

Prevalence of Normal Weight Obesity in the Turkish Population: A Preliminary Report

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Research Article

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Abstract

BACKGROUND.

Obesity is a chronic, recurrent, and progressive disease that impairs health due to abnormal accumulation of adipose tissue. One of the most commonly used methods for the assessment of obesity is the Body Mass Index (BMI), and individuals with a BMI value of $\geq 30 \text{ kg/m}^2$ are defined as "obese." However, BMI alone is not always sufficient to characterize obesity. Individuals who fall within the normal BMI range ($18.5\text{--}24.9 \text{ kg/m}^2$) but have a high body fat percentage are classified as having Normal Weight Obesity.

AIM.

The aim of this cross-sectional study is to determine the prevalence of normal-weight obesity in the Turkish population by evaluating body fat percentage among individuals within the normal BMI range.

MATERIALS AND METHODS.

This cross-sectional analytical study was conducted on 683 volunteer participants (212 men, 471 women) who applied to a Family Medicine outpatient clinic. Body fat percentage was assessed using a Tanita BC601 bioelectrical impedance analyzer. Total body fat percentage of 35% and above in women and 25% and above in men was considered normal weight obesity.

RESULTS.

According to our findings, the prevalence of normal-weight obesity in the Turkish population was determined to be 28.4%. When evaluated according to gender, the frequency of normal-weight obesity was found to be 37.7% in women and 3.8% in men. Accordingly, normal-weight obesity is much more common in women than in men. In addition, waist circumference, waist-to-hip ratio, and visceral fat levels were significantly higher in the normal-weight obesity group ($p < 0.05$).

CONCLUSION.

Normal-weight obesity appears to have a considerable prevalence in the Turkish population. These findings highlight the need to consider not only BMI but also body fat percentage and distribution in the assessment of obesity.

1. RATIONALE

Obesity is a chronic, recurrent, and progressive disease that impairs health due to abnormal accumulation of adipose tissue. The World Health Organization (WHO) defines obesity as one of the most important public health problems of the 21st century. Over the past four decades, the prevalence of obesity has increased at least threefold, and it is currently estimated that more than 1 billion individuals worldwide are obese[1].

According to the WHO European Region Obesity Report 2022, Turkey is among the countries with the highest obesity rates in the region. The findings indicate that more than 65% of the adult population in Turkey is overweight or obese[2]. Furthermore, when obesity prevalence is analyzed by sex, higher rates are observed in women (39.1%) compared to men (24.6%)[3].

One of the most commonly used criteria for defining obesity is the Body Mass Index (BMI). However, BMI does not always adequately reflect body composition. In particular, BMI values can be misleading in athletes with high muscle mass, in elderly individuals with sarcopenia, and in clinical conditions that alter body fluid balance. Moreover, BMI does not provide information about the distribution of adipose tissue and is therefore insufficient in distinguishing obesity phenotypes. For this reason, additional anthropometric and metabolic parameters are needed alongside BMI to define obesity. There are alternative anthropometric methods used in the assessment of obesity, which are waist circumference, body fat percentage, and metabolic indicators are among the measures that more accurately demonstrate obesity-related risks. In addition, total fat mass, visceral fat amount, waist-to-hip ratio, waist-to-height ratio, neck circumference, skinfold thickness, and wrist circumference[1]. In conclusion, obesity is a complex clinical condition that cannot be evaluated using a single measurement method and must be approached in a multidimensional and comprehensive manner.

Although their BMI values fall within the normal range ($18.5\text{--}24.9\text{ kg/m}^2$), individuals with high body fat percentage are classified in the literature as having “Normal Weight Obesity (NWO).” Despite appearing to be of normal weight, these individuals are associated with metabolic syndrome, insulin resistance, dyslipidemia, and an increased risk of cardiovascular disease. The concept of NWO originates from Ruderman et al., who in 1981 defined individuals as “metabolically obese normal weight (MONW).” Ruderman demonstrated that individuals with normal BMI but metabolic risk profiles resembling obesity do exist, and it was emphasized that relying solely on BMI is insufficient to detect metabolically unhealthy individuals. Thus, it has been proposed that even normal-weight individuals constitute a hidden risk group and that both body composition and metabolic markers should be considered together in the evaluation of obesity[4].

