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Metabolic syndrome in women — correlation between BMI and waist circumference

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Abstract

Introduction: Metabolic syndrome (MetS), which includes abdominal obesity, hypertension, hypertriglyceridaemia, low high-density lipoprotein cholesterol and elevated fasting plasma glucose, is now well understood. The prevalence of MetS is increasing all over the world. Central obesity is the main and the most common component of MetS. The most simple, practical, and frequently used tool for assessing body weight is body mass index. The aim of our study was to show the correlation between waist circumference (WC) and BMI in women with MetS depending on its components.

Material and methods: It was a study of 36-month duration (2016–2019) conducted in University Hospital No. 1 in Bydgoszcz, Poland. The study included 696 women with diagnosed MetS according to the 2009 International Diabetes Federation criteria.

Results: In the study group, WC was found to be significantly correlated with BMI according to the arterial hypertension, T2DM, IFG, lower HDL-C, and higher TG level.

Conclusion: We should consider changing the WC guidelines for Europeans, but for this we need more prospective studies. **(Endokrynol Pol 2022; 73 (1): 163–164)**

Key words: *metabolic syndrome; waist circumference; BMI*

Introduction

Metabolic syndrome (MetS), which includes abdominal obesity, arterial hypertension (AH), hypertriglyceridaemia (↑TG), low HDL-C, and elevated fasting plasma glucose, is now well understood [1]. The prevalence of MetS is increasing all over the world. It is worth noting the observation that the increase of MetS is greater in women than in men [2]. What is important, the prevalence of MetS increases with age [1]. The most simple, practical, and frequently used tool for assessing body weight is body mass index (BMI), but we must be aware of its limitations. BMI ignores the physiological differences in the proportions of the tissues such as adipose, osseous, and muscular. The aim of our study was to show the correlation between waist circumference (WC) and BMI in women with MetS depending on its components.

Material and methods

It was a study of 36-month duration (2016–2019) conducted in University Hospital No. 1 in Bydgoszcz, Poland. The study included 696 women with diagnosed MetS according to the 2009 International Diabetes Federation (IDF) criteria. BMI was calculated as body weight (in kilograms) divided by the square of body height (in metres). WC was measured halfway between the lowest rib and the top of the hipbone. We followed the methods of Gierach et al. 2014 [3].

Results

In the study group, WC was found to be significantly correlated with BMI according to AH, type 2 dabetes mellitus (T2DM), IFG, ↓HDL-C, and ↑TG (Tab. 2).

Discussion

The constantly increasing population of patients diagnosed with MetS is a leading health concern all over the world [4]. Janszky et al. [5] said that the prevalence of MetS is greater in women than in men (49.9% *vs.* 34.3%), and it increases with age. Also, in Poland MetS is a very serious social problem that is growing. The NATPOL 2002 study shows MetS in 19.7% of women, and the average WC in women is 86.5 cm. In the subgroups 18–39 years, 40–59 years, and 60–79 years, the results were 79.3 cm, 87.6 cm, and 95.7 cm, respectively, in females [6]. After almost 10 years as much as 26% of the Polish population were diagnosed with MetS, as was shown in the 2011 NATPOL PLUS study. Abdominal obesity, which is the most common component of MetS, occurs in about 6.5 million people in Poland. It is predicted that this number will increase to as much as 10 million during the next 10–15 years. The second most frequent component was AH (71%), followed by glucose metabolism disturbances (37.3%), ↑TG (21.2%), and ↓HDL

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Table 1. *General characteristics of the study group*

Women	N (%)	Age [years]	SD	BMI [kg/m2]	SD	WC [cm]	SD
Total	696 (100)	67.5	11.9	30.7	5.5	105.9	22.5
Abdominal obesity	678 (97.4)	67.4	12.0	30.9	5.4	108.2	21.7
AH	650 (93.4)	67.9	12.4	30.8	5.7	108.0	19.7
IFG	140 (20.2)	63.6	14.2	30.3	5.2	102.6	27.7
T2DM	412 (59.2)	68.4	11.1	31.2	5.9	109.3	23.9
↑ TG	256 (36.8)	63.8	11.7	30.4	4.9	103.6	23.1
↓ HDL-C	392 (56.3)	68.1	11.1	30.9	5.3	108.1	18.9

AH — arterial hypertension; IFG — impaired fasting glucose; T2DM — type 2 diabetes mellitus; TG — triglycerides; HDL-C — high-density lipoprotein cholesterol

Table 2. *General correlation between body mass index (BMI) and waist circumstance (WC) in the study group, according to arterial hypertension (AH), type 2 diabetes mellitus (T2DM), impaired fasting glucose (IFG), decreased high-density lipoprotein cholesterol (↓HDL-C), and increased triglyceride (↑TG)*

BMI/WC		AH			Arterial normotension	
Women	n = 650	r = 0.81	p < 0.05	n = 46	r = 0.65	p < 0.05
BMI/WC		T2DM			No carbohydrate disorders	
Women	n = 412	r = 0.83	p < 0.05	n = 144	r = 0.79	p < 0.05
BMI/WC		IFG			No carbohydrate disorders	
Women	n = 140	r = 0.78	p < 0.05	n = 144	r = 0.81	p < 0.05
BMI/WC		Decreased HDL-C			Normal HDL-C	
Women	n = 392	r = 0.80	p < 0.05	n = 304	r = 0.83	p < 0.05
BMI/WC		Increased TG			Normal TG	
Women	n = 151	r = 0.76	p < 0.05	n = 304	r = 0.83	p < 0.05

(15.9%) [5]. In our study, we observed that correlation occurred between BMI and WC in each of the studied subgroups. In the subgroup of AH, the correlation coefficient was the lowest (r = 0.65). This was probably due to the small size of the subgroup with normal arterial blood pressure (n = 46) and lower BMI and WC values *vs*. the subgroup with AH (BMI 28.6 *vs*. 30.8, respectively, and WC 104.3 *vs*. 108.0, respectively). The results obtained in the group with BMI = 30 kg/m^2 correlate with a WC of 102 cm in women. In the European female population abdominal obesity is currently defined as WC ≥ 80 cm, which corresponds to BMI = 21.62 kg/m^2. The question is whether the obesity criteria currently in force, based on BMI calculation, should be reviewed or if the usage of these criteria to assess abdominal body fat excess should be abandoned. On the other hand, WC analysis can be burdened with some measurement limitations resulting from the different measurement sites, e.g. umbilicus, hip crest, and minimal waist, which can lead to diagnostic problems. However, the difference in WC measurement is reduced by the sample size and the high occurrence of obesity among patients [7]. Therefore, WC seems to be a preferable predictor of the risk factors of MetS development compared to BMI [8].

We believed that there is a strong linear correlation between WC and BMI values in women with MetS regardless of its components. The presence of even normal body weight in females (BMI 21.62 kg/m^2) corresponds to an increased amount of abdominal adipose tissue, so we should consider changing the WC guidelines for Europeans, but for this we need more prospective studies.

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