kg/m² among those with three or more comorbidities. These findings are consistent with and support previously published studies.[29-31]

Study Limitations

In our study, diagnoses of dyslipidemia, CHD, and T2DM were assessed based on participants' self-reported information, whereas HT was assessed separately. In addition, weight status was determined from measurements obtained at assessment; therefore, participants who had previously been obese but were of healthy weight at that assessment were classified in the healthy-weight group. Consequently, some participants in the healthy-weight group who were diagnosed with obesity-related diseases may previously have been overweight.

CONCLUSION

This study demonstrated a high prevalence of both general and abdominal obesity among adults in North Cyprus. Approximately one in two adults (47.4%) had abdominal obesity, and nearly one in four (27.4%) had general obesity. While the associations between age, gender, and BMI are well established in the literature, our findings highlight the strong relationship of increasing BMI and WC with both the prevalence and the number of obesity-related comorbidities. These results emphasize that excess weight substantially increases the risk of obesity-related health conditions, including CVD, while weight reduction may reduce the risk of cardiometabolic disorders and all-cause mortality.

MAIN POINTS

- The prevalence of obesity was 27.4% (24.9% in females and 30.1% in males).
- The prevalence of excess weight was 64.3% (55.3% among females and 74.4% among males).
- The prevalence of abdominal obesity was 47.4% (45.5% in females and 49.5% in males).
- Higher body mass index and waist circumference values were associated with increased prevalence of type 2 diabetes mellitus, coronary heart disease, hypertension, and dyslipidemia.

ETHICS

Ethics Committee Approval: Ethical approval for this research was obtained from the Cyprus Science University Ethics Committee (approval number: 2025/01.012, date: 21.01.2025).

Informed Consent: Patient consent was obtained.

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Footnotes

Authorship Contributions

Concept: E.B., Design: E.B., Data Collection and/or Processing: E.B., G.Ö., Analysis and/or Interpretation: E.B., S.A., G.Ö., Literature Search: E.B., S.A., Writing: E.B., S.A., G.Ö.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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