

# THE RELATIONSHIP OF BODY MASS INDEX TO DIABETES MELLITUS AND PRE-DIABETES

<sup>1</sup>Ema Lumi, <sup>2</sup>Prof.Asc Thanas Furreraj, <sup>3</sup>Entela Puca, <sup>4</sup>Bleritina Oldashi,  
<sup>5</sup>Prof.Asc.Elizana Petrela, <sup>6</sup>Prof. Dr, Agron Ylli

<sup>1</sup>Endocrinologist, Department of Internal Medicine, Regional Hospital "Teni Konomi", Korçe, Albania

<sup>2</sup>Endocrinologist, Endocrine Department, UHC Mother Teresa, Tirana, Albania

<sup>3</sup>Endocrinologist, American Hospital, Tirana, Albania

<sup>4</sup>Endocrinologist, Hygea Hospital, Tirana, Albania

<sup>5</sup>Department of Statistics, UHC Mother Teresa, Tirana, Albania

<sup>6</sup>Head of Endocrine Department, UHC Mother Teresa, Tirana, Albania

---

**Abstract:** There is a close association between obesity and type 2 diabetes. The likelihood and severity of type 2 diabetes are closely linked with body mass index (BMI).

**Aim:** The objectives of this study were to explore the relation between body mass index (BMI) and prevalence of diabetes mellitus.

**Materials and methods:** 86 patients, which were all newly-diagnosed with diabetes mellitus or pre-diabetes, from January until March 2016 in the polyclinic of Korça-Albania, were recruited and evaluated. To evaluate the obesity we used the body mass index (BMI).

**Results:** During the three-months study, 81 people were newly diagnosed with type 2 diabetes mellitus and 5 people with pre-diabetes. Of those, 54 were females (62%), and 32 were males (38%). The mean age of diagnosed people was  $59.6 \pm 10.8$  (SD) years of age. The most affected age with diabetes mellitus was 60-69 with (34% of new cases). The mean BMI among this group of newly diagnosed patients with diabetes mellitus or pre-diabetes, was  $28.8 \pm 3.5$  (SD). The most prevalent was the BMI 25-29.9 kg/m<sup>2</sup> with 45 cases or (52%), followed by BMI 30-34.9 kg/m<sup>2</sup> with 26 cases or (30%). The prevalence of overweight was higher in newly diagnosed patients, than obesity. People diagnosed with diabetes, who had normal BMI values 18-24.9 kg/m<sup>2</sup>, were only 10 cases or (11.6%).

**Conclusions:** Overweight and obesity are major health problems associated with increased risk of diabetes. The prevalence of overweight was higher in newly diagnosed patients, than obesity

**Keywords:** Diabetes Mellitus, Pre-diabetes, Overweight, Obesity, BMI.

---

## 1. INTRODUCTION

The increased risk for type 2 diabetes in individuals with obesity is considerable. In persons aged 20 to 44, obesity is associated with a fourfold increase in the relative risk of diabetes.[1] The most widely used method to gauge obesity is the *body mass index* (BMI),  $\text{weight}/\text{height}^2$  (in kg/m<sup>2</sup>). Using data from the Metropolitan Life Tables, BMIs for the midpoint of all heights and frames among both men and women range from 19 to 26 kg/m<sup>2</sup>. Based on data of substantial morbidity, a BMI of 30 is most commonly used as a threshold for obesity in both men and women.[2] Obesity results in morbidity and mortality largely because of its association with other diseases, including diabetes, hypertension, sleep apnea, endometrial cancer, colon cancer, and gallbladder disease.[3] Most but not all large-scale epidemiologic studies suggest that all-cause, metabolic, cancer, and cardiovascular morbidity begin to rise (albeit at a slow rate) when BMIs are  $\geq 25$ , suggesting that the cutoff for obesity should be lowered. Most authorities use the term *overweight* (rather than obese) to describe individuals with BMIs between 25 and 30.[2]

## 2. MATERIALS AND METHODS

This study included 86 patients, which were all newly diagnosed with diabetes mellitus or pre-diabetes, from January, until March 2016 in the policlinic of Korca-Albania. HbA<sub>1c</sub> and/or fasting glucose and 2h postprandial glucose was used to diagnose Diabetes Mellitus and Pre-diabetes.[4] To evaluate the obesity we used the *body mass index* (BMI), which is equal to weight/height<sup>2</sup> (in kg/m<sup>2</sup>). BMI is used since it provides an estimate of body fat, and is related to risk of disease.[5] A register of new-diagnosed diabetic individuals was opened.

