The Trends of Prevalence of Obesity in Turkey From 2008-2016

Fatma Kantas Yilmaz[1*],Onur Yarar[2]

1. Assistant Professor, Faculty of Health Sciences, Department of Health Management, University of Health Sciences Turkey, Istanbul, Turkey.
2. Assistant Professor, Institute of Health Sciences, Okan University, Istanbul, Turkey.

***Correspondence:**
Fatma Kantaş Yı lmaz, Assistant Professor, Faculty of Health Sciences, Department of Health Management, University of Health Sciences Turkey, Istanbul, Turkey.
Tel: (90) 216 418 9616
Email: fatmakantas.yilmaz@sbu.edu.tr
ORCID ID: 0000-0003-0512-382X

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Abstract

Objective: Obesity is one of the major public health problems in Turkey and worldwide. This study was conducted to determine the trends of the obesity prevalence in Turkey from 2008 to 2016 by analysing sociodemographic data.

Materials and Methods: This study was cross-sectional. Analysis was performed based on 2008, 2010, 2012, 2014 and 2016 data from Health Survey by Turkish Statistical Institute. Of the 128484 individuals who participated in Turkish Health Research, the body mass index (BMI) of 87205 individuals with aged 15 and older has been calculated. Categorical variables were represented as frequency (%) and continuous variables were represented as mean (±standard deviation) within parentheses. The data were analyzed with SPSS 20 software.

Results: Our findings showed that 16.2% of the individuals 15 years and over was obese (18.7% among women and 13.5% among men *P*-value< 0.001) in 2008, and the prevalence increased to 22 % in 2016 (26% among women and 17% among men *P*-value< 0.001). The ratios of obesity were higher among the individuals having a low education (*P*-value< 0.001) and income level (*P*-value< 0.001; between 2010-2016) compared to other groups.

Conclusion: Our study demonstrated alarming rates of obesity, particularly among women, among the population 55 to 64 years of age regardless of gender, which was closely associated with low education and income levels. It is crucial to gain healthy lifestyle behaviors within the society and implement strategies and policies for diverse risk groups.

Keywords: Obesity, Sociodemographic, Prevalence, Health science, Turkey

Introduction

Public health includes health protection and maintanence as well as education of the community. It also aims to decrease the risks among the population. Approaches to public health problems should address social, communal, cultural, economic, political and environmental aspects. Although many advances have been achieved in the field of public health since the 1950s, each year nearly 36 million people still die due to non-communicable diseases such as diabetes, chronic lung diseases and cancer (1). Preventable risk factors for non-communicable diseases include hypertension, tobacco use, diabetes, physical inactivity and overweight-obesity regardless of the countries'

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development level (2). Being a global public health problem, obesity as the leading risk factor in many fatal diseases that are responsible for nearly 3.4 million deaths each year (3).

The World Health Organization (WHO) and health authorities of many countries have planned and have been implementing basic strategies and activities to prevent non-communicable diseases to achieve the goal of "health for all" (2). In Turkey, obesity was introduced as major public health problem in the 2013-2017 Strategic Plan of the Ministry of Health, aiming protect the community from risk factors for health and to encourage healthy lifestyles through adopting healthy dietary habits, increasing the level of physical activity and decreasing the incidence of obesity (4,5).

The WHO has defined overweight and obesity as abnormal and excess accumulation of fat that may impair health (6). With growing prevalence of obesity, it is estimated that nearly 20% of all adult population, namely more than one billion people, will become obese worldwide by 2030, complicated by increased risks for metabolic syndrome, type-II diabetes mellitus, cardiovascular diseases, other chronic diseases, early deaths and high mortality rates (7). In the USA, nearly 17% (or 12,7 million) of children and adolescents 2 to 19 years of age are obese (8).

According to the Organisation for Economic Co-operation and Development (OECD), 19,5% of adult population is obese. While this rate is less than 6% in Korea and Japan, it exceeds 30% in Hungary, New Zealand, Mexico and America (9). An extensive study (2010) in Turkey reported the incidence of obesity as 7,7% among men and 13,8% among women (10).

Moreover, obesity is responsible for 1% to 3% of total health expenses in many countries (5% to 10% in the US) and these costs are expected to increase in the future due to obesity-associated diseases (11).

This study was conducted to determine trends in the prevalence of obesity in Turkey from 2008 to 2016. Also, sociodemographic characteristics of obesity were assessed using nationwide databases in Turkey.

Materials and Methods

This study was cross-sectional. Statistical data regarding obesity were analyzed based on sociodemographic criteria such as age groups, sex, education level, income status, chronic diseases and physical activity, and the differences were examined.

