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ORIGINAL ARTICLE

EFFECT OF SELECTED LIFESTYLE FACTORS ON THE NUTRITION STATE OF ELDERLY PEOPLE WITH METABOLIC SYNDROME

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ABSTRACT

Background. The formation and development of the metabolic syndrome (MetS) is largely caused by lifestyle factors. Many studies have shown that excessive consumption of simple carbohydrates, alcohol, salt, physical inactivity and smoking increase the risk of MetS.

Objective. The aim of the study was to assess the nutritional status and its relationship with selected lifestyle factors in elderly people with MetS.

Material and methods. 81 people aged 51-75 participated in the study. According to the guidelines, all tests were performed on an empty stomach. The comparison of individual quantitative variables between the groups was performed using the *Student's* t-test for independent measurements or using the *Mann-Whitney* U test. The relationship between quantitative variables was verified with the *Spearman's* correlation coefficient. All statistical tests were based on a significance level of $p<0.05$.

Results. The BMI, the percentage of body fat and the waist circumference significantly exceed the norm for the population in the examined persons. The responses of respondents aged 51-65 show that 36% of people sweetened their drinks, 65.6% were salted their food, 51.6% consumed alcohol, and at the age of 66-75, respectively: 47.1%, 52.9%, 41.2%. There was no correlation between sweetening beverages and salting food and the concentration of glucose and lipids. However, a positive correlation was found between the amount of salt consumed and the heart rate ($r=0.28$, $p<0.05$). In both age groups, statistically significant differences in the concentration of triglycerides depending on alcohol consumption or non-consumption were found. Due to the lack of precise data on the amount of alcohol consumed, the correlation between alcohol consumption and the concentration of glucose and lipids was not analyzed. Physical activity was not undertaken by 39.1% of patients aged 51-65 years and 41.2% of patients aged 66-75 years. In the group of elderly people without physical activity, a statistically significantly higher glucose concentration was found in relation to those who were physically active (130 mg/dl vs. 105 mg/dl; $p=0.031$). Patients aged 51-65 who engaged physical activity had statistically significantly lower body weight, BMI, waist circumference and lean body mass, which requires further studies.

Conclusions. The anthropometric indices and parameters of MetS patients indicated disturbances in the nutritional status. Unhealthy lifestyle was shown mainly in the younger group of patients 51-65 years old (they sweetened drinks more often, salted dishes, consumed alcohol). Patients with metabolic syndrome did not undertake physical activity as often as recommended.

Key words: *metabolic syndrome, lipid profile, body composition, anthropometric measurements, lifestyle*

STRESZCZENIE

Wprowadzenie. Za powstanie i rozwój zespołu metabolicznego (MetS) w dużej mierze odpowiadają czynniki związane ze stylem życia. Wyniki wielu badań wskazują, że spożycie w nadmiarze węglowodanów prostych, alkoholu, soli, brak aktywności fizycznej oraz palenie papierosów zwiększa ryzyko MetS.

Cel. Celem badania była ocena stanu odżywienia i jego związki z wybranymi czynnikami stylu życia u osób starszych z MetS.

Materiał i metody. W badaniu udział wzięło 81 osób w wieku 51-75 lat. Zgodnie z wytycznymi wszystkie badania wykonane były na czczo. Porównanie poszczególnych zmiennych ilościowych pomiędzy grupami wykonano za pomocą testu *t-Studenta* dla pomiarów niezależnych lub za pomocą testu U *Manna-Whitneya*. Zależność pomiędzy zmiennymi ilościowymi była weryfikowana współczynnikiem korelacji *Spearmana*. Wszystkie testy statystyczne oparto na poziomie istotności $p<0,05$.