### Classification of Overweight and Obesity by BMI, and Associated Disease Risks

	BMI (kg/m <sup>2</sup> )	Obesity Class	Disease Risk* Relative to Normal Weight
<b>Underweight</b>	< 18.5		-
<b>Normal</b>	18.5–24.9		-
<b>Overweight</b>	25.0–29.9		Increased
<b>Obesity</b>	30.0–34.9	I	High
	35.0–39.9	II	Very High
<b>Extreme Obesity</b>	40.0 +	III	Extremely High

\* Disease risk for type 2 diabetes, hypertension, and CVD.

Source [6]

## 3. STATISTICS

The data were calculated using means and SDs, or numbers and percentages. The relation between variables was expressed as a function of percentage of patients with BMI, age, and gender.

## 4. RESULT

During the three-month study, 81 people were newly diagnosed with type 2 diabetes mellitus and 5 people with pre-diabetes (Impaired glucose tolerance). Among them 54 were females (62%), and 32 were males (38%). *Figure 1*.

The mean age of diagnosed people was  $59.6 \pm 10.8$  (SD) years of age. The most affected age with diabetes mellitus was 60-69 with (34% of new cases), followed by age 50-59 with (29% of new cases), age 40-49 with (20% of new cases), and over 70 years of age (15% of new cases). *Figure 2*.

The mean BMI among this group of newly diagnosed patients with diabetes mellitus or pre-diabetes, was  $28.8 \pm 3.5$  (SD). The most prevalent was the BMI 25-29.9 with 45 cases or (52%), followed by BMI 30-34.9 with 26 cases or (30%). So the prevalence of overweight was higher in newly diagnosed patients, than obesity. People diagnosed with diabetes, who had normal BMI values 18-24.9 were only 10 cases or (11.6%). *Figure 3*.