The “Normal Weight Obesity Syndrome” was first defined in 2007 by De Lorenzo and colleagues. According to this definition, individuals with a BMI $< 25\text{ kg/m}^2$ but a body fat percentage greater than 30% are classified as NWO. MONW and NWO are concepts that indicate similar phenotypes but differ in certain aspects. While MONW refers to the presence of metabolic syndrome components in normal-weight individuals, NWO describes individuals who do not yet have overt metabolic syndrome but are characterized by a high body fat percentage ($> 30\%$), reduced lean mass, and early inflammatory

changes. Accordingly, MONW represents a distinct subgroup within the NWO spectrum, and differentiating these two phenotypes is crucial for both conceptual understanding and clinical practice[4–7].

There is still no full consensus on the boundaries and diagnostic criteria of the NWO concept in the literature. The threshold values used for body fat percentage vary according to sex, age, and ethnic groups, while the measurement methods employed (DXA, BIA, CT) differ from study to study. This reduces the comparability of epidemiological data and complicates the standardization of diagnostic criteria. Studies in the literature indicate that the prevalence of NWO varies across different populations and is generally observed more frequently in women. Previous studies have suggested that a body fat percentage greater than 25% in men and 35% in women represents the threshold for diagnosing obesity; these cutoff values were also adopted in 2004 by the American Association of Clinical Endocrinologists/American College of Endocrinology (AACE/ACE). In some studies, a body fat percentage of 30–35% for women and 25–30% for men has been accepted as the threshold value. Furthermore, environmental, cultural, and genetic factors may influence the prevalence of NWO, and therefore, it may be observed at different rates in different populations. Based on our literature review, no study has investigated the prevalence or sex-specific distribution of NWO in Türkiye[8–17].

2. AIM OF THE STUDY

In our study, the aim was to determine the prevalence of NWO in the Turkish population by evaluating body fat percentage among individuals with a body mass index within the normal range, and to compare total body fat percentages between sexes. Furthermore, the data obtained may contribute to the development of bioimpedance-based screening algorithms that can be integrated into clinical practice, the establishment of national screening protocols in healthcare institutions, and the shaping of gender-sensitive health policies. Early recognition of NWO is expected to prevent obesity-related cardiometabolic diseases, reduce healthcare expenditures, and decrease long-term workforce loss.

3. MATERIALS AND METHODS

This was a cross-sectional analytical study.

Site and time of the study

Study site. Study was conducted at the family medicine outpatient clinic of Buca Seyfi Demirsoy Training and Research Hospital.

Time of the study. The study was conducted between November 1, 2023, and August 1, 2025.

Study populations

Inclusion criteria: Volunteers aged 18 years and older,

Exclusion criteria: Participants with chronic diseases, pregnancy, or menopause were excluded.

Sampling method from the study population

According to the Turkey Health Survey (2022) data, the proportion of normal-weight women and men aged 15 and over is reported as 40.6% for both sexes. According to the Address-Based Population Registration System results, in 2022, the female population was 42 575 441 and the male population was 42 704 112. Based on this data, the sample size calculated using Raosoft.com's sample size calculation method is 387 people, with a 5% margin of error, a 95% confidence interval, and a significance level of $p = 0.05$.

Study design

This study is a single-center, observational, single-sample, uncontrolled, and non-comparative cross-sectional study.

Methods

Body composition was assessed using the Tanita BC-601 bioimpedance device, which operates based on the bioelectrical impedance analysis (BIA) principle, estimating body fat, muscle mass, and total body water by measuring the resistance and reactance of body tissues to a low, safe electrical current.

According to literature, NWO was defined as a BMI between 18.5 and 24.9 kg/m² and a total body fat percentage $\geq 35\%$ in women and $\geq 25\%$ in men[9, 11, 14, 15, 17].