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Wyniki. Wskaźnik BMI, procent tkanki tłuszczowej oraz obwód talii znacząco przewyższają u badanych osób normę dla populacji. Z odpowiedzi ankietowanych w wieku 51-65 lat wynika, że 36% osób słodziło napoje, 65,6 % dosalało potrawy, 51,6% spożywało alkohol, a w wieku 66-75 lat odpowiednio: 47,1%, 52,9%, 41,2%. Nie wykazano związku pomiędzy słodzeniem napojów i soleniem potraw a stężeniem glukozy i lipidów. Stwierdzono natomiast dodatnią korelację pomiędzy ilością spożywanej soli a tętnem ($r=0,28$, $p<0,05$). Wykazano w obu grupach wiekowych istotne statystycznie różnice w stężeniu triglicerydów w zależności od spożycia alkoholu lub jego niespożywania. Z powodu braku precyzyjnych danych dotyczących ilości spożywanego alkoholu w ciągu 1 tygodnia lub 1 miesiąca nie wykonano analizy korelacji pomiędzy spożyciem alkoholu a stężeniem glukozy i lipidów.
Aktywności fizycznej nie podejmowało 39,1% pacjentów w wieku 51-65 lat i 41,2% w wieku 66-75 lat. W grupie osób starszych bez aktywności fizycznej stwierdzono istotnie statystycznie większe stężenie glukozy w odniesieniu do wykazujących aktywność fizyczną (130 mg/dl vs. 105 mg/dl; $p=0,031$). Pacjenci w wieku 51-65 lat wykazujący aktywność fizyczną mieli istotnie statystycznie mniejszą masę ciała, wskaźnik BMI, obwód talii oraz beztłuszczową masę ciała co wymaga dalszych badań.
Wnioski. Wskaźniki i parametry antropometryczne pacjentów z MetS wskazywały na zaburzenia stanu odżywienia. Niezdrowy styl życia wykazywała głównie młodsza grupa pacjentów 51-65 lat (częściej słodzili napoje, solili potrawy, spożywali alkohol). Pacjenci z zespołem metabolicznym nie podejmowali aktywności fizycznej tak często jak jest to rekomendowane.

Słowa kluczowe: *zespół metaboliczny, lipidogram, skład ciała, pomiary antropometryczne, styl życia*

INTRODUCTION

Ongoing civilization changes related to technical progress and the widespread availability of mobile multifunctional devices are the cause of the increase in the frequency of metabolic disorders, especially in the area of carbohydrate-lipid metabolism, leading, inter alia, to the metabolic syndrome (MetS), which includes several risk factors for cardiovascular disease and type 2 diabetes. The 2009 integrated MetS definition assigns equal levels of importance to all its components; abdominal obesity as measured by waist circumference (WC), elevated triglyceride (TG) levels, low high-density lipoprotein cholesterol (HDL), elevated blood pressure (BP) and elevated fasting glucose [1].

For the formation and development of the metabolic syndrome environmental factors related to lifestyle correspond to: improper diet (excessive consumption of simple carbohydrates, salt), insufficient physical activity, smoking. In contrast, several studies have shown a significant reduction in the risk of cardiovascular events and all-cause mortality from the consumption of light / moderate alcoholic beverages [2, 3].

Alcohol consumption is positively correlated with plasma HDL concentration [4]. However, high alcohol consumption adversely affects abdominal obesity, TG levels, blood pressure and possibly insulin sensitivity [5, 6, 7, 8].

A meta-analysis of observational studies found that the beneficial metabolic effect appeared to be limited to moderate alcohol consumption (<20 g/d for women and <40 g/d for men) [9]. The consequence of improper diet is excessive body weight, and the main method of treating people with metabolic syndrome is weight reduction and increasing physical activity, regardless of age. In contrast, inactivity can cause loneliness, social isolation, progressive disability, and even premature mortality, especially among the elderly [10].

This is all the more worrying because we may soon be observers of the growing percentage of older people using online social networks.

The aim of the study was to assess the nutritional status and its relationship with selected lifestyle factors such as: physical activity, sweetening drinks, adding salt to food, alcohol consumption in elderly people with metabolic syndrome, and to compare the lifestyle of pre-retirement and retired people.

MATERIAL AND METHODS

The study involved 81 people diagnosed with the metabolic syndrome based on the 2009 consensus, including 64 aged 51-65 years and 17 people aged 66-75 years. All persons gave their written consent to participate in the research.

In accordance with WHO guidelines, anthropometric measurements and body composition tests were performed using the bioelectric impedance method with the Akern BIA 101 analyzer. Measurements of height and weight were used in the study, on the basis of which the body mass index (BMI) was calculated, which allows to estimate the frequency of underweight, overweight and obesity. BMI was assessed according to the criteria indicated by WHO. Biochemical determinations (lipogram, glucose) were made by enzymatic methods with the use of Johnson & Johnson reagents. According to the guidelines, all tests were performed on an empty stomach. Statistical calculations were performed using the statistical program Statistica 6.0. The comparison of individual quantitative variables between the groups was performed using the *Student's* t-test for independent measurements or using the *Mann-Whitney* U test.