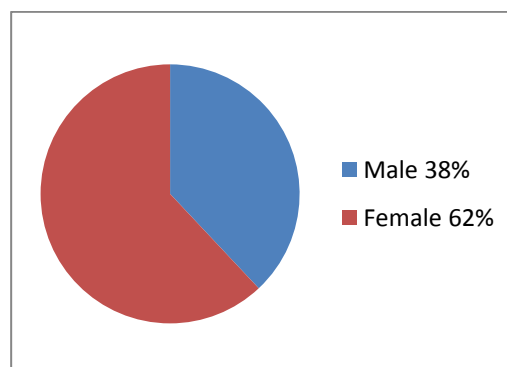


Figure 1: Percentage of diabetic patients according gender

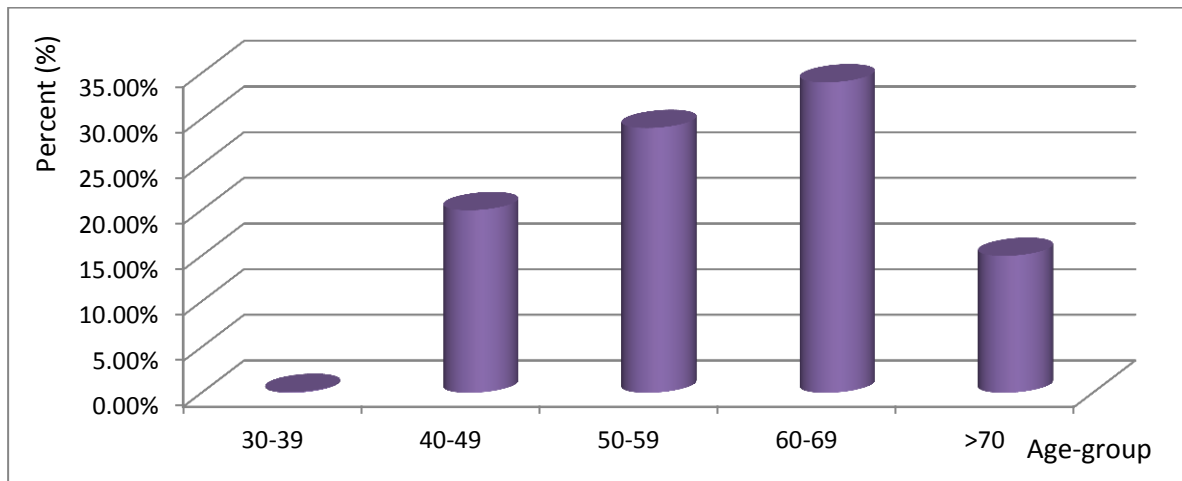


Figure 2: Percentage of diabetic patients according age

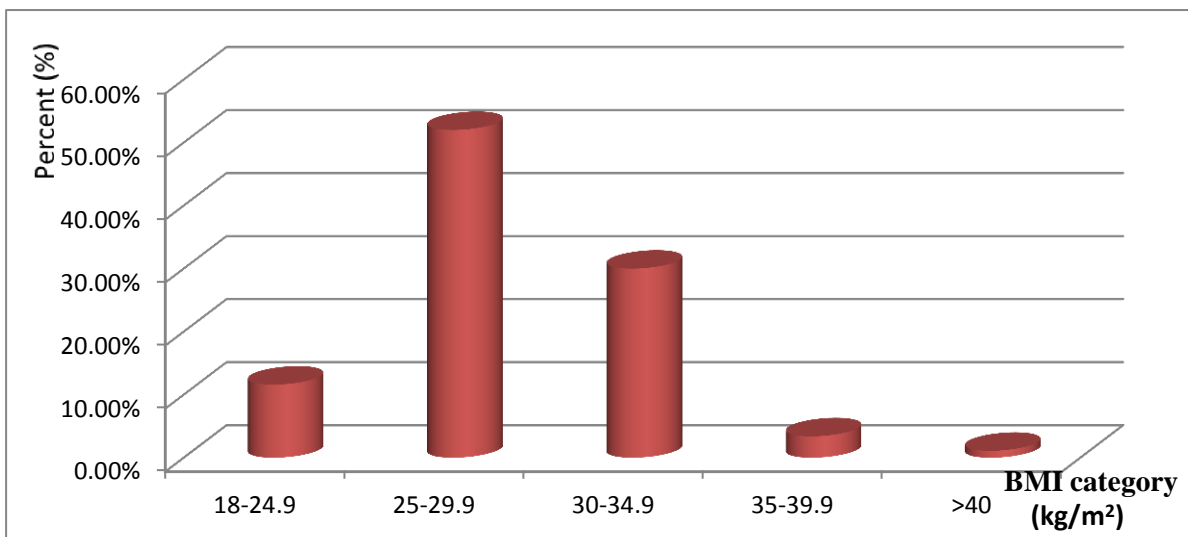


Figure 3: Percentage of diabetic patients according BMI

#### 4. DISCUSION

In our study the prevalence of overweight and obesity was high in newly-diagnosed patient with diabetes mellitus and pre-diabetes. But the prevalence of overweigh was higher in these patients, than obesity. Normal BMI values (18-24.9) were seen only in 10 cases or (11.6%). Data from other studies shows that with increasing overweight and obesity class, there is an increase in the prevalence of diabetes.[7],[8] National Diabetes Audit (NDA) data showed that in England, 90% of adults with type 2 diabetes aged 16-54 years were overweight or obese, compared to only 10% who were a healthy weight or underweight in 2009-10.[9] There is a seven times greater risk of diabetes in obese people compared to those of healthy weight, with a threefold increase in risk for overweight people.[1] In our study the mean age of newly diagnosed patients with diabetes mellitus or pre-diabetes, was  $59.6 \pm 10.8$  (SD) years of age, and the mean BMI among all patients group was  $28.8 \pm 3.5$  (SD). Other studies which examined new diagnoses of diabetes in a population between 18-44 years of age,[11] have found that adults developing diabetes before age 44 had an average BMI of 39, whereas adults developing diabetes at 45 or older had an average BMI of 33. Among all adults, the odds ratio for developing diabetes is 6.38 for those with BMI greater than 40. [12] There is a clear association between increasing age and greater diabetes prevalence.[13] In our study female subjects with overweight or obesity, are found to have higher risks than male subjects for both type 2 diabetes and pre-diabetes (62% versus 38%). This result complies with other studies.[14]