Turkey Health Research is conducted biennially by Turkish Statistical Institute (TSI) in order to reveal general health characteristics of the community and to obtain data for health indicators. The content of the study included all settlement areas within the borders of Turkey. The source of data was the household that was selected for the sample. General health conditions, chronic diseases, weight and height values, tobacco and alcohol use and many various variables within this field can be obtained from the individuals of 15 years and older in this study (12).

Data of Turkish Health Research Study were demanded by Micro Data Request Form in written form, and data from 2008, 2010, 2012, 2014 and 2016 were retrieved at the end of TSI approval. The study was conducted in accordance to tenets of Helsinki Declaration. A total of 128484 individuals participated in TSI Turkish Health Research including 20624 in 2008, 20200 in 2010, 37979 in 2012, 26075 in 2014 and 23606 in 2016. During the study, 15 years and older individuals, who were applied questionnaire form and whose BMI was measured, were analyzed including 12402 in 2008, 12758 in 2010, 25674 in 2012, 19129 in 2014 and 17242 in 2016. Age, sex, education and income level, chronic diseases and physical activity level were analysed. Categorical variables were represented as frequency(%) and continuous variables were represented as mean (±standard deviation) and compared between the groups with Pearson's chi-square test. IBM SPSS ver. 20 package software was used to analyze data. While activities such as aerobics, fast cycling, field work, construction work and heavy lifting

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were considered as vigorous activities, moderate level activities included playing tennis, cycling at normal speed and light-load lifting. Body mass index (BMI) was calculated to classify overweight and obesity. The individuals who had the BMI in 25-29.9 range are identified as overweight and > 30 are obese (6).

Ethical considerations

The study was approved by Istanbul Sabahattin Zaim University Ethics Committee (28.01.2021-2021/01).

Results

Data regarding 2008

When 12402 individuals were analyzed across Turkey, it was detected that 16.2% were obese and 32.9% were overweight. While the number of overweight individuals were higher among men (18.7%), the obesity precent were higher among women (13.5%) (*P*-value< 0.001). Based on age groups, it was seen that the rate of obese individuals (27.4%) within the age group of 45-54 years old was significantly higher than the other age groups (*P*-value< 0.001). The state of being overweight was increased until 45 years old; and it became decreasing again after 45 years old. This was similar among obese ones at the age of 55 years old.

When education level was analyzed, obesity rates were found to be higher among the individuals who were illiterate (25%) and the ones who did not finish any school (21.4%) compared to the ones who were graduates of elementary school (17.3%), high school (9.9%) and university and higher (10.8%) (*P*-value< 0.001). The individuals who had an associate degree/undergraduate, master or doctorate degree were the ones who had the highest rate of overweight. Based on income level, it was found that the rates in BMI categories were very comparable; and no significant differences were found between income groups (*P*-value= 0.116).

When chronic diseases were examined based on BMI, musculoskeletal lower back pain (32.3%), hypertension (31.3%), rheumatoid arthritis (28.1%), arthrosis (23%) and ulcer (peptic ulcer, gastric ulcer or duodenal ulcer) (18.4%) were found to be at a significantly higher rate among the obese individuals compared to the other BMI categories (*P*-value< 0.001). When an analysis was carried out for moderate and vigorous physical activity, these activities were found to be lower among the obese and underweight individuals compared to the ones who were normal and overweight. (Table 1)

Data regarding 2010

Among 12.758 individuals whose BMI was calculated in 2010, obesity rate was found as 22.4% among women and 14.8% among men. It can be stated that the rates were similar in the other BMI categories. While the rate of overweight individuals was higher among men compared to women (*P*-value< 0.001), the rate of obese individuals was found to be significantly higher among women compared to the men (*P*-value< 0.001).

Based on age distribution, it was seen that obesity rate in 55-64 years old group (34.5%) was higher than the other age groups. While the rate of overweight individuals was increased until 45 years old, the rate of obese individuals was increased until 55 years old and showed a decrease afterwards. The difference across the age groups was found to be significant (*P*-value< 0.001). The differences in BMI categories based on income states were significant although low (*P*-value< 0.001). It was also observed that obesity rates were lower among the ones whose income level was high.

The groups with the highest obesity rates were the ones who were illiterate, who did not finish any school and who were graduates of elementary school. The highest number of overweight was seen among the individuals who had a master or doctorate degree; and the difference between education levels was found to be statistically significant (*P*-value< 0.001).

When chronic diseases were examined, hypertension (31.1%), musculoskeletal lower

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back pain (26.6%), rheumatoid arthritis (19.6%), arthrosis (17.8%) and ulcer (peptic ulcer, gastric ulcer or duodenal ulcer) (12.9%) were found to be most common among obese individuals.

When physical activity was examined, 10-minute walk (additional category in this year), moderate and vigorous activities were found to be low among the obese and underweight; and significant differences were found in terms of 10-minute walk and moderate level activity (*P*-value< 0.001). (Table 2)

Data regarding 2012

Among 25.674 individuals whose BMI values were calculated in 2012, obesity rate was found to be 22.4% among women and 15.2% among men. The rate of obesity was found to be significantly higher among women compared to the men as it was found in the previous years (*P*-value< 0.001).