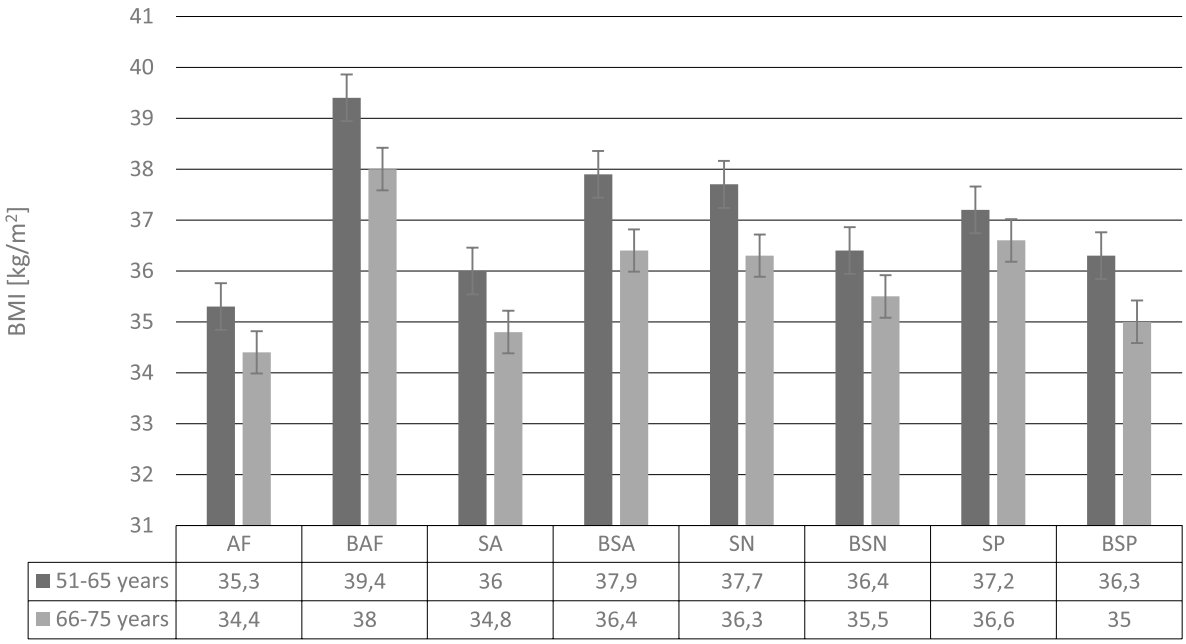
The relationship between quantitative variables was verified with the *Spearman* correlation coefficient. All statistical tests were based on a significance level of $p < 0.05$.

RESULTS

Table 1 presents the characteristics of people with metabolic syndrome, taking into account selected lifestyle factors. Lack of physical activity was found in 39.1% of people aged 51-65 years and 41.2% of people aged 66-75 years. In the group of younger patients, there were more people consuming alcohol (51.6%) and adding salt to their dishes (65.6%). On the other hand, more elderly people (66-75 years old) sweetened beverages (47.1%) and did not drink alcohol (52.9%) (Table 1). Our study examined the effect of selected lifestyle factors on body mass index (BMI) (Figure 1). Statistically significantly higher BMI was found in physically inactive people compared to active people (aged 51-65 by 4.1 kg/m^2 ($p<0.05$), in the group 66-75 by 3.6 kg/m^2 ($p<0.05$). People who consumed alcohol had a lower BMI than those who declared not drinking alcohol (in the 51-65 age group by 1.9 kg/m^2, and in the 66-75 age group by 1.6 kg/m^2). BMI values were found in both age groups in people who sweeten drinks and add extra salt (Figure 1). In the group of physically inactive elderly people, a statistically significantly higher glucose concentration was found in relation to physically active people (130 mg/dl vs 105 mg/dl; $p = 0.031$) (Table 2). People aged 51-65 years old demonstrating physical activity had statistically significantly lower body weight, BMI, waist circumference and lean body mass (Table 2).

Table 1. Characteristics of the studied patients with metabolic syndrome

	Patients aged 51-75 years (total)	Patients aged 51-65 years	Patients aged 66-75 years
n	81	64	17
Physically active person, n (%)	49 (60.5)	39 (60.9)	10 (58.8)
Physically inactive person, n (%)	32 (39.5)	25 (39.1)	7 (41.2)
Alcohol drinkers, n (%)	40 (50)	33 (51.6)	7 (41.2)
Non-alcohol drinkers, n (%)	40 (50)	31 (48.4)	9 (52.9)
Persons who sweeten drinks, n (%)	31 (38.3)	23 (35.9)	8 (47.1)
Persons who not sweeten drinks, n (%)	50 (61.7)	41 (64.1)	9 (52.9)
Persons who salt food, n (%)	51 (63)	42 (65.6)	9 (52.9)
Persons who do not add salt to food, n (%)	30 (37)	22 (34.4)	8 (47.1)



AF - persons physically active, BAF - persons physically inactive, SA - alcohol drinkers, BSA - non alcohol drinkersconsumption, SN - persons who sweeten drinks, BSN - persons who non-sweeten drinks, SP - persons who salt food products and meals, BSP - persons who do not add salt to food products and meals, BMI - body mass index

Figure 1. Influence of lifestyle factors on BMI in patients aged 51-75 years with metabolic syndrome

