



## BODY MASS INDEX (BMI) - PREDICTOR OF DISEASES ONSET AND REGULATOR OF PREVENTION?

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### ABSTRACT:

The Body Mass Index (BMI) is a well-known tool for measuring normal, healthy weight. Nowadays, we can also use it as a prognostic factor for various diseases.

**Purpose:** Our study aims to confirm or decline the correlation between body mass index and the onset of different diseases.

**Methods:** The study was conducted among a random sample of 550 people (324 women and 226 men) from the district of Stara Zagora, Republic of Bulgaria. The participants in the study were aged between 18 and 65. The connection between BMI and the occurrence of diseases of different systems has been researched. A statistically significant relationship was found at  $p < 0.05$ . The statistically significant influence of BMI on the occurrence of diseases is proved by the results of the ANOVA procedure.

**Results:** The results give us reason to believe that not only obesity but also overweight is a risk of cardiovascular disease. This is evidenced by our study, according to which people with the highest average BMI ( $BMI = 28.72 \text{ kg / m}^2$ ) have diseases of the cardiovascular system. People with a BMI around and above  $25.87 \text{ kg / m}^2$  often suffer from diseases of the endocrine system, and those with a BMI around  $25.60 \text{ kg / m}^2$  are at risk for diseases of the musculoskeletal system.

**Conclusions:** BMI would find its daily implementation in the activities of every physician working in every field of medicine. BMI can be used as a tool to predict the onset of disease and a regulator of prevention.

**Keywords:** body mass index, overweight, obesity, diseases prevention,

### INTRODUCTION

The body mass index (BMI) is a well-known anthropometric indicator used for the evaluation of normal, healthy weight [1,2]. Nowadays, we can also use it as a prognostic factor for the occurrence of various diseases. Many authors describe obesity as a worldwide epidemic that leads to the occurrence of many diseases [3]. Adequate assessment of body mass index and reporting of its values can be implemented as a means to deal with this global problem. BMI also turns out to be a socio-economic indicator. Data shows that obesity increases morbidity and reduces the productivity and incomes of workers.

Nowadays, BMI is related to the overall health of the population, considered in all its aspects [4, 5].

The purpose of our study is to confirm or deny the existence of the correlation between body mass index and the occurrence of diseases of various systems.

### MATERIALS AND METHODS:

We conducted a study involving 550 people (324 women and 226 men) in the Stara Zagora district, Republic of Bulgaria. The sample is random. The study participants were between the ages of 18 and 65. The height of the subjects was measured to the nearest 1 mm using a portable stadiometer. The weight was measured with a calibrated electronic scale with an accuracy of 0.1 kg. For the accurate measurement of height and weight, WHO recommendations were followed [6].

A questionnaire survey was conducted to determine the presence of diseases. The disease survey was based on the International Classification of Diseases, 10th Revision (ICD 10). For more reliable results, the survey was conducted by an interviewer. Participation in the study was anonymous and voluntary after prior informed consent. Based on actual measurements, BMI was calculated using the standard formula:

$$BMI = \text{Weight (kg)} / \text{Height}^2 (\text{m}^2)$$

The interpretation of the results after measurements for the presence of underweight, normal weight, overweight, or obesity was determined based on established WHO criteria. The data were processed with SPSS Statistics, version 26. Descriptive analysis was used to describe and analyze the distribution. The results are presented as

arithmetic mean (Mean), standard deviation (Std. Deviation), and average error (Std. Error Mean). An analysis of variance was also performed to determine the variation of the studied indicators through confidence intervals. The analysis of variance was performed with ANOVA to determine the statistical reliability of the influence of BMI on the occurrence of diseases.

## RESULTS:

The correlation between BMI and the occurrence of diseases of various systems has been studied. A statistically significant relationship was established at  $p < 0.05$ . A statistically significant influence of BMI on the occurrence of diseases is proven by the results of the ANOVA procedure (table 1).

**Table 1.** Influence of BMI on diseases according to ICD-10

Variable	Analysis of Variance. Marked effects are significant at $p < 0,05000$							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
BMI	755,7152	10	75,5715	4771,804	167	28,5737	2,6448	0,0051

Our study shows that there are no subjects with a BMI over 30 in the study. A large-scale study of 260,000 people in the UK shows that people with severe obesity and a BMI over 33.8 kg/m<sup>2</sup> are at the greatest risk of cardiovascular disease, such as heart failure. This leads to shorter life expectancy and increased mortality [7]. The results give us reason to consider that not only obesity but also overweight is a risk factor for the occurrence of diseases of the cardiovascular system. This is also proven by our research, according to which people with the highest average value of BMI (BMI=28.72 kg/m<sup>2</sup>) have diseases of the cardiovascular system. The present study confirms the results of a study by Khan et al. in the USA, which proves the correlation between increased BMI or overweight and the significant risk of developing cardiovascular diseases at an earlier age and deterioration of the quality of life [8].

