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Self-reported health-related behaviors and dietary habits in patients with metabolic syndrome

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Abstract

Background: *There is an ongoing debate about factors affecting the maintenance of a healthy lifestyle especially in the population without coronary artery disease (CAD) symptoms and with one or several risk factors. The study was aimed at describing self-reported health-related behaviors and dietary habits in patients with metabolic syndrome (MetS).*

Methods: *Consecutive patients with an outpatient diagnosis of MetS admitted to our cardiology department underwent clinical examination and cardiovascular risk assessment based on the SCORE scale. Self-reported intensity of pro-healthy behaviors was described using the Health Behavior Inventory (HBI) developed by Juczynski. Diet quality was assessed using the 24-h dietary recall method, diet history questionnaire and the Healthy Eating Index-2010 (HEI).*

Results: *A total of 113 patients were recruited (90 males, mean age 48 ± 9 years) including 85% of patients with at least moderate cardiovascular risk (SCORE ≥ 1%). Central obesity was confirmed in 100%, family history of CAD in 75%, LDL exceeding 115 mg/dL in 68% of the patients. A total of 66% of the patients had already been on antihypertensive and 30% on lipid-lowering treatment without previous counselling on lifestyle modification. Most patients reported high or medium level health-related behaviors (23% and 45%, respectively). However, 91% led sedentary lifestyle and none of the patients followed cardioprotective diet recommendations. According to the HEI, 73% required partial and 27% complete diet modification.*

Conclusions: *There is a significant discrepancy between health perception and medical recommendations in patients with MetS. Effective patient education, taking into account a revision of the patient's knowledge on the principles of prophylaxis, may form the fundament for the changes in patient behavior, and cardiovascular risk reduction.* (Cardiol J 2015; 22, 4: 413–420)

Key words: cardiovascular risk, dietary habits, healthy lifestyle, health perception, metabolic syndrome

Introduction

Atherosclerotic cardiovascular disease (CVD), especially coronary artery disease (CAD), is the major cause of premature death in Europe and the leading somatic cause of loss of productivity. More than 50% of the reduction in mortality in CAD is related to changes in risk factors connected with

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lifestyle [1]. A combination of healthy behaviors was predicted to prevent 77% of myocardial infarctions in the population of 22,444 postmenopausal women [2]. That demands creation of effective risk reduction programs for CVDs [3]. Apart from smoking, unhealthy eating habits are the most commonly reported reasons for unsuccessful prevention programs [4]. Numerous studies have examined the relationship between individual food intake and chronic diseases [5]. However, little is known about health perception and health behaviors affecting the diets of patients with no symptoms of disease but at cardiovascular (CV) risk. According to the European Guidelines on CVD prevention in clinical practice, targeting patients without clinical symptoms of CVD and with one or several risk factors may give them a benefit from prevention. These patients are, in particular, those who consider themselves 'healthy' and whose risk factors are 'silent' (inconspicuous) and include: central obesity, dyslipidemia, glucose intolerance and high blood pressure, previously described as metabolic syndrome (MetS) [6]. The prevalence of the MetS varies according to the employed definition, population, age and gender, and regardless of the applied definitions is associated with a notably increased risk of CV morbidity and mortality [7]. Moreover, none of the presented definitions of MetS (WHO, ATP III, IDF) includes established major CV risk factors, such as physical inactivity, age, family history, or smoking status.

In light of an ongoing debate on factors influencing healthy lifestyle, the changes in behaviors are the least understood [8]. According to the model of changes in behavior, the process may proceed when the patient begins to perceive the need for its implementation [9]. Therefore, the aim of the study was to assess self-reported health-related behaviors and dietary habits in patients with MetS.

Methods

Study population

Consecutive patients with ambulatory diagnosed MetS were recruited into the registry designed to identify CV risk factors and admitted to the Department of Cardiology and Internal Medicine between 2009 and 2013 for the clinical evaluation. The criteria for MetS were used according to the International Diabetes Federation (IDF) [10]. Patients with diabetes, hormonal disturbances, renal diseases, and any known or symptomatic CVD were excluded from the study.

All patients gave their written informed consents to participate in the study, approved by the local Ethics Committee (no. 44/WIM/ 2010).