When it was analyzed based on age groups, it was seen that obesity rate was higher between 55-64 years old (32%) and the difference between age groups was statistically significant (*P*-value< 0.001). Obesity rates were found to be significantly higher in low income group compared to the other income groups (*P*-value< 0.001).

The groups with the highest obesity rates were the ones who were illiterate, who did not finish any school and who were graduates of elementary school. Obesity rates decreased as the education level increased. The difference betwen the education groups was found to be statistically significant (*P*-value< 0.001).

When chronic diseases were examined based on BMI, it was found that musculoskeletal lower back pain (21.1%), hypertension (30.8%), rheumatoid arthritis (17.7%), arthrosis (15.1%) and ulcer (peptic ulcer, gastric ulcer or duodenal ulcer) (11.6%) were significantly higher in obese individuals compared to the other BMI categories (*P*-value< 0.001). The rates of physical activities were found to be significantly lower in obese

Table 1. Demographic data based on BMI - 2008

Variable		BMI categories				*P*-value
		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
Sex	Women	367 (5.8%)	2989 (47.3%)	1786 (28.2%)	1181 (18.7%)	<0.001*
	Men	157 (2.6%)	2809 (46.2%)	2290 (37.7%)	823 (13.5%)	
	Total	524 (4.2%)	5798 (46.8%)	4076 (32.9%)	2004 (16.2%)	
Age	15-24	316 (12.7%)	1819 (73.1%)	293 (11.8%)	60 (2.4%)	<0.001*
	25-34	106 (20.2%)	1665 (28.7%)	877 (21.5%)	271 (13.5%)	
	35-44	46 (8.8%)	931 (16.1%)	1011 (24.8%)	505 (25.2%)	
	45-54	16 (3.1%)	619 (10.7%)	891 (21.9%)	550 (27.4%)	
	55-64	15 (2.9%)	377 (6.5%)	559 (13.7%)	363 (18.1%)	
	65-74	13 (2.5%)	216 (3.7%)	296 (7.3%)	193 (9.6%)	
	75+	12 (2.3%)	171 (2.9%)	149 (3.7%)	62 (3.1%)	
Education	Illiterate	19 (1.9%)	393 (38.6%)	352 (34.5%)	255 (25%)	<0.001*
	No graduation	36 (4.9%)	311 (42.1%)	234 (31.7%)	158 (21.4%)	
	Elementary school	295 (4.2%)	3170 (44.8%)	2382 (33.7%)	1226 (17.3%)	
	High school and equal	118 (5.1%)	1320 (56.6%)	663 (28.4%)	231 (9.9%)	
	College/Faculty/Master/Doctorate	56 (4.5%)	604 (48.7%)	445 (35.9%)	134 (10.8%)	
Income	<500 TL	123 (4.2%)	1465 (49.6%)	880 (29.8%)	485 (16.4%)	0.116
	501-900 TL	160 (4.2%)	1754 (46.1%)	1280(33.6%)	610 (16%)	
	901-1300 TL	97 (3.9%)	1150 (46.1%)	849 (34%)	400 (16%)	
	1301-2300 TL	94 (4.5%)	930 (44.4%)	734 (35.1%)	335 (16%)	
	>2300 TL	43 (4.4%)	450 (46.5%)	312 (32.3%)	162 (16.8%)	
Chronic diseases	Waist region problems	50 (9.5%)	989 (17.1%)	999 (24.5%)	647 (32.3%)	<0.001*
	Hypertension	21 (4%)	470 (8.1%)	729 (17.9%)	626 (31.3%)	<0.001*
	Rheumatoid arthritis	45 (8.6%)	656 (11.3%)	774 (19%)	561 (28.1%)	<0.001*
	Arthrosis	19 (3.6%)	440 (7.6%)	574 (14.1%)	458 (23%)	<0.001*
	Ulcer	50 (9.6%)	724 (12.5%)	673 (16.5%)	369 (18.4%)	<0.001*
Activity	Moderate level activity	91 (17.8%)	1434 (25.4%)	987 (24.7%)	450 (23.0%)	<0.001*
	Vigorous level activity	34 (6.5%)	653 (11.4%)	474 (11.8%)	207 (10.4%)	0.003*

Note: Chi-square used for analysis group differences. Significant (*P*-value <0.05). TL= Turkish Lira

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and underweight individuals compared to normal and overweight (*P*-value< 0.001). (Table 3)

Data regarding 2014

Among 19.129 individuals whose BMI was calculated in 2014, obesity rate was found to be 25.8% among women and 17.1% among men. While the rate of overweight individuals was higher among men compared to women, the rate of obesity was significantly higher among women (*P*-value< 0.001).