Statistical analysis

Data analysis was performed using IBM SPSS version 26. The suitability of continuous variables to a normal distribution was tested with the Shapiro-Wilk test. As the data were non-normally distributed, non-parametric tests were used. The Mann-Whitney U test was employed for comparisons between independent groups, while the Wilcoxon signed-rank test was applied for repeated measurements. Distribution of categorical variables was analyzed using Pearson's chi-squared test or Fisher's exact test. A value of $p < 0.05$ was considered statistically significant, and all tests were performed two-tailed.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Izmir Buca Seyfi Demirsoy Training and Research Hospital (Approval No: 2023/167, Date: 27.09.2023). Written informed consent was obtained from all participants.

4. RESULTS

A total of 683 individuals participated in the study, including 471 women and 212 men. Descriptive statistics showed that the mean age of participants was 25.86 ± 9.05 years (18–65). Detailed analyses were performed on the data of 387 participants classified as normal weight (Table 1).

When examining the BMI distribution, it was found that 62.6% of the participants were in the normal weight category, 35 % were in the overweight/obese group, and a very small proportion were underweighted (Table 2).

It was determined that 91.2% (n=618) of the participants did not have any chronic disease

Among individuals with a normal BMI range (N = 387), the proportion with a high body fat percentage was calculated as 28.4% (N = 110). NWO was found to be much more prevalent in women (37.7%) compared to men (3.8%). A significant association was observed between female sex and NWO status ($\chi^2 = 43.60$; $p < 0.001$). In individuals with NWO, waist circumference, waist-to-hip ratio, and visceral fat levels were significantly higher (Table 3).

In the comparison of anthropometric and body composition variables by sex among the individuals included in the study, men were found to have a younger mean age, as well as significantly higher height and weight compared to women. Men also had higher BMI, waist circumference, hip circumference, and waist-to-hip ratio than women. On the other hand, women had a significantly higher total body fat percentage, whereas men had higher visceral fat levels. These results indicate that women have greater overall body fat, while men show more pronounced abdominal adiposity and visceral fat accumulation (Table 4).

5. DISCUSSION

Representativeness of Samples

In this study, the prevalence of normal-weight obesity (NWO) was evaluated in a Turkish population, and the anthropometric and body composition characteristics of 683 participants were recorded. To minimize the confounding effects of fat distribution differences and to more accurately reflect the prevalence of NWO, individuals with chronic diseases and postmenopausal women were excluded. Analyses showed that 62.6% of participants had a BMI within the normal range, and among this group, 28.4% had a high total body fat percentage.

Comparison with other publications

According to our research, the number of studies investigating the prevalence of NWO in the literature is limited. In a recent review by Angriani et al. (2024), studies conducted over the last decade were analyzed, and the prevalence of NWO was reported to range between 10% and 46%[8]. A nationwide study conducted in China reported an overall prevalence of 4.76%[18]. De Lorenzo et al. (2016) estimated the global prevalence of NWO to be approximately 10%, emphasizing that it is significantly higher in women than in men[19]. Similarly, Wijayatunga et al. (2019) reported that the prevalence of

NWO varies between 4.5% and 22%, depending on study design and population characteristics[15]. Correa-Rodríguez et al. (2020) found a prevalence of 29.1% among young Colombian adults, which is consistent with our findings[20].

Studies conducted in Asian countries also demonstrate a wide variation in NWO prevalence. Jia et al. (2018) analyzed data from 23,748 individuals (9,633 men and 14,115 women) in the China National Diabetes and Metabolic Disorders Study and reported NWO prevalence rates of 9.5% in men and 6.06% in women. Kapoor et al. found a prevalence of 31.7% in India, whereas Moy et al. reported a rate of 19.8% among 6,854 women in Malaysia. In Korea, Mee Kyoung Kim et al. found a prevalence of approximately 32%, and a study among government physicians in India revealed a remarkably high rate of 48.7%. Variations in reported prevalence are thought to result from differences in study populations, body fat percentage cut-off values, and measurement techniques[10, 18, 21–23].