Overweight participants in the study with an aver-

age value of BMI around 26.75 kg/m<sup>2</sup> most often suffer from diseases of the respiratory system. A typical example of such a disease is chronic obstructive pulmonary disease (COPD). A study by German scientists shows that reducing weight and BMI can improve the condition of people with severe to moderate COPD [9].

People with a BMI around and above 25.87 kg/m<sup>2</sup> often suffer from diseases of the endocrine system, and those with a BMI around 25.60 kg/m<sup>2</sup> are at risk of diseases of the musculoskeletal system. However, these values are not indicative enough because they are slightly above the norm, and there is not such a strong correlation between them and health. No statistically significant relationship was found between BMI and diseases of other systems.

Therefore, respondents with the highest BMI suffer most often from diseases of the cardiovascular, respiratory, endocrine, and musculoskeletal systems, respectively (table 2).

**Table 2.** ICD-10 diseases and high-risk BMI value

Number of the class	Name of the ICD-10 class of diseases	BMI Means	BMI Std. Dev.
IX	Diseases of the circulatory system	28,72	5,2399
X	Diseases of the respiratory system	26,75	5,0385
IV	Endocrine, nutritional or metabolic diseases	25,87	6,0057
XIII	Diseases of the musculoskeletal system or connective tissue	25,6	4,3676
VI	Diseases of the nervous system	23,69	10,8465
XIX	Injury, poisoning, or certain other consequences of external causes	23,57	4,6533
V	Mental, behavioral or neurodevelopmental disorders	23,48	7,4342
XI	Diseases of the digestive system	23,27	2,6904
II	Neoplasms	21,39	2,1912
XIV	Diseases of the genitourinary system	21,25	4,6411

The present study confirmed the existence of a correlation between body mass index and the occurrence of diseases. This gives us reason to believe that reducing weight and maintaining BMI in optimal values is a good strategy for reducing the risk of diseases, primarily of the cardiovascular and respiratory and other systems, but fu-

ture studies are needed to clarify, whether overweight and obesity are a cause or effect of some of the diseases where they occur more frequently. While BMI is a widely used measure, it has some disadvantages and limitations. BMI is a direct calculation that includes the measurement of height and weight, so it cannot measure a person's body

fat percentage. This is especially a problem for athletes, people and higher-than-average muscle mass and those with normal weight but with visceral obesity.

One way to address this discrepancy is to use BMI in conjunction with waist circumference to increase the validity and accuracy of health indicators for future research.

## DISCUSSION

Body mass index (BMI) is a main tool for monitoring obesity in the population [10]. The measurement of weight and height and the subsequent determination of the body mass index (BMI) makes it possible to assess the risk of various chronic diseases [11]. Most often, BMI is used as a predictor of the risk of developing diabetes, hypertension, depression, and oncological diseases [12-15].

A study by Chinese scientists demonstrated a positive linear correlation between BMI and cardiovascular disease risk among individuals with type 2 diabetes [16]. A study conducted in the USA by Chan et al. among 51,529 men aged 40 to 75 reported an increased risk of developing type II diabetes among those with a BMI greater than 35 kg/m<sup>2</sup> compared to those with a BMI lower than 23 kg/m<sup>2</sup>. These results partially overlap with the data of the present study, according to which people with a BMI over 25.87 kg/m<sup>2</sup> most often suffer from diseases of the endocrine system [17].

A study by Finnish scientists conducted among 17,441 people proved higher BMI values often lead to hypertension among the population. The risk factors for hypertension based on different values of body mass index are as follows: (<25, 25 to 29.9 and ≥30), were 1.00, 1.18, and 1.66 for men (Ptrend<0.001) and 1.00, 1.24, and 1.00, 1.24 and women (Ptrend=0.007), respectively [18]. In ad-

dition to these data, American scientists studied 13,563 healthy men without hypertension. This large-scale study found a strong association between higher BMI and an increased risk of hypertension. For BMI from 22.4 to 23.6; 23.7 to 24.7; 24.8 to 26.4, and >26.4 kg/m<sup>2</sup> are the relative risk with the corresponding values: 1.20 (1.09–1.32), 1.31 (1.19–1.44), 1.56 (1.42–1.72) and 1.85 (1.69–2.03) [19]. These data correspond with our results, according to which people with the highest average value of BMI (BMI=28.72 kg/m<sup>2</sup>) have the greatest risk of diseases of the cardiovascular system.

To reduce the frequency of such conditions and improve the population's health status, preventive measures such as increasing physical activity can be applied to reduce weight and maintain normal values, an effective method suggested by Korean scientists. [20].

## CONCLUSIONS

BMI can be used as an instrument to predict the probability of disease occurrence. This indicator can find its daily application in any field of medicine. The body mass index may, in the future, not only consolidate its current importance in public health but also become a basic tool for disease surveillance, predicting and reducing the incidence of various diseases. BMI can help improve people's quality of life by being a predictor of disease onset and regulator of prevention.

## Abbreviations:

**BMI** – Body mass index

**ICD-10** - International Classification of Diseases, revision 10

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