The following tables examined the effect of alcohol consumption (Table 3), sweetening drinks (Table 4) and salting meals on a plate (Table 5) for blood pressure, heart rate, lipids and glucose serum level, body weight, waist circumference, total water content (TBW), lean mass (FFM), and body fat mass (FM). BMI, percentage of body fat and waist circumference are well above the norm for the study population. The responses of respondents aged 51-65 show that 36% of people sweetened their drinks, 65.6% added salt to their meals, 51.6% consumed alcohol, and at the age of 66-75, respectively: 47.1%, 52.9%, 41.2%. There was no correlation between the sweetening of beverages and the salting of dishes and the concentration of glucose and lipids. However, a positive correlation was found between the amount of consumed salt and heart rate ($r = 0.28$, $p < 0.05$). In both age groups, statistically significant differences in the concentration of triglycerides were found depending on the consumption or non-consumption of alcohol. Due to the lack of precise data on the amount of alcohol consumed, the correlation between alcohol consumption and the concentration of glucose and lipids was not analyzed. In the group of elderly people, a statistically significantly higher blood glucose concentration was found in relation to physically active people (130 mg/dL vs 105 mg/dL; $p = 0.031$). Patients aged 51-65 years who showed physical activity had statistically significantly lower body weight, BMI, waist circumference and weight of adipose tissue.

DISCUSSION

Lifestyle is undoubtedly a very important factor influencing human health, regardless of age. Dietary preferences, physical activity and maintaining a healthy body weight play an important role in counteracting civilization diseases, such as diabetes, cardiovascular diseases, cancer, especially of the large intestine, osteoporosis and depression [11, 12, 13]. Meta-analyzes of long-term prospective cohort studies and short-term randomized controlled trials indicate that total sugars or sugar-sweetened beverages are associated with a higher risk of metabolic syndrome and type 2 diabetes [14, 15, 16]. Sugar-sweetened beverages (SBB) are not as filling as solid foods, which can lead to excessive energy consumption. In our study, a significant proportion of patients in both age groups sweetened their drinks, with more people consuming sugar in the elderly (47.1%). However, no correlation was found between the sweetening of the beverages and the concentration of glucose or TG in the blood serum. However, meta-analyzes of long-term prospective cohort studies and short-term RCTs have shown that total consumption of sugar or sugar-sweetened beverages (SSB) is associated with weight gain or a higher BMI [11], a greater risk of diabetes [14, 16], dyslipidemia [17] and hypertension [18, 19].

However, it was found that lowering blood pressure was significantly influenced by salt restriction, while diets rich in sodium chloride increased blood pressure in people with metabolic syndrome compared to people without this syndrome [20]. In our study, 63% of people salted their meals on a plate, despite the fact that they had previously been diagnosed with metabolic syndrome, mainly in the age group 51-65, who had a statistically significantly higher heart rate compared to people who did not salt their dishes. A risk factor for metabolic syndrome and mortality is lack of physical activity ($r=0,28$, $p<0,05$). Regular physical activity is associated with a reduced risk of MetS, type 2 diabetes, ischemic heart disease, cognitive impairment, depression and osteoporosis [21]. Doctors recommend regular aerobic training to prevent MetS: walking, cycling, and swimming [22, 23]. People with obesity are recommended 60-90 minutes of moderate-intensity training in combination with a properly balanced diet. Part of this decline in performance with age can be prevented by regular exercise. Exercise is a planned and conscious attempt, at least in part, to improve fitness and health and maintain mental well-being. Part of the decline in insulin sensitivity in the elderly is due to lack of exercise. Experts recommend that older people engage in moderate-intensity physical activity, such as brisk walking for at least 30 minutes 5 days a week (150 minutes/week) or high-intensity physical activity for at least 20 minutes three days a week [24].

Lima and the team showed that the three-month training program consisting of aerobic exercise had a positive effect on the reduction of abdominal fat, blood glucose concentration and an increase in the maximum VO_2 max in people exercising with metabolic syndrome. However, this did not affect the blood pressure values [25]. The Navigator trial studies showed that for every additional 2,000 steps per day, the risk of cardiovascular events was reduced by 10% [26], diabetes by 5.5% [27], and the risk index of the metabolic syndrome was 0.29 z-score [28]. In a Finnish 3-month intervention study involving 78 subjects with impaired oral glucose tolerance, an improvement in some cardiometabolic markers was observed in those taking an average of 5,576 steps per day compared to 4,434 steps per day in the control group [29]. In a 5-year study of approximately 500 Australians, there was a 13% reduction in the risk of dysglycemia for every 1,000 steps per day (as measured by a pedometer) and an increase in the number of steps over 5 years, which is favorably associated with obesity and insulin sensitivity [30].