Research focusing on older adults indicates that NWO prevalence varies depending on diagnostic criteria. Using data from the NHANES III (1988–1994) survey, the prevalence of NWO among individuals aged 60 years and older ranged between 20% and 31%, with rates of 21.4–27.9% in men and 20.4–31.3% in women. In that study, individuals with NWO exhibited higher rates of dyslipidemia, hypertension, and reduced muscle mass, and NWO was shown to increase the risk of cardiovascular mortality independently of BMI[24]. Similarly, a study from Switzerland reported that NWO prevalence remained below 1% among men but increased with age among women, ranging from 1.4% to 27.8%[25].

When examining sex differences, most studies indicate that NWO is more common among women. In an Israeli study of 1,779 adults, 26% of men and 38% of women were classified as having NWO based on excess body fat[9]. Oliveros et al. (2014) reported NWO prevalence ranging from 2–28% in women and below 3% in men[7]. In our study, the prevalence of NWO was 37.7% in women and 3.8% in men, showing a clear predominance among females, consistent with previous findings.

These results suggest that NWO occurs more frequently in women and that sex may be an important determinant. Previous research has shown that women generally have a higher total body fat percentage, whereas men exhibit greater visceral adiposity. Our findings are consistent with this evidence. The higher NWO prevalence in women may be explained by biological and hormonal factors. Women physiologically possess more adipose tissue, which is mainly stored in peripheral regions, whereas men tend to accumulate fat viscerally. Estrogen promotes subcutaneous fat storage and suppresses visceral adiposity; however, declining estrogen levels after menopause lead to increased visceral fat accumulation and a higher metabolic risk. These biological differences may contribute to higher total fat mass in women and earlier onset of metabolic complications in men[26].

In our study, individuals classified as NWO had significantly higher waist circumference, waist-to-hip ratio, and visceral fat levels. This finding indicates that metabolic risks can be elevated even in individuals with normal body weight. It also supports the notion that central adiposity is an early indicator of cardiometabolic risk. Central obesity is typically defined by waist circumference, one of the best-known components of the metabolic syndrome. According to globally accepted cut-off values,

central obesity is defined as a waist circumference exceeding 102 cm in men and 88 cm in women. The International Diabetes Federation (IDF) recommends the use of population-specific waist circumference thresholds. In Turkey, large-scale community-based studies such as TEKHARF, TURDEP-II, and the Metabolic Syndrome Study have defined these thresholds as 96 cm for men and 91 cm for women. Waist circumferences above these limits are significantly associated with cardiovascular diseases and clustering of multiple metabolic risk factors. Therefore, evaluating obesity solely based on BMI does not adequately reflect true metabolic risk[27].

Recent multicenter studies have emphasized that BMI alone is insufficient to capture metabolic risk and that body composition and fat distribution assessments are essential. The literature consistently demonstrates that the NWO phenotype is closely associated with cardiometabolic abnormalities. Individuals with a normal BMI but elevated body fat percentage show significantly higher rates of dyslipidemia, metabolic syndrome, cardiovascular risk, and mortality. Furthermore, visceral fat accumulation has been identified as a strong predictor of metabolic syndrome even among metabolically healthy individuals. The central obesity frequently observed in NWO reflects increased visceral fat, which places individuals at a higher risk of cardiometabolic diseases and mortality—a risk comparable to or even greater than that observed in overweight or obese individuals[9–11, 14, 16, 17, 19, 28, 29].

Clinical significance of results

Taken together, these findings highlight the critical importance of early identification of the NWO phenotype for risk stratification and targeted lifestyle interventions. This underscores the clinical relevance of body fat distribution and visceral adiposity, suggesting that early detection of NWO could play a key role in preventing cardiometabolic complications.

Study limitations,

The main limitations of our study include its single-centre and cross-sectional design. However, the relatively large sample size increases the reliability and generalizability of the results. Based on an extensive literature review, this appears to be the first study to report NWO prevalence and related anthropometric characteristics in the Turkish population. Therefore, it fills an important gap in the existing literature and provides a foundation for future epidemiological and clinical research in this area.

Next studies

These data should be supported by future large-scale, multicenter studies.

