Weight gain and biochemical parameters of metabolic syndrome in women aged 50-60 years

Przyrost masy ciała i biochemiczne parametry zespołu metabolicznego u kobiet w wieku 50-60 lat

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Summary
The aim of this study was to determine the impact of the weight change during 30–40 year follow-up on metabolic syndrome (MS) parameters. The study included 131 women. Blood pressure, anthropometric and laboratory measures were done at the age of 50-60 years. All women declared normal body weight at age 20. The MS was defined according to the International Diabetes Federation (2005). Women were divided into three groups according to weight gain: stable normal weight, normal weight to overweight, normal weight to obesity. There was a linear trend between increasing weight gain and increasing glucose, HOMA index. Trends to increasing concentrations of TG and decreasing HDL-C were weaker. The highest prevalence of abnormal glucose concentrations and HOMA index were observed in obese group compared to overweight and stable normal weight groups. Among traditional biochemical parameters of metabolic syndrome glucose and HOMA index seem to be the most significantly related to weight gain.

Streszczenie
Celem pracy było określenie wpływu zmian masy ciała ocenianej po upływie 30-40 lat na parametry zespołu metabolicznego (ZM). Badaniem objęto 131 kobiet w wieku 50-60 lat, u których wykonano pomiar ciśnienia tętniczego krwi, pomiary antropometryczne i badania laboratoryjne. Wszystkie kobiety deklarowały prawidłową masę ciała w wieku 20 lat. Występowanie zespołu metabolicznego definiowano w oparciu o kryteria International Diabetes Federation (2005). Badane podzielono na trzy grupy w zależności od masy ciała: ze stabilną prawidłową masą ciała, z prawidłową masą ciała zmieniającą się na przestrzeni lat do nadwagi oraz z prawidłową masą ciała zmieniającą się na przestrzeni lat do otyłości. U badanych stwierdzono silny liniowy trend do wzrostu glikemii i wskaźnika oporności na insulinę (HOMA) wraz z przyrostem masy ciała oraz słabszys trend do wzrostu stężenia triglicerydów i obniżania się HDL-cholesterolu. Największą częstość występowania hiperglykemii i oporności na insulinę obserwowano w grupie kobiet z otyłością. Wydaje się, że spośród tradycyjnych parametrów biochemicznych związanych z zespołem metabolicznym stężenie glukozy we krwi i wskaźnik insulinooporności HOMA są najsilniej związane z przyrostem masy ciała.

Key words: weight gain, metabolic syndrome, insulin resistance
Słowa kluczowe: przyrost masy ciała, zespół metaboliczny, insulinooporność

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Introduction
Obesity, weight gain and age above 50 years are associated with metabolic syndrome (MS) in women. Only few studies have specifically investigated the association between increases in weight and the risk of metabolic syndrome during 30-40 year follow-up (1,2,3). The aim of this study was to determine the impact of the weight change over 30–40 years on metabolic syndrome parameters in women 50-60 years of age.
Materials and methods

Study included 131 women aged 50-60 years. None of them had thyroid or liver disease, diabetes mellitus type I, cardiovascular disease, chronic inflammation or was taking anti-inflammatory agents, a hormonal replacement therapy or oral contraceptives before enrollment. Anthropometric measures and blood pressure were done at the age of 50-60 years. Weight at age 20 was assessed from a self-report questionnaires. All women declared normal body weight (BMI 18.5-24.5 kg/m^2) at age 20. 18% of the women at age 50-60 years had normal body weight, 33% were overweight (BMI 25-29.9 kg/m^2) and 49% were obese (BMI> 30 kg/m^2).

Fasting blood samples were drawn from women at the age of 50-60 years and stored at –70 °C until analysis. Serum was assayed for HDL-C, triglycerides (TG) and plasma was assayed for glucose (Architect ci8200, Abbott Diagnostics). Insulin was measured by ELISA (DRG MedTek, R&D). The diagnosis of MS was based on the definitions of the International Diabetes Federation (IDF 2005). The prevalence of MS was 51% in peri and postmenopausal women. In the MS group prevalence of individual components of MS was as follows: elevated waist circumference >=80 cm (100%), elevated glucose >=100 mg/dl or previously diagnosed type 2 diabetes (87%), elevated triglycerides >=150 mg/dl or treatment for this lipid abnormality (34%), low HDL-C <50 mg/dl or treatment for this lipid abnormality (33%), and systolic pressure>=130 or diastolic pressure >=85 mmHg or treatment of previously diagnosed hypertension (79%). Homeostasis model assessment (HOMA) was taken as a measure of insulin sensitivity using the equation: fasting plasma insulin (mU/l) x glucose (mmol/l)/22.5. The 75th percentile value was used as a cut-off point for HOMA index [4].

The study was approved by the Collegium Medicum Ethics Committee at N Copernicus University. All participants gave written informed consent.

