

# Breif Communication:

## The Prevalence of Metabolically Healthy and Unhealthy Obesity Among Bariatric Surgery Candidates, According to ATP III Criteria



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## ABSTRACT

**Background:** Previous studies have demonstrated that patients with obesity can be metabolically healthy. However, little is known about the healthy or unhealthy metabolic status of patients undergoing bariatric surgery. This study, therefore, assesses the prevalence of Metabolically Healthy Obesity (MHO) and Unhealthy Obesity (MUO) among bariatric surgery candidates.

**Methods and Materials:** The study involved 713 bariatric surgery candidates (580 women and 133 men; age range: 18-69 years). MHO and MUO were defined according to The National Cholesterol Education Program-Adult Treatment Panel III (ATP III).

**Results:** The Mean±SD age, weight, body mass index, waist, and hip circumference of the patients were 40.44±10.26 years, 127.15±22.15 kg, 164.33±8.85 cm, 46.90±5.79 kg/m<sup>2</sup>, 122.57±13.93 cm, and 140.10±12.40 cm, respectively. A total of 318 patients (44.6%) were classified as MHO and 395 (55.4%) as MUO. A higher percentage of participants aged 40 years and older suffered from unhealthy metabolic status (61%).

**Conclusion:** A large percentage of bariatric surgery candidates are metabolically healthy. Additionally, the prevalence of MHO was higher at younger ages.

## 1. Introduction

The rising prevalence of obesity globally [1] has increased the healthcare burdens of various comorbidities, such as type 2 diabetes, hypertension, dyslipidemia, cardiovascular disease, and cancers [2]. In this regard, bariatric surgery has been proposed as a well-understood,

effective method for treating morbid obesity [3]. However, the effectiveness of surgical techniques for obesity seems to differ between patients with obesity. Previous evidence has shown that patients with Metabolically Healthy Obesity (MHO), compared to Metabolically Unhealthy Obesity (MUO), had a better prognosis for morbidity and mortality [4]. Numerous criteria, such as Adult Treatment Panel III (ATP III), have been proposed to identify MHO and MUO

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**Table 1.** Prevalence of metabolically healthy and unhealthy obesity by sex, age, and body mass index according to ATP III Criteria

Metabolic Health Status	Sex		P	Age, y		P	Body Mass Index, kg/m <sup>2</sup>				P
	Female (n=580)	Male (n=133)		<40 (n=364)	≥40 (n=349)		40-45 (n=332)	45-50 (n=190)	50-55 (n=119)	≥55 (n=72)	
MHO, %	43.6	48.9	0.63	50	39	0.003	45.8	45.3	41.2	43.1	0.84
MUO, %	56.4	51.1		50	61		54.2	54.7	58.8	56.9	

P-values were derived from the Chi-square test; P-values less than 0.05 were considered statistically significant.



[4]. According to various studies, the MHO prevalence ranges from 1.1% to 28.5% [5]. However, little is known with regard to the healthy or unhealthy metabolic status in patients undergoing bariatric surgery.

This study, therefore, aimed to assess the prevalence rates of MHO and MUO among bariatric surgery candidates. Additionally, the prevalence of MHO and MUO was also evaluated in relation to sex, age, and Body Mass Index (BMI). Knowing this prevalence may help clinicians to better predict the expected morbidity and mortality in their patients. Such scientific, evidence-based discussions with patients before the operation will assist in adjusting expectations based on their metabolic state.

## 2. Materials and Methods

### Study participants

This retrospective study included 713 bariatric surgery candidates (age range: 18-69 years) referred to the Obesity Clinic of Hazrat-e Rasool General Hospital, Tehran, Iran between November 2010 and September 2017. The patients older than 17 years and BMI ≥40 kg/m<sup>2</sup> or BMI ≥35 kg/m<sup>2</sup> with any comorbidities were included in the study. However, patients with neurologic or psychiatric conditions, substance abuse, cancer, chronic rheumatoid disease, chronic kidney disease, immune diseases, acute infective disorders, and those who took steroid immunosuppressive drugs (corticosteroids) and women who are lactating or pregnant were excluded. This study was conducted in accordance with the Helsinki Declaration and approved by the Research Ethics Committee of Iran University of Medical Sciences, Tehran, Iran (Ethical number: IR.IUMS.REC.13970134).

### Data Collection

Basic characteristics (age, sex, occupation, education, marital status, smoking, and drinking alcohol), anthropometric data (weight, height, BMI, waist and hip circumference), and biochemical parameters were drawn from the

National Obesity Surgery Database (<http://obesitysurgery.ir/>). Details of collecting demographic data and measuring anthropometric indices and biochemical parameters have previously been published [6].