## 5. CONCLUSION

Overweight and obesity are major health problems associated with increased risk of diabetes.[15] While it is known that body fat distribution is an important determinant of increased risk of diabetes, the precise mechanism of association remains unclear. It is also uncertain why not all people who are obese develop type 2 diabetes and why not all people with type 2 diabetes are obese. [16],[17] It is important for the physicians to identify, evaluate and treat patients for obesity and associated comorbid conditions. [5]

## REFERENCES

- [1] Vanitallie TB, Body weight, morbidity, and longevity. In: Bjorntrop P, Brodoff BN, eds. Obesity, Philadelphia: JB Lippincott Co, 1992.
- [2] Biology of Obesity Jeffrey S. Flier, Eleftheria Maratos-Flier, Harrison's Principles of Internal Medicine, 18e >, Chapter 77
- [3] Obesity, Eleftheria Maratos-Flier and Jeffrey S. Flier, Joslin's Diabetes Mellitus, fourteenth edition Chapter 31, Pg no 534.
- [4] Source: American Diabetes Association: Diabetes Care 34:S11, 2011.
- [5] Evaluation and management of obesity, Robert F. Kushner, Harrison's Endocrinology, J Larry Jameson, 3rd edition, chapter 17, pg 244-245.
- [6] Adapted from National Institute of Health, National Heart, Lung and Blood Institute: Clinical Guidelines of Identification, Evaluation and Treatment of Overweight and Obesity in Adults. U.S. Department of Health and Human Services, Public Health Service, 1998.
- [7] Association of Hypertension, Diabetes, Dyslipidemia, and Metabolic Syndrome with Obesity: Findings from the National Health and Nutrition Examination Survey, 1999 to 2004 2008 American College of Surgeons. December 2008 Volume 207, Issue 6, Pages 928–934.
- [8] Int J Clin Pract. 2007 May 1; 61(5): 737–747. doi: 10.1111/j.1742-1241.2007.01336.x The relationship of body mass index to diabetes mellitus, hypertension and dyslipidemia: comparison of data from two national surveys.
- [9] Gatineau M, Hancock C, Holman N, Outhwaite H, Oldridge L, Christie A, Ells L. Adult obesity and type 2 diabetes. Oxford: Public Health England, 2014.
- [10] Abdullah A, Peeters A, de Courten M, et al. The magnitude of association between overweight and obesity and the risk of diabetes: a meta-analysis of prospective cohort studies. Diabetes Research & Clinical Practice 2010;89(3):309-19.
- [11] Hiller TA, Pedula KL, Characteristics of an adult population with newly diagnosed type 2 diabetes: the relationship of obesity and age at onset. Diabetes Care 2001;24:1522-1527.
- [12] Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes and obesity-related health risk factor, 2001, JAMA 2003;289:76-79.
- [13] Gatineau M, Hancock C, Holman N, Outhwaite H, Oldridge L, Christie A, Ells L. Adult obesity and type 2 diabetes. Oxford: Public Health England, 2014.
- [14] Eur J Clin Nutr. 2002 Jun;56(6):557-60. Prevalence of obesity in a Canarian community. Association with type 2 diabetes mellitus: the Guía Study.
- [15] Obesity, Eleftheria Maratos-Flier and Jeffrey S. Flier, Joslin's Diabetes Mellitus, fourteenth edition Chapter 31, Pg no 544.
- [16] Eckel RH, Kahn SE, Ferrannini E, et al. Obesity and type 2 diabetes: what can be unified and what needs to be individualized? Diabetes Care 2011;34(6):1424-30. doi: 10.2337/dc11-0447. Epub 2011 May 20. 5.
- [17] Neeland IJ, Turer AT, Ayers CR, et al. Dysfunctional adiposity and the risk of prediabetes and type 2 diabetes in obese adults. Jama 2012;308(11):1150-9.