The data were expressed as means (SD) or medians (25th and 75th percentiles). Variables with non-Gaussian distribution were compared by Kruskal-Wallis Anova; others were compared by one-way Anova. Spearman and Pearson correlations were used. All statistical analysis were performed with the Statistica 8 (StatSoft).

Results

The mean weight gain was 8.8 kg in a stable weight group, 19 kg in an overweight group and 34.6 kg in obese group. Values of BMI were similar and normal in three groups of women at age 20. We observed that there was a linear trend between increasing weight gain and increasing waist circumference, glucose, HOMA index. Trends to increasing concentrations of TG and decreasing HDL-C were weaker (Table I).

Statistical analysis of differences between groups showed that the concentrations of glucose, HOMA index and triglycerides were significantly higher and HDL-C significantly lower in obese group compared to stable normal weight group. There were no significant differences between overweight and stable normal weight group (Table I). In the univariate correlation analysis, weight gain correlated with TG (r=0.26; p=0.02), glucose (r=0.31; p=0.006) and HOMA index (r=0.32;
Among biochemical parameters of metabolic syndrome, the highest prevalence of abnormal glucose concentrations and HOMA index were observed in obese group compared to overweight and stable normal weight groups (Table III).

The prevalence of metabolic syndrome was about six-fold higher in obese group compared to stable normal weight group and about two-fold higher compared to overweight group (Table II).

**Discussion**

Our prospective study confirms the increasing prevalence of overweight (33%) and obesity (49%) in women at age above 50 years [5,6]. In order to exclude the influence of young adulthood’s BMI on weight gain at the age of 50-60 years, only young women with normal weight were included in the study. For this reason, it seems that normal body weight in young women does not protect them against obesity after menopause. According to Everson et al. 64% obese men at middle age where not obese at age of 20 [1]. In our study the average weight gain was 19 kg in overweight and 34 kg in obese women. Similar results were obtained by Rurik et al; overweight and obese women gained 16 kg and 26 kg, respectively [2]. De Fine Olivarius et al. found that women gained more weight than men [7].

We defined three groups of women according to increase in BMI over the 30-40 year follow-up: stable normal weight, normal to overweight and normal to obese. We observed the highest prevalence of metabolic syndrome in the group with the highest weight gain. The analysis of biochemical individual parameters of metabolic syndrome showed that the highest values of triglycerides, glucose, HOMA index and the lowest concentrations of HDL-C were found in the obese group (mean weight gain 34 kg). The differences were most significant between obese and stable normal weight group. There were no significant differences between overweight and stable normal weight group. Therefore, it seems that most significant worsening in metabolic syndrome parameters occur in the group with the highest weight gain. We may also conclude that weight gain leading towards obesity is most significantly related to metabolic syndrome and normal body weight at age 20 years does not protect against components of metabolic syndrome after menopause. This conclusion can be only related to normal body weight at age of 20. Only a few prospective studies have evaluated the relation between change in adult weight and the risk of metabolic syndrome among women or men during 30-40 years of follow-up. In the Nurses’ Health Study has been found that women whose BMI at age of 18 years was greater than 22.0 kg/m² had a substantially elevated risk of clinical diabetes mellitus compared with women whose BMI was less than 22 kg/m² and relative risk for women who gained 20.0 or more kg was 12.3 [3]. Another study has shown that weight gain from age 20 to diagnosis of diabetes at age of 65 years was 6 -23kg and average weight gain from 10 years prior to diabetes diagnosis until diagnosis was only 1 kg [7]. The authors of the French 6-year follow-up study (D.E.S.I.R.) and the Stanislas 5-year follow-up study have found a strong linear trend between increasing weight gain and the worsening of all the metabolic syndrome parameters among both men and women. The risk of developing the metabolic syndrome increased 22% for every kilogram of weight gain [8,9]. In the univariate correlation analysis, weight gain correlated with TG, glucose and HOMA index. Our observation confirms the strong relation between TG, glucose and obesity [4,10,11,12].

The limitation of this study is the use of self-reported weight data at age 20. Measured weight at both times would have been ideal because self-reported weight tends to be biased toward underreporting, particularly among overweight individuals. We included only women with normal body weight at age of 20 years, thus it seems that self-reported weight was more accurate. However, several studies indicate that self-reported weight is reasonably accurate and can be reliably used in epidemiological studies when measured weight in not available [13,14].

**In conclusion,** we consider that weight gain leading towards obesity is most significantly related to metabolic syndrome. Among traditional biochemical parameters of metabolic syndrome glucose and HOMA index seem to be the most significantly related to weight gain.

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**References**


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**Table III.**

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<th>Groups</th>
<th>Glucose &gt; 100 mg/dL</th>
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<td>27 %</td>
<td>63 %</td>
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</tbody>
</table>

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