### Definition of metabolically healthy and unhealthy obesity

The National Cholesterol Education Program-Adult Treatment Panel III (ATP III) criteria were used to classify MHO and MUO [4]. Accordingly, having at least three indicators out of five following criteria is defined as MUO: 1- waist circumference >102 cm in men and > 88 cm in women, 2- systolic blood pressure ≥130 mm Hg and or diastolic blood pressure ≥ 85 mm Hg or conventional blood pressure treatment, 3-triglyceride ≥1.7 mmol/L or treatment, 4-HDL <1.04 mmol/L in men and <1.29 mmol/L in women and 5- fasting blood glucose ≥5.6 mmol/L or treatment.

### Data analysis

All eligible patients who had all five components of ATP III criteria were entered into the study. SPSS v. 22. (Armonk, NY: IBM Corp) was used for statistical analysis of the data. Descriptive statistics were presented as Mean±SD, and categorical data were reported as frequencies and percentages by MHO and MUO subgroups. The Chi-square test was used to determine the differences between groups. P values less than 0.05 were considered statistically significant.

## 3. Results

### Basic patient characteristics

A total of 713 patients (580 women and 133 men) were enrolled in the study. The Mean±SD patients' age, weight, height, Body Mass Index (BMI), waist, and hip circumference were 40.44±10.26 years, 127.15±22.15 kg, 164.33±8.85 cm, 46.90±5.79 kg/m<sup>2</sup>, 122.57±13.93 cm, and 140.10±12.40 cm, respectively. About 70.5% of the samples were married, and 58.6% had an education level

of 7 to 12 years. Additionally, the majority did not smoke (89.5%) or drink alcohol (85%).

#### Prevalence rates of MHO and MUO

Among all bariatric surgery candidates, 318 patients (44.6%) were classified as MHO. However, 395 (55.4%) were classified as MUO. [Table 1](#) presents the prevalence rates of MHO and MUO in relation to sex, age, and BMI.

#### 4. Discussion

The present study investigated the prevalence rates of MHO and MUO among bariatric surgery candidates based on ATP III criteria. The main result indicated that a significant percentage of patients were metabolically healthy (44.6%). However, 55.4% of them were MUO. Additionally, the prevalence of MUO was higher in the age group of 40 years and older (61%) than in patients under 40.

The prevalence of MHO has been reported variously in different populations with obesity, based on several criteria [7, 8]. There is no consensus on a conclusive definition of MHO. In this regard, one of the approaches used is having at least three out of five criteria of abdominal obesity, hypertension, low level of high-density lipoprotein cholesterol, high level of triglyceride, and high level of blood sugar (based on ATP III) [4, 9]. Accordingly, a lower prevalence of MHO was observed in other studies than in the present study [7]. This inconsistency may be due to differences in race (European vs Asian), the number of participants in the two studies, and BMI.

Regarding BMI, few studies are available to assess the prevalence of MHO in bariatric surgery candidates. Barzin et al. showed that 36.2% of patients with morbid obesity were in the MHO group, which was close to the result of the present study (44.6%). However, the criteria they used to define MHO were different from ours (the joint interim statement [JIS] vs ATP III) [10]. On the other hand, the present study demonstrated that MUO was higher in the age group of 40 years and older than in patients under 40, which was consistent with previous studies [10]. The main strength of the present study is that it adds to the low previous knowledge regarding the prevalence of MHO and MUO in patients undergoing bariatric surgery. The current findings add to the growing literature in this field. However, the single-center nature of this study may be considered a limitation. It is worth noting that patients are referred to this clinic from all over the country so that the results may be generalizable with minimal bias.

#### 5. Conclusion

This study showed that a large percentage of bariatric surgery candidates are metabolically healthy. Furthermore, younger age is related to better metabolic control in patients undergoing weight-loss surgery.

#### Ethical Considerations

##### Compliance with ethical guidelines

This study was approved by the Research Ethics Committee of Iran University of Medical Sciences (Ethics number: IR.IUMS.REC.13970134). All ethical principles are considered in this article. The participants were informed about the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information. They were free to leave the study whenever they wished, and if desired, the research results would be available to them. The Helsinki declaration (Ethical principles in medical research on humans) was also observed.

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##### Authors' contributions

All authors equally contributed to preparing this article.

##### Conflict of interest

The authors declared no conflict of interest.

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