Regarding mortality, research in Australia ($n = 2576$) [31], Great Britain ($n = 1,655$) [32] and

Table 2. Effect of physical activity on blood pressure, heart rate, lipid levels, glucose levels, body weight and body composition in people with MetS in two age groups

Patients 51-65 years of age	Physical activity (n=39) mean± SD	Physical inactivity (n=25) mean± SD	95% CI	p	Patients 66-75 years of age	Physical activity (n=10) mean± SD	Physical inactivity (n=7) mean± SD	95% CI	p
Systolic blood pressure (mmHg)	137.58±15.26	138.04±22.9	-11.19 to 10.26	0.931	Systolic blood pressure (mmHg)	135.00±10.05	128.14±15.29	-8.48 to 22.19	0.344
Diastolic blood pressure (mmHg)	83.45±9.97	79.04±14.47	-2.55 to 11.36	0.207	Diastolic blood pressure (mmHg)	74.86±7.03	76.80±10.28	-14.65 to 10.76	0.726
Pulse	73.70±13.26	73.30±10.25	-6.14 to 6.94	0.903	Pulse	67.00±9.82	66.50±7.82	-12.13 to 13.13	0.929
TCH (mg/dl)	189.18±44.83	178.76±49.7	-14.25 to 35.09	0.399	TCH (mg/dl)	183.44±36.36	192.14±64.52	-70.38 to 52.98	0.757
TG (mmol/L)	2.10±0.89	2.53±2.07	-1.32 to 0.46	0.332	TG (mmol/L)	1.94±0.72	2.22±1.06	-1.33 to 0.75	0.553
HDL (mg/dl)	46.97±10.49	42.96±10.42	-1.36 to 9.39	0.140	HDL (mg/dl)	55.11±11.75	49.43±12.09	-7.34 to 18.70	0.363
LDL (mg/dl)	106.97±40.06	89.88±35.70	-2.48 to 36.68	0.086	LDL (mg/dl)	94.89±30.48	103.43±54.39	-60.51 to 43.43	0.718
Glucose (mg/dl)	120.2±39.9	111.6±16.2	-5.72 to 22.98	0.233	Glucose (mg/dl)	105±17.0	130±15.4	-37 to -2.0	0.031*
Body weight (kg)	99.27±20.51	114.17±23.0	-26.28 to -3.52	0.011*	Body weight (kg)	94.44±15.56	108.27±27.47	-39.96 to 12.29	0.260
WC (cm)	112.71±15.67	122.48±19.0	122.48 to19.0	0.028*	WC (cm)	108.33±12.13	119.43±19.46	-29.92 to 7.73	0.217
TBW(kg)	43.62±9.42	50.22±12.25	-12.42 to 0.77	0.027*	TBW(kg)	41.10±6.90	46.33±10.71	-15.76 to 5.30	0.295
TBW (%)	44.81±6.29	44.29±5.34	-2.52 to 3.57	0.732	TBW (%)	44.45±5.70	43.64±4.55	-4.92 to 6.53	0.766
FM (kg)	40.23±13.59	45.73±11.76	-11.96 to 0.95	0.093	FM (kg)	40.03±10.29	49.10±15.75	-24.60 to 6.45	0.222
FM (%)	40.51±8.92	40.56±8.00	-4.38 to 4.27	0.979	FM (%)	43.05±8.45	45.46±5.67	-10.40 to 5.58	0.525
FFM (kg)	57.39±14.99	67.54±17.47	-18.73 to -1.59	0.021*	FFM (kg)	52.54±9.50	57.19±13.53	-18.17 to 8.88	0.464
FFM (%)	59.59±9.02	59.31±8.28	-4.29 to 4.86	0.901	FFM (%)	56.71±9.09	54.54±5.67	-6.85 to 11.85	0.604

* statistically significant differences

TCH (total cholesterol), LDL (low density cholesterol), HDL (high density cholesterol), TG (triacylglycerols), TBW (total body water), FM (fat mass), FFM (fat free mass), WC (waist circumference)

Table 3. Effect of alcohol consumption on blood pressure, heart rate, lipid levels, glucose levels, body weight and body composition in people with MetS in two age groups