Based on age groups, it was seen that the rate of obese individuals within the age group of 55-64 years old (36.2%) was significantly higher than the other age groups (*P*-value< 0.001). Obesity rate was increased until 65 years old, state of being overweight was increased until 55 years old and decreased afterwards.

As it was in the previous years, obesity rate was found to be significantly higher in low income group compared to the other income groups (*P*-value< 0.001).

The highest obesity rates were observed among the ones who were illiterate, who did not finish any school and who were graduates of elementary school. As education level increased, obesity rates decreased significantly (*P*-value< 0.001).

When chronic diseases were examined, it was seen that the most common ones were musculoskeletal lower back pain (47.1%), hypertension (35.9%), neck region problems (31.8%), arthrosis (15.7%) and diabetes (21.8%) among obese individuals (*P*-value< 0.001). The items relating to chronic diseases in the questionnaire were changed in 2014, for instance, peptic ulcer item was not included.

Based on physical activity, mild, moderate and vigorous activities were found to be low in obese and underweight; and the difference was significant (*P*-value< 0.001). (Table 4)

Data regarding 2016

When 17.242 individuals were evaluated

Table 2. Demographic data and frequencies of BMIx category- 2010

Variable		BMI categories				*P*-value
		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
Sex	Women	366 (5.3%)	2915 (42.4%)	2047 (29.8%)	1542 (22.4%)	<0.001
	Men	191 (3.2%)	2533 (43%)	2294 (39%)	870 (14.8%)	
	Total	557 (4.4%)	5448 (42.7%)	4341 (34%)	2412 (18.9%)	
Age	15-24	357 (14.5%)	1728 (70.0%)	307 (12.4%)	76 (3.1%)	<0.001
	25-34	98 (3.7%)	1440 (53.8%)	854 (31.9%)	287 (10.7%)	
	35-44	27 (1.1%)	884 (34.9%)	1064 (42.0%)	560 (22.1%)	
	45-54	19 (0.9%)	574 (26.0%)	971 (44.0%)	644 (29.2%)	
	55-64	14 (0.9%)	355 (23.7%)	612 (40.9%)	517 (34.5%)	
	65-74	22 (2.5%)	268 (30.9%)	345 (39.7%)	233 (26.8%)	
	75+	20 (3.9%)	199 (4.9%)	188 (7.9%)	950(9.7%)	
Income	<500 TL	100 (4.9%)	932 (45.7%)	638 (31.3%)	369 (18.1%)	<0.001
	501-900 TL	168 (4.3%)	1597 (40.9%)	1312 (33.6%)	828 (21.2%)	
	901-1300 TL	86 (3.9%)	911 (41.5%)	771 (35.1%)	429 (19.5%)	
	1301-2300 TL	140 (4.7%)	1246 (41.6%)	1086 (36.2%)	525 (17.5%)	
	>2300 TL	59 (3.9%)	710 (46.5%)	509 (33.4%)	248 (16.3%)	
Education	Illiterate	32 (2.9%)	360(32.7%)	377 (34.3%)	331 (30.1%)	<0.001
	No graduation	57 (6.4%)	361 (40.4%)	282 (31.6%)	193 (21.6%)	
	Elementary school	341 (4.8%)	2896 (40.8%)	2425 (34.1%)	1441 (20.3%)	
	High school and equal	86 (3.9%)	1137 (51.7%)	731 (33.2%)	245 (11.1%)	
	College/Faculty/Master/Doctorate	41 (2.8%)	694 (47.4%)	526 (36.0%)	202 (13.8%)	
Chronic diseases	Musculoskeletal lower back pain	43 (7.7%)	693 (12.7%)	814 (18.8%)	642 (26.6%)	<0.001
	Hypertension	20 (3.6%)	390 (7.2%)	719 (16.6%)	749 (31.1%)	<0.001
	Rheumatoid arthritis	28 (5%)	387 (7.1%)	510 (11.8%)	472 (19.6%)	<0.001
	Arthrosis	15 (2.7%)	289 (5.3%)	417 (9.6%)	429 (17.8%)	<0.001
	Ulcer	39 (7%)	425 (7.8%)	484 (11.2%)	310 (12.9%)	<0.001
Activity	10-minute walk daily	344 (4.2%)	3495 (42.7%)	2859 (34.9%)	1489 (18.2%)	0.003
	Moderate level activity	114 (3.6%)	1332 (41.8%)	1125 (35.3%)	618 (19.4%)	0.021
	Vigorous level activity	57 (3.4%)	699 (41.6%)	620 (36.9%)	304 (18.1%)	0.271

Note: Chi-square used for analysis group differences. Significant (*P*-value <0.05). TL= Turkish Lira

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across Turkey in 2016, it was found that 22% were obese and 36% were overweight. While the rate of overweight individuals was higher among men compared to the women, the rate of obesity was higher among women (26%) compared to the men (17%) (*P*-value< 0.001).