6. CONCLUSION

Our study is the first to investigate the prevalence of NWO in Türkiye, making it a unique and pioneering study. Our findings demonstrate the significant prevalence of NWO in Türkiye and are consistent with the literature. NWO was significantly more common in women. Consequently, individuals with normal body

weight may appear healthy but still be at increased cardiometabolic risk. Therefore, obesity assessments should not be based solely on BMI; body fat percentage and fat distribution should also be routinely assessed. Obesity should not be limited to excess body weight but should also encompass total fat mass and its distribution.

In this context, the use of practical methods such as bioelectrical impedance analysis in primary care, the development of screening programs for at-risk groups, and raising awareness that obesity is not synonymous with body weight are crucial. Lifestyle modifications aimed at reducing cardiometabolic risk should be encouraged, and large-scale national studies are needed to standardize diagnostic criteria for NWO. Such a comprehensive approach will facilitate early identification of cardiometabolic risks and timely implementation of appropriate interventions.

Declarations

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Conflict of interest. "The authors declare no obvious and potential conflicts of interest related to the content of this article."

Contribution of authors.

Hakan Gülmez 1 - contribution of author 1 according to criterion 1, significant contributions to the conceptualization or design, analysis, or interpretation of the study, according to criterion 2, drafting the study and critically reviewing it for significant intellectual content;

Hicret Cin 2 - contribution of author 2 according to criterion 1, significant contributions to the collection, analysis, or interpretation of data for the study, according to criterion 2, drafting the study;

According to criterion 3; AND according to criterion 4;

"All of the authors read and approved the final version of the manuscript before publication, agreed to be responsible for all aspects of the work, implying proper examination and resolution of issues relating to the accuracy or integrity of any part of the work".

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Tables

Table 1. Descriptive characteristics of participants with normal body mass index

	N	Min.	Max.	Mean	SD
Age	387	18	65	25.49	8.42
Metabolic Age	313	12	50	23.26	8.96
Height	387	147	196	167.75	9.01
Weight	387	41.62	95.02	61.87	9.32
BMI	387	18.5	24.99	21.92	1.98
Waist Circumference	381	54	105	74.52	9.46
Hip Circumference	381	75	175	96.97	7.47
Waist-to-Hip Ratio	381	0.57	1.08	0.76	0.07
Total Body Fat Percentage	387	7.2	40.7	25.31	6.94
Visceral Fat Level	386	1	21	2.50	1.90

BMI: Body Mass Index

Table 2. Distribution of participants without chronic diseases by body mass index

		N	%
BMI	Underweight	15	2.4
	Normal weight	387	62.6
	Overweight	216	35
	Total	618	100

BMI: Body Mass Index

Table 3. Distribution of normal weight obesity by sex

			NWO		Total
			None	Present	
Sex	Female	N	175	106	281
		%	62.3	37.7	100
	Male	N	102	4	106
		%	96.2	3.8	100
Total		N	277	110	387
		%	71.6	28.4	100

$X^2=43.60$ $p<0.001$

Table 4. Comparison of anthropometric and body composition variables by sex among the study participants

	Sex	Mean	SD	p value
Age	Female	26.27	8.69	0.003*
	Male	23.42	7.31	
Metabolic Age	Female	23.50	8.87	0.45
	Male	22.67	9.20	
Height	Female	163.54	5.62	0.000**
	Male	178.91	6.41	
Weight	Female	58.11	6.28	0.000**
	Male	71.84	8.71	
BMI	Female	21.72	1.95	0.002*
	Male	22.43	1.97	
Waist Circumference	Female	71.24	7.62	0.000**
	Male	83.03	8.43	
Hip Circumference	Female	96.34	7.88	0.008*
	Male	98.61	6.03	
Waist-to-Hip Ratio	Female	0.74	0.06	0.000**
	Male	0.84	0.06	
Total Body Fat	Female	28.26	5.09	0.000**
	Male	17.49	4.81	
Visceral Fat	Female	2.25	1.78	0.000**
	Male	3.15	2.05	

BMI: Body Mass Index *p<0.05 **p<0.001