Patients 51-65 years of age	Drinking alcohol (n=33) mean± SD	No drinking alcohol (n=31) mean± SD	95% CI	p	Patients 66-75 years of age	Drinking alcohol (n=7) mean± SD	No drinking alcohol (n=9) mean± SD	95% CI	p
Systolic blood pressure (mmHg)	138.88±20.25	136.57±16.49	-7.05 to 11.67	0.623	Systolic blood pressure (mmHg)	134.00±11.20	129.89±14.66	-13.16 to 21.38	0.596
Diastolic blood pressure (mmHg)	83.23±12.75	80.30±11.07	-3.19 to 9.04	0.342	Diastolic blood pressure (mmHg)	82.67±13.65	73.38±4.81	-22.68 to 41.26	0.359
Pulse	73.85±11.22	73.23±13.19	-6.15 to 7.39	0.855	Pulse	72.33±10.69	63.29±6.24	-13.89 to 31.99	0.277
TCH (mg/dl)	191.48±53.41	178.32±38.01	-9.23 to 36.25	0.259	TCH (mg/dl)	208.67±44.13	180.44±47.98	-24.52 to 80.96	0.265
TG (mmol/L)	2.76±1.84	1.74±0.59	0.33 to 1.70	0.005*	TG (mmol/L)	2.66±0.75	1.68±0.79	0.09 to 1.86	0.034
HDL (mg/dl)	46.39±10.85	44.35±10.33	-3.25 to 7.33	0.444	HDL (mg/dl)	50.83±12.22	55.67±11.09	-18.65 to 8.99	0.454
LDL (mg/dl)	97.52±43.06	103.19±35.05	-25.64 to 14.29	0.571	LDL (mg/dl)	110.67±37.70	95.89±43.53	-31.33 to 60.89	0.498
Glucose (mg/dl)	120.67±33.11	112.81±32.55	-8.55 to 24.27	0.342	Glucose (mg/dl)	113.33±17.53	127.22±42.82	-48.89 to 21.11	0.402
Body weight (kg)	105.68±26.71	104.45±17.55	-10.02 to 12.49	0.827	Body weight (kg)	105.80±28.98	93.63±13.67	-15.14 to 39.48	0.335
WC (cm)	117.32±20.55	115.68±14.07	-7.13 to 10.41	0.709	WC (cm)	112.17±22.40	111.44±10.70	-22.82 to 24.27	0.944
TBW(kg)	48.05±12.20	44.37±9.51	-1.83 to 9.19	0.186	TBW(kg)	51.06±9.09	38.17±4.11	1.82 to 23.97	0.030*
TBW (%)	46.65±5.76	42.57±5.38	-1.20 to 6.96	0.006*	TBW (%)	48.70±5.65	41.33±2.49	0.48 to 14.25	0.040*
FM (kg)	39.76±14.56	45.15±10.93	-11.87 to 1.09	0.101	FM (kg)	42.02±20.80	44.74±9.57	-28.10 to 22.61	0.793
FM (%)	37.78±8.52	43.36±7.60	-9.65 to 1.52	0.008*	FM (%)	37.94±8.41	47.78±3.86	-18.30 to -0.40	0.042*
FFM (kg)	64.74±17.43	57.98±15.33	-1.51 to 15.02	0.107	FFM (kg)	64.04±12.83	48.06±4.25	0.27 to 31.70	0.048*
FFM (%)	62.59±8.68	56.38±7.60	1.99 to 10.43	0.005*	FFM (%)	62.05±8.40	51.43±3.23	0.37 to 20.89	0.045*

* statistically significant differences

TCH (total cholesterol), LDL (low density cholesterol), HDL (high density cholesterol), TG (triacylglycerols), TBW (total body water), FM (fat mass), FFM (fat free mass), WC (waist circumference)

Table 4. Effect of sweetening beverages on blood pressure, heart rate, lipid levels, glucose levels, body weight and body composition in people with MetS in two age groups