Based on age groups, the rate of obese individuals within 55-64 year old group (36.0%) was significantly higher than the other age groups (*P*-value< 0.001). It was observed that obesity rates increased with age and decreased after 65 years old.

The differences in BMI categories were low based on income state. It was also seen that obesity rates were significantly lower in the ones who had a high income compared to the other groups (*P*-value< 0.001).

As education level increased, obesity rates decreased. Obesity rates were significantly higher among the ones who were illiterate and who did not finish any school compared to the other groups (*P*-value< 0.001).

When chronic diseases were examined, most common diseases were found to be musculoskeletal lower back pain (42.8%), hypertension (35.4%), neck region problems (28.1%), arthrosis (16.6%) and diabetes (22%) among obese individuals. The items relating to chronic diseases in the questionnaire were changed in 2014, for instance, peptic ulcer item was not included.

When physical activity level was examined, mild, moderate and vigorous activities were found to be low in obese and underweight individuals; and the difference was found to be significant (*P*-value< 0.001).

Our findings showed that 16.2% of the individuals 15 years and over was obese (18.7% among women and 13.5% among men *P*-value< 0.001) in 2008, and the prevalence increased to 22 % in 2016 (26% among women and 17% among men *P*-value< 0.001). (Figure 1)

Table 3. Demographic data based on BMI - 2012

Variable		BMI categories				*P*-value
		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
Sex	Women	646 (4.8%)	5481 (40.9%)	4274 (31.9%)	3004 (22.4%)	<0.001
	Men	305 (2.5%)	5147 (42%)	4950 (40.3%)	1867 (15.2%)	
	Total	951 (3.7%)	10628 (41.4%)	9224 (35.9%)	4871 (19%)	
Age	15-24	631 (13.1%)	3286 (38.4%)	710 (14.8%)	177 (3.7%)	<0.001
	25-34	174 (3.3%)	2799 (52.7%)	1798 (33.9%)	540 (10.2%)	
	35-44	52 (1.0%)	1766 (33.9%)	2269 (43.5%)	1130 (21.7%)	
	45-54	28 (0.6%)	1129 (25.2%)	2004 (44.7%)	1325 (29.5%)	
	55-64	18 (0.6%)	732 (23.9%)	1332 (43.5%)	982 (32.0%)	
	65-74	19 (1.1%)	519 (29.0%)	731 (40.8%)	523 (29.2%)	
	75+	29 (2.9%)	397 (39.7%)	380 (38.0%)	194 (19.4%)	
Income	<500 TL	86 (4.3%)	900 (44.8%)	647 (32.2%)	376 (18.7%)	<0.001
	501-900 TL	221 (3.6%)	2453 (39.9%)	2207 (35.9%)	1272 (20.7%)	
	901-1300 TL	149 (3.2%)	1902 (40.6%)	1739 (37.1%)	896 (19.1%)	
	1301-2300 TL	324 (4.2%)	3154 (41.2%)	2730 (35.7%)	1444 (18.9%)	
	>2300 TL	152 (3.1%)	2105 (43.1%)	1796 (36.8%)	831 (17%)	
Education	Illiterate	45 (2.1%)	644 (30.7%)	773 (36.9%)	633 (30.2%)	<0.001
	No graduation	76 (5.4%)	536 (37.9%)	449 (31.7%)	355 (25.1%)	
	Elementary school	521 (3.7%)	5570 (39.6%)	5133 (36.5%)	2849 (20.2%)	
	High school and equal	212 (4.4%)	2290 (47.9%)	1648 (34.5%)	632 (13.2%)	
	College/Faculty/Master/Doctorate	97 (2.9%)	1588 (48.0%)	1221 (36.9%)	402 (12.2%)	
Chronic diseases	Musculoskeletal lower back pain	46 (4.8%)	955 (9%)	1334 (14.5%)	1026 (21.1%)	<0.001
	Hypertension	27 (2.8%)	747 (7%)	1489 (16.1%)	1500 (30.8%)	<0.001
	Rheumatoid arthritis	48 (5%)	550 (5.2%)	890 (9.7%)	862 (17.7%)	<0.001
	Arthrosis	15 (1.6%)	374 (3.5%)	608 (6.6%)	737 (15.1%)	<0.001
	Ulcer	41 (4.3%)	647 (6.1%)	786 (8.5%)	565 (11.6%)	<0.001
Activity	10-minute walk daily	(3.4%)	(41.9%)	(36.6%)	(18.1%)	<0.001
	Moderate level activity	(2.6%)	(40.2%)	(37.9%)	(19.2%)	<0.001
	Vigorous level activity	(1.9%)	(42.9%)	(38.1%)	(17.0%)	<0.001

Note: Chi-square used for analysis group differences. Significant (*P*-value <0.05). TL= Turkish Lira

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Discussion

There has been an increase in obesity rates since 1980s at a global scale. While there has been an average increase of 16% in Europe since 2008, this increase has been about 19 % in Turkey (13).