Clinical assessment

The clinical assessment including demographic and clinical characteristics was conducted by a cardiologist. A 10-year risk of fatal CVD in high risk regions of Europe was calculated using the SCORE Risk Chart. The low risk group was defined with calculated SCORE $< 1\%$, moderate risk with SCORE of $\geq 1\%$ and $< 5\%$, high risk with SCORE of ≥ 5 and $< 10\%$, and very high with SCORE $\geq 10\%$ [11].

Data on physical activity at work and at leisure were collected using a three-category scale: 1 — sedentary (e.g. working day in front of a computer or sedentary lifestyle at leisure), 2 — moderate (regular vigorous activities once or twice a week), and 3 — heavy (intense physical work or vigorous activities more than twice a week at leisure).

Assessment of health-related behaviors

Patients completed the Health Behaviors Inventory (HBI), developed and standardized by Juczynski [12]. The HBI is a self-reported questionnaire which consists of 24 statements describing on a 5-point scale the intensity of different bahaviors related to health. As a result, the general index, in the range of 24 to 120 points, is calculated where the scores correlate with the intensity of healthy behaviors (the higher the score the more healthy bahaviors assigned to three levels of intensity: high, medium, and low). The HBI also allows to assess the intensity of the following four categories: 'healthy eating habits' focusing on the types of food consumed by the patient (wholemeal bread, eating significant amounts of fruit and vegetables), 'prophylactic behaviors' associated with disease prevention, defined as adherence to doctor's recommendations, regular medical check-ups, getting medical information. 'Health practices' assessing sleep quality, rest, exercise, monitoring body weight, and 'positive mental attitude' focusing on the avoidance of situations that might cause depressed mood and the avoidance of strong emotions, anger and anxiety. For each category, a mean score is calculated and the results allow comparison with the means reported for the reference population (published by Juczynski) [12]. Since no significant differences between age groups nor origin were reported, the only factor taken into account in normalization was the gender effect.

Dietary habits and anthropometry

Dietary habits and anthropometry parameters were collected by a trained dietician. Body weight, fat mass (FM, in kg and as % of the body weight), fat free mass, total body water, basal metabolic rate were obtained using Body Composition Analyzer BC-418 (Tanita, The Netherlands).

During individual consultation with a dietician, the information about patient's food intake, dietary habits and diet patterns was collected using a 24-h dietary recall method and a diet history questionnaire. Participants were asked about the frequency of consuming groups of products such as: fruit and vegetables, whole grain products, milk and milk products, meat, fish, starch and nuts. Hydration status and beverage choices were also recorded. Subjects reported an average size of usually consumed portion and the seasonal variation of consumption. Standard serving sizes and food models were provided as a reference for intake estimation (photo album products and dishes were shown). Food consumption was converted into total energy intake and nutrients (expressed in kcal and grams or percent of the total energy intake per day, respectively) using the software Dieta 2.0 (Institute of Food and Nutrition, Poland). The average daily consumption of: total fat (saturated, monounsaturated and polyunsaturated fatty acids, SFA, MUFA and PUFA, respectively), total carbohydrate, sucrose, protein (total, animal and plant), dietary fiber, cholesterol, sodium, potassium and calcium was assessed. The dietary polyunsaturated to saturated fatty acids ratio (P/S ratio) was also calculated.

Diet quality was assessed by Healthy Eating Index-2010 (HEI) that provides a picture of food choices and the amount and variety in the daily menu [13]. The HEI consists of 12 components: 9 of them focus on adequacy — dietary components to increase, e.g. fruit, vegetables, whole grains, dairy — scoring system: 0, 5, 10, where higher score indicates higher consumption; 3 components focus on moderation — dietary components to decrease, e.g. refined grains, sodium, scoring: 0, 10, 20, where higher score indicates lower consumption;

Possible scores range from 0 to 100, with 100 points referring to ideal diet quality and lower results indicating larger differences between dietary guidelines and patient's eating habits.

Laboratory measurements

Fasting blood samples were collected and the level of biochemical markers were determined using standard methods.

Statistical analysis

Data are shown as mean ± standard deviation. Parameters were compared using the 2-way analysis of variance. For the post hoc analysis, the NIR Fisher test was used. Correlations were assessed by the Pearson test and *r* coefficients were shown. A $p \leq 0.05$ was considered statistically significant.