Patients 51-65 years of age	Sweetening the drinks (n=23) mean± SD	No sweetening of the drinks (n=41) mean± SD	95% CI	p	Patients 66-75 years of age	Sweetening the drinks (n=8) mean± SD	No sweetening of the drinks (n=9) mean± SD	95% CI	p
Systolic blood pressure (mmHg)	141.87±16.05	135.33±19.46	-2.63 to 15.71	0.159	Systolic blood pressure (mmHg)	133.83±9.50	129.88±15.44	-10.67 to 18.59	0.566
Diastolic blood pressure (mmHg)	82.52±8.39	81.34±13.75	-4.49 to 6.85	0.679	Diastolic blood pressure (mmHg)	76.17±9.95	75.17±6.82	-10.17 to 12.17	0.844
Pulse	74.90±12.49	72.66±11.97	-4.72 to 9.21	0.518	Pulse	63.60±6.77	69.33±9.16	-16.63 to 5.16	0.264
TCH (mg/dl)	184.00±42.67	185.73±49.32	-25.35 to 21.89	0.884	TCH (mg/dl)	167.88±39.78	206.63±51.78	-88.57 to 11.07	0.117
TG (mmol/L)	2.26±0.81	2.27±1.74	-0.65 to 0.63	0.975	TG (mmol/L)	1.95±0.65	2.18±1.07	-1.20 to 0.74	0.610
HDL (mg/dl)	43.65±10.04	46.39±10.85	-8.15 to 2.67	0.314	HDL (mg/dl)	51.00±13.06	54.25±11.17	-16.31 to 9.81	0.601
LDL (mg/dl)	102.77±38.03	99.03±40.00	-16.96 to 24.45	0.717	LDL (mg/dl)	82.25±31.40	115.00±45.16	-74.94 to 9.44	0.117
Glucose (mg/dl)	120.26±36.23	114.95±31.05	-12.83 to 23.45	0.558	Glucose (mg/dl)	113.13±15.92	131.50±44.52	-56.34 to 19.59	0.301
Body weight (kg)	106.42±24.51	104.34±21.68	-10.30 to 14.46	0.736	Body weight (kg)	103.59±26.50	97.07±17.31	-17.49 to 30.53	0.565
WC (cm)	116.87±15.22	116.33±18.97	-8.16 to 9.24	0.901	WC (cm)	115.88±19.31	110.50±13.14	-12.56 to 23.31	0.527
TBW(kg)	47.17±10.45	45.71±11.44	-4.22 to 7.16	0.610	TBW(kg)	46.54±10.45	40.91±7.08	-4.74 to 15.99	0.255
TBW (%)	45.23±6.74	44.23±5.37	-2.36 to 4.35	0.553	TBW (%)	44.17±5.01	43.99±5.39	-5.62 to 5.99	0.946
FM (kg)	42.20±15.59	42.53±11.61	-7.90 to 7.24	0.930	FM (kg)	48.00±15.23	40.99±11.73	-8.56 to 22.58	0.344
FM (%)	39.52±9.59	41.11±7.87	-6.34 to 3.18	0.506	FM (%)	44.79±6.28	43.64±8.22	-6.97 to 9.27	0.765
FFM (kg)	63.23±14.94	60.37±17.66	-5.53 to 11.26	0.497	FFM (kg)	58.17±13.09	51.68±9.44	-6.67 to 19.67	0.300
FFM (%)	60.48±9.59	58.87±8.12	-3.25 to 6.47	0.507	FFM (%)	55.21±6.28	56.04±8.82	-9.84 to 8.19	0.844

TCH (total cholesterol), LDL (low density cholesterol), HDL (high density cholesterol), TG (triacylglycerols), TBW (total body water), FM (fat mass), FFM (fat free mass), WC (waist circumference)

Table 5. Effect of adding salt in dishes on blood pressure, heart rate, lipid levels, glucose levels, body weight and body composition in people with MetS in two age groups

Patients 51-65 years of age	Salting food (n=42) mean± SD	No salting of dishes (n=22) mean± SD	95% CI	p	Patients 66-75 years of age	Salting food (n=9) mean± SD	No salting of dishes (n=8) mean± SD	95% CI	p
Systolic blood pressure (mmHg)	140.15±18.66	133.10±17.40	-2.60 to 16.70	0.148	Systolic blood pressure (mmHg)	137.00±12.06	126.14±12.17	-3.25 to 24.96	0.119
Diastolic blood pressure (mmHg)	83.51±11.29	78.25±12.76	-1.55 to 12.08	0.126	Diastolic blood pressure (mmHg)	76.14±9.08	75.00±7.62	-9.69 to 11.97	0.818
Pulse	75.46±12.83	69.13±9.14	0.05 to 12.62	0.048	Pulse	64.00±6.13	70.00±10.07	-18.43 to 6.44	0.286
TCH (mg/dl)	181.36±39.92	192.27±57.87	-39.01 to 17.18	0.435	TCH (mg/dl)	168.89±34.12	210.86±57.16	-96.97 to 13.02	0.119
TG (mmol/L)	2.12±0.82	2.55±2.24	-1.46 to 0.58	0.384	TG (mmol/L)	2.00±0.66	2.14±1.13	-1.22 to 0.95	0.781
HDL (mg/dl)	45.71±10.16	44.82±11.54	-5.01 to 6.80	0.760	HDL (mg/dl)	51.89±12.50	53.57±11.89	-14.89 to 11.52	0.788
LDL (mg/dl)	98.62±37.33	104.00±43.20	-28.26 to 17.50	0.636	LDL (mg/dl)	82.33±26.65	119.57±48.87	-83.81 to 9.33	0.104
Glucose (mg/dl)	114.69±31.13	121.00±36.21	-24.72 to 12.11	0.492	Glucose (mg/dl)	114.00±13.44	133.00±48.53	-64.02 to 26.03	0.349
Body weight (kg)	106.21±23.49	102.95±21.05	-8.34 to 14.87	0.574	Body weight (kg)	103.62±24.54	96.21±18.69	-15.04 to 29.86	0.492
WC (cm)	116.70±14.70	116.18±22.50	-10.31 to 11.35	0.923	WC (cm)	116.38±18.95	110.00±13.41	-11.41 to 24.16	0.456
BW(kg)	46.54±11.73	45.70±9.83	-4.75 to 6.43	0.764	TBW(kg)	46.19±10.52	40.51±6.18	-3.94 to 15.29	0.222
TBW (%)	44.53±6.16	44.75±5.55	-3.33 to 2.90	0.890	TBW (%)	43.69±4.19	44.51±6.17	-3.96 to 5.30	0.770
FM (kg)	42.62±13.24	42.02±13.07	-6.39 to 7.59	0.863	FM (kg)	47.40±14.05	40.67±12.82	-8.27 to 21.72	0.350
FM (%)	40.40±8.87	40.75±7.96	-4.75 to 4.06	0.874	FM (%)	44.64±7.12	43.64±7.70	-7.36 to 9.35	0.800
FFM (kg)	62.60±16.81	59.22±16.51	-5.47 to 12.23	0.446	FFM (kg)	58.49±13.85	50.39±6.09	-3.98 to 20.18	0.166
FFM (%)	59.62±9.16	59.25±7.96	-4.15 to 4.91	0.868	FFM (%)	55.36±7.11	55.98±8.37	-10.10 to 8.85	0.886