Although obesity ratio is significantly higher among women in Turkey, no significant difference is observed among the sexes in OECD countries (20% in women vs 19% in men). However, obesity was more incident among women compared men in the countries above OECD average such as America, Chile, Hungary, Mexico and Russia (9).

When distribution of obese individuals was examined based on age, ratios of the individuals have increased until 55 years old and then began to decrease again. According to the results of 2015 National Health Interview Survey of America and other studies performed, obesity that generally began to increase around 30 years old, started to decrease by the age of 60 (14).

According to this research, obesity rates were higher among the individuals who were illiterate and who did not graduate from any school. The status of overweight among the women who had a low education level in OECD countries was 2-3 times more than the ones who had a higher education level whereas the differences between men with various education levels were less. Although this difference is less among men, it gradually increases (15).

When obesity rates were examined based on income levels, the rates were found to be very close to each other between the groups; but a significant difference was found between the years except 2008. Obesity rates were found to be higher in low income groups in 2010, 2012 and 2014 whereas it was found to be higher in moderate income group in 2016. This situation suggests that taking income level intervals in 2008, 2010 and 2012 differently in the studies

Table 4. **Demographic data based on BMI - 2014**

Variable		BMI categories				*P*-value
		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
Sex	Women %	506 (4.9%)	3919 (37.6%)	3301 (31.7%)	2682 (25.8%)	<0.001
	Men %	223 (2.6%)	3563 (40.8%)	3447 (39.5%)	1488 (17.1%)	
	Total %	729 (3.8%)	7482 (39.1%)	6478 (35.3%)	4170 (21.8%)	
Age	15-24	460 (13.6%)	2237 (66.0%)	568 (16.8%)	123 (3.6%)	<0.001
	25-34	130 (3.6%)	1861 (50.8%)	1238 (33.8%)	432 (11.8%)	
	35-44	52 (1.4%)	1257 (33.4%)	1575 (41.8%)	884 (23.5%)	
	45-54	23 (0.7%)	761 (22.8%)	1406 (42.2%)	1142 (34.3%)	
	55-64	17 (0.7%)	591 (23.1%)	1023 (40.0%)	924 (36.2%)	
	65-74	18 (1.2%)	436 (29.1%)	588 (39.3%)	456 (30.4%)	
	75+	29 (3.1%)	339 (36.6%)	350 (37.8%)	209 (22.5%)	
Income	<1081 TL	248 (4.2%)	2348 (39.8%)	1951 (33.1%)	1347 (22.9%)	<0.001
	1081 – 1550 TL	141 (3.7%)	1458 (37.8%)	1384 (35.9%)	876 (22.7%)	
	1551 – 2170 TL	133 (4.3%)	1174 (37.7%)	1102 (35.4%)	706 (22.7%)	
	2171 – 3180 TL	129 (3.9%)	1299 (39.7%)	1204 (36.8%)	642 (19.6%)	
	>3181 TL	78 (2.6%)	1203 (40.3%)	1107 (37.1%)	599 (20.1%)	
Education	Illiterate	48 (2.5%)	565 (29.9%)	644 (34.1%)	633 (33.5%)	<0.001
	No graduation	28 (2.9%)	341 (35.6%)	325 (33.9%)	265 (27.6%)	
	Elementary school	410 (4.0%)	3756 (36.4%)	3664 (35.5%)	2487 (24.1%)	
	High school and equal	159 (4.7%)	1568 (46.6%)	1203 (35.8%)	432 (12.8%)	
	College/Faculty/Master/Doctorate	84 (3.2%)	1252 (48.1%)	912 (35.1%)	353 (13.6%)	
Chronic diseases	Musculoskeletal lower back pain	143 (19.6%)	2062 (27.6%)	2561 (38%)	1963 (47.1%)	<0.001
	Hypertension	38 (5.2%)	736 (9.8%)	1265 (18.7%)	1496 (35.9%)	<0.001
	Neck region problems	105 (14.4%)	1399 (18.7%)	1162 (24.6%)	1326 (31.8%)	<0.001
	Arthrosis	45 (6.2%)	416 (5.6%)	659 (9.8%)	653 (15.7%)	<0.001
	Diabetes	16 (2.2%)	360 (4.8%)	712 (10.6%)	908 (21.8%)	<0.001
Activity	Low level activity	295 (3.9%)	2694 (35.3%)	2656 (34.8%)	1980 (26.0%)	<0.001
	Moderate level activity	409 (4.1%)	4161 (41.2%)	3571 (35.4%)	1955 (19.4%)	
	Vigorous level activity	25 (1.8%)	627 (44.5%)	521 (37.0%)	235 (16.7%)	