Results

Study population

A total of 130 patients with an outpatient diagnosis of MetS were recruited. Seventeen patients were excluded so the final analysis included 113 patients (90 males, 23 females: aged 48 ± 9 years). SCORE Risk Charts placed 15% of the patients at low risk, 68% at moderate risk, 13% patients at high risk and 4% at very high risk. Most patients reported physical inactivity at work and at leisure time (69% and 67%, respectively). Activity twice a week was reported by 23% at work and 24% at leisure time. Recommended physical activity was met by 8% patients at work and 9% patients at leisure time. The detailed clinical data are shown in Table 1. The prevalence of MetS components according to IDF criteria is shown in Figure 1.

Self-reported health-related behaviors

Of the 113 recruited patients, 8 did not return the questionnaire. The results of intensity of healthy behaviors expressed as general index were as follows: 23% obtained high scores, 45% medium scores, and 32% low scores. In the general health behaviors assessment, the mean score achieved by MetS patients was not significantly different from the reference population. Also, the average scores obtained by MetS patients within the three of four categories (healthy eating habits, prophylactic behaviors, and health practices) did not differ significantly. The scores for positive mental attitude were significantly higher in comparison to the reference population. Table 2 shows the detailed results of the HBI.

Qualitative diet evaluation

More than 85% of the patients were not aware of the dietary recommendations for CV risk reduction. None of the interviewed was classified as having a 'good diet'. Table 3 shows the results of patients' diets evaluation according to the HEI.

The average number of meals during the day was 2 (61%), 21% of patients ate once a day and 16% ate 3 meals a day, and 77% did not eat

Table 1. Clinical characteristics of studied population.

Parameters		Mean ± SD or n (%)
Demographic data	Male/female	90/23 (79%/21%)
	Age [years]	48 ± 9
Metabolic syndrome components	Waist circumference [cm]	110.5 ± 9.9
	Systolic BP [mm Hg]	141 ± 17
	Diastolic BP [mm Hg]	90 ± 10
	Triglycerides [mmol/L]	2.5 ± 1.0
	HDL [mmol/L]	1.1 ± 0.3
	Fasting plasma glucose [mmol/L]	5.6 ± 0.6
Additional clinical information	LDL [mmol/L]	3.5 ± 1.0
	SCORE ≥ 1%	96 (85%)
	Family history of CVD	85 (75%)
	Body mass index [kg/m^2]	32.7 ± 4.0
	Fat mass (% of body mass)	30.6 ± 7.6
	Hip circumference [cm]	103 ± 8.9
	Basic metabolic rate [kcal/d]	2050.0 ± 372.7
Smoking status	Current smoker	25 (22%)
	Former smoker	39 (35%)
	Never smoker	49 (43%)

SD — standard deviation; BP — blood pressure; HDL — high-density lipoprotein; LDL — low-density lipoprotein; CVD — cardiovascular disease

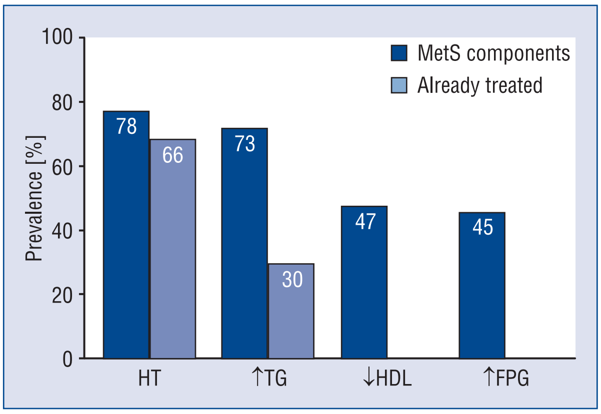

Figure 1. Components of metabolic syndrome (MetS) phenotype; hypertension (HT) defined as blood pressure ≥ 130 and ≤ 85 mm Hg, raised triglicerydes (TG) as ≥ 1.7 mmol/L, reduced high density lipoprotein (HDL) as ≤ 1.03 mmol/L in males and ≤ 1.29 mmol/L in females, raised fasting plasma glucose (FPG) ≥ 5.6 mmol/L.

a morning meal. Skipping main meals and irregular eating were not only strongly associated with snacking during (the most common 'snacks': high-sucrose and/or high fat-foods and sugar sweetened beverages) the working hours (78%) but also with overeating in the evenings — 20 patients reported uncontrolled eating late at night. Increased sweets consumption, independently of meals, was also declared during stressful situations.