TCH (total cholesterol), LDL (low density cholesterol), HDL (high density cholesterol), TG (triacylglycerols), TBW (total body water), FM (fat mass), FFM (fat free mass), WC (waist circumference)

Japan (n = 419) [33] have shown that a higher number of steps (as assessed by a pedometer or accelerometer) is associated with lower mortality rates during follow-up ranging from 5 to 10 years. For Australians, every 1,000 steps per day increase was associated with a 6% risk reduction, and for British participants, for a 14% risk reduction. Among Japanese participants, only the most active quartile, with an average of 10,241 steps / day, experienced a significant reduction in risk; however, the statistical power was limited. A study by Min Lee and his team published in 2019 in the journal JAMA found that in women aged 72, around 4,400 steps/day was significantly associated with lower mortality compared to around 2,700 steps/day. The recommended 10,000 steps per day has also been found to be of limited scientific basis, having shown that around 7,500 steps per day are associated with lower mortality [34]. On the other hand, the Statistics Poland (GUS) research showed that 73.4% of Poles aged 50–59 were physically inactive [35]. The report of the Ministry of Sport and Tourism shows that only 12–15% of the elderly were active in line with WHO recommendations [36]. Low physical activity and age entail changes in body composition, which result in increasing body fat, loss of muscle mass and strength. The total body hydration as well as the proportions between the extracellular and intracellular water content are also changing in an unfavorable direction. The changes in body composition that occur during the aging process are inherently unfavorable. They also include disproportions in body composition, i.e. changes in the direction of a decrease in lean body mass (including muscle mass), with a simultaneous increase in adipose tissue (both subcutaneous and deposited between internal organs). Therefore, a natural consequence is the appearance of visceral obesity, which is responsible for a number of cardiovascular, internal secretion and immune diseases. This obesity may contribute to the cascade of metabolic changes typical of the metabolic syndrome, which is one of the most serious risk factors for cardiovascular diseases [37].

In the inhabitants of Biała Podlaska (Poland), abdominal obesity based on the waist circumference was found in 72.23% of women (WC>88 cm) and 41.35% of men (WC>102 cm) [38].

In our study physical activity was not undertaken by 39.1% of patients aged 51-65 years and 41.2% of patients aged 66-75 years. In the group of elderly people without physical activity, a statistically significantly higher glucose concentration was found in relation to those who were physically active (130 mg/dl vs. 105 mg/dl; p=0.031). Patients aged 51-65 who showed physical activity had statistically significantly lower body weight, BMI, waist circumference and lean body mass, which requires further studies.

CONCLUSIONS

The anthropometric indices and parameters of MetS patients indicated disturbances in the nutritional status. In both age groups, patients consuming alcohol were found to have statistically higher concentration of triglycerides. In the group of younger patients without physical activity, body weight and BMI were statistically significantly higher. In the group of older patients without physical activity, statistically significantly higher glucose concentration was found. A statistically significantly higher heart rate was also found in people aged 51-65 years using food.

Unhealthy lifestyle was shown mainly by the younger group of patients 51-65 years old (they sweetened drinks more often, salt dishes, consumed alcohol).

Patients with metabolic syndrome did not undertake physical activity as often as recommended.

Modification of eating habits and reduction of alcohol consumption in combination with increased physical activity may reverse this unfavorable trend.

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Conflict of interest

The authors declare no conflict of interest.

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