Note: Chi-square used for analysis group differences. Significant (*P*-value <0.05). TL= Turkish Lira

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performed in 2014 and 2016, might have affected this outcome. According to WHO data, this situation showed difference; and obesity increased proportionally as income levels increased in 2016. Moreover, it was observed that obesity ratios have shown increases in all income groups since 1990 (13). In America, this phenomenon is parallel with the data of Turkish Health Research Study. The ratio of obesity (33.3%) was higher among the ones who had an income level less than 35.000 dollars than the ones who had more than 35.000 dollars (28.2%). The status of overweight was found to be higher among the ones who had a high income level (14).

When chronic diseases were examined based on BMI, it was found in the data of Turkish Health Research Study that diseases such as hypertension, diabetes, musculoskeletal lower back pain, ulcer and arthrosis were present in obese individuals at the highest rates. The increase in BMI also increases the rates of having the disease. The incidences of chronic diseases were also higher in overweight secondary to obese individuals. Five chronic diseases with the highest rates were addressed in the results part; and waist region problems, hypertension, neck region problems, arthrosis, diabetes and ulcer are generally the most common health problems among obese individuals. In the literature, obesity has been found to affect morbidity and mortality in coronary heart disease significantly by increasing risk for hypertension, diabetes and dyslipidemia (16). In a study conducted with 4.803 individuals in Canada, multimorbidity rate was reported to be higher among the obese ones compared to the nonobese. It was revealed in the study that 2.979 participants had at least one chronic disease. Having obesity increased the probability of having multimorbidity when compared to nonobese (odds ratio = 2.2, 95% CI 1.9 – 2.7) (17). In a cross-sectional study that was performed in Ireland on 10.364 adults older than 18 years old, the incidence of chronic diseases was

Table 5. **Demographic data based on BMI - 2016**

Variable		BMI categories				*P*-value
		Underweight N (%)	Normal N (%)	Overweight N (%)	Obese N (%)	
Sex	Women	448 (4.7%)	3529 (36.9%)	3105 (32.4%)	2492 (26%)	<0.001
	Men	181 (2.4%)	3086 (40.2%)	3099 (40.4%)	1302 (17%)	
	Total	629 (3.6%)	6615 (38.4%)	6204 (36%)	3794 (22%)	
Age	15-24	391 (13.5%)	1885 (64.9%)	502 (17.3%)	127 (4.4%)	<0.001
	25-34	104 (3.5%)	1571 (52.3%)	982 (32.7%)	349 (11.6%)	
	35-44	51 (1.5%)	1161 (33.7%)	1420 (41.2%)	812 (23.6%)	
	45-54	22 (0.7%)	726 (24.1%)	1307 (43.5%)	952 (31.7%)	
	55-64	14 (0.6%)	518 (21.9%)	983 (41.5%)	853 (36.0%)	
	65-74	17 (1.1%)	405 (26.2%)	638 (41.3%)	485 (31.4%)	
	75+	30 (3.1%)	349 (36.1%)	372 (38.5%)	216 (22.3%)	
Income	<1264 TL	137 (3.7%)	1411 (38.4%)	1298 (35.4%)	825 (22.5%)	<0.001
	1265 – 1814 TL	176 (3.7%)	1773 (37.7%)	1663 (35.3%)	1095 (23.3%)	
	1815 – 2540 TL	101 (3.2%)	1154 (36.6%)	1147 (36.4%)	750 (23.8%)	
	2541 – 3721 TL	117 (4.0%)	1128 (38.3%)	1056 (35.9%)	643 (21.8%)	
	>3722 TL	98 (3.5%)	1149 (41.5%)	1040 (37.6%)	481 (17.4%)	
Education	Illiterate	66 (2.5%)	751 (28.4%)	992 (37.5%)	839 (31.7%)	<0.001
	No graduation	69 (1.2%)	1649 (27.7%)	2420 (40.7%)	1810 (30.4%)	
	Elementary school	245 (8.2%)	1508 (50.7%)	850 (28.6%)	373 (12.5%)	
	High school and equal	157 (5.1%)	1452 (46.7%)	1041 (33.5%)	456 (14.7%)	
	College/Faculty/Master/Doctorate	92 (3.6%)	1255 (48.9%)	901 (35.1%)	316 (12.3%)	
Chronic diseases	Musculoskeletal lower back pain	110 (17.5%)	1391 (21%)	2031 (32.7%)	1624 (42.8%)	<0.001
	Hypertension	26 (4.1%)	618 (9.3%)	1281 (20.6%)	1344 (35.4%)	<0.001
	Neck region problems	79 (12.6%)	943 (14.3%)	1399 (22.5%)	1068 (28.1%)	<0.001
	Arthrosis	22 (3.5%)	360 (5.4%)	595 (9.6%)	631 (16.6%)	<0.001
	Diabetes	8 (1.3%)	322 (4.9%)	712 (11.5%)	836 (22%)	<0.001
Activity	Low level activity	278 (3.8%)	2604 (35.4%)	2582 (35.1%)	1893 (25.7%)	<0.001
	Moderate level activity	331 (3.7%)	3640 (40.6%)	3264 (36.4%)	1731 (19.3%)	
	Vigorous level activity	20 (2.2%)	371 (40.4%)	358 (39.0%)	170 (18.5%)	

Note: Chi-square used for analysis group differences. Significant (*P*-value <0.05). TL= Turkish Lira

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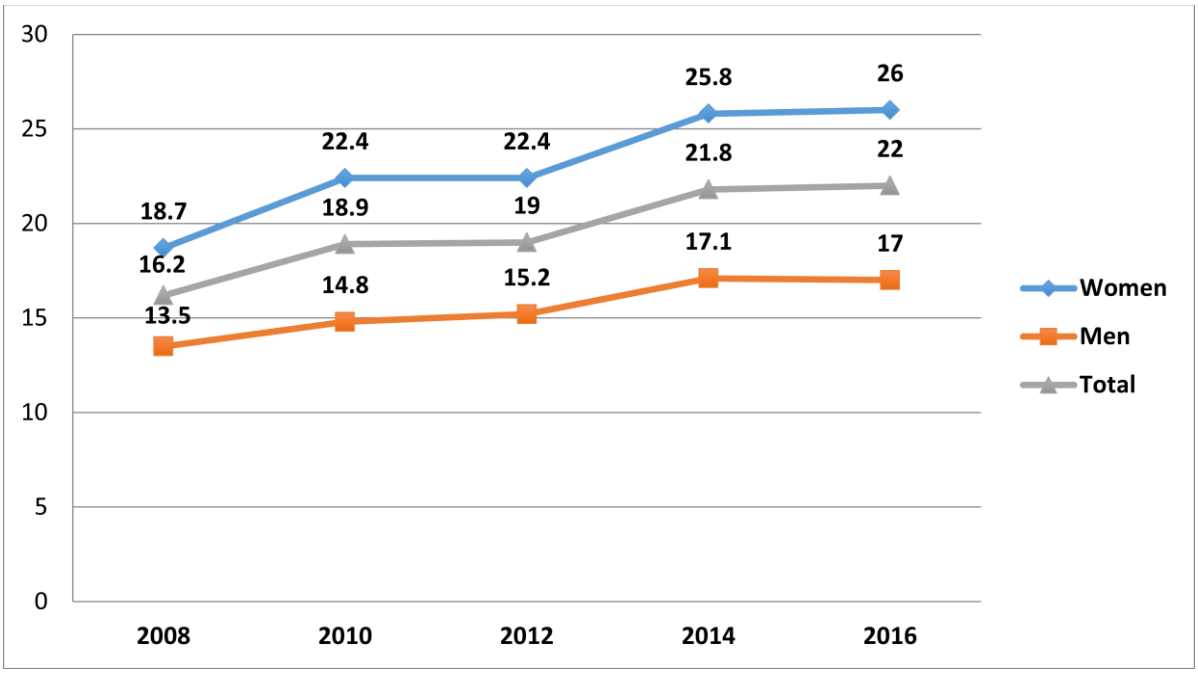

Figure 1. The trends of prevalence of obesity in Turkey from 2008 to 2016

reported to increase as BMI increased (18)

In Turkish Health Research Study, 10-minute walk daily, moderate and vigorous activity rates in obese and under weight individuals are lower than normal and overweight individuals. Physical activity level was found to be correlated with obesity rate. A study conducted in South Africa supports Turkish Health Research Study, due to the fact that the level of physical activity in obese individuals (> 30.0) is lower than in under weight individuals (19).

Conclusions

As in other studies, our study demonstrated alarming rates of obesity particularly among women, among the population 55 to 64 years of age regardless of gender, which were closely associated with low education and income levels. Obesity is one of the leading major public health problems in Turkey and worldwide. It is crucial to gain healthy lifestyle behaviors within the society and to plan basic strategies and activities within the health policies of countries for this problems. Programs and campaigns that are organized for struggling with obesity are various. Some strategic plans have been established for diverse risk groups and they are still in progress. In terms of achieving success in the attempts, it is important that plans especially made for high-risk groups should be based on cross-sectoral collaboration at an international level, including relevant partner groups such as non-governmental organizations, media and professional organizations. In addition, more research is needed to investigate obesity-related major risk factors and to develop programs for preventing obesity in Turkey.

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Conflict of Interest

There are no conflicts of interest.

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