Low consumption of wholegrain products was manifested by a very low intake of dietary fiber (Table 4). Sixty-seven patients indicated that fruit and vegetables were a permanent part of their everyday menu, but the average number of their servings fell below the minimum number to reach cardioprotective effect. Consumption of dairy products varied considerably among the participants: 9 participants were on high-protein diet (27% of total energy as protein), about 65% ate at least one serving of a dairy product per day, for 27% the average portion of dairy products was 3 a week.

Quantitative diet evaluation

The mean daily energy and selected nutrients intakes are presented in Table 5. The energy intake was about 20% greater than their basal metabolic rate. In the average nutrient ratio, the energy from fat, including SFA, was higher, thereby complex carbohydrate content was lower than the recommended level. The P/S ratio was 0.56 ± 0.18.

Table 2. Results of Health Behavior Inventory (HBI).

Populations/ HBI	General index	Healthy eating habits	Prophylactic behaviors	Health practices	Positive mental attitude
Adjusted Ref.[a] N = 496	79.63 ± 14.05	3,00 ± 0.78	3.34 ± 0.77	3.34 ± 0.69	3.17 ± 0.92
MetS N = 107	79.9 ± 11.0	3.12 ± 0.8	3.36 ± 0.7	3.32 ± 0.6	3.52 ± 0.6
Ref. vs. MetS (p)	0.84	0.16	0.77	0.76	< 0.0001

[a]Gender adjusted reference population, data shown in mean ± standard deviation; MetS — metabolic syndrome; Ref. — reference population

Table 3. Patients' quality diet classification according to Healthy Eating Index.

Rating points	Diet evaluation	Patients [%]
80 and more	Good/correct	0
51–80	Needs modification	73
Less than 51	Bad/poor diet	27

Table 4. Percentage of interviewed who met the nutritional recommendations.

Key cardioprotective diet components	Patients [%]
Saturated fatty acids to account for < 10% of total energy intake	11
< 5 g of salt per day	30
30–45 g of fiber per day	0
200 g of fruit per day	45
200 g of vegetables per day	47
Fish at least twice a week	37
Alcohol consumption	88

Table 5. Average daily energy and nutrients intake.

Parameters	Mean ± SD
Diet energy [kcal/d]	2,555.2 ± 513.6
Protein [g/d]	92.5 ± 20.5
Animal origin [g/d]	57.7 ± 15.7
Plant origin [g/d]	34.5 ± 11.3
Fat [g/d]	101.4 ± 27.8
SFA [g/d]	35.5 ± 9.9
PUFA [g/d]	17.4 ± 5.9
PUFA n-3 [g/d]	1.5 ± 1.0
PUFA n-6 [g/d]	15.6 ± 5.9
Carbohydrates [g/d]	313.3 ± 60.8
Sucrose [g/d]	65.0 ± 15.1
Dietary fiber [g/d]	20.5 ± 3.2
Na [g/d]	5.81 ± 0.87
K [g/d]	2.72 ± 0.4
Ca [g/d]	0.87 ± 0.33
Dietary cholesterol [g/d]	285.5 ± 77.9

SD — standard deviation; SFA — saturated fatty acids; PUFA — polyunsaturated fatty acids; Na — dietary sodium; K — dietary potassium; Ca — dietary calcium

Crosstalk between nutritional and clinical cardiometabolic risk factors

Table 6 presents the correlations between dietary and the selected clinical cardiometabolic risk factors. Increased energy, SFA and sucrose intake were strongly associated with greater values of waist circumference (WC), FM and fasting plasma glucose (FPG). Daily Na consumption was positively correlated with total energy intake ($r = 0.54$, $p < 0.0001$), SFA ($r = 0.52$, $p < 0.0001$) and animal protein consumption ($r = 0.49$, $p < 0.0001$), thus significant positive correlations between Na intake, WC, FM, low-density lipoprotein cholesterol (LDL) and systolic blood pressure (SBP) were found. Increased dietary fiber consumption was associated with decreased values of almost all of the presented metabolic risk factors. There was a negative correlation between Ca intake and WC, FM and SBP.

Discussion

Our study clearly demonstrates a large discrepancy between patient beliefs and the need for health behavioral change, as noted by specialists.

Obesity is undoubtedly an emerging epidemic that, similar to other chronic diseases, is caused by complex lifestyle-dependent interactions [14]. Thus, the crucial step in clinical practice is to estimate the risk of CVD. According to SCORE Risk Charts, the majority of the study population was at a moderate or higher risk of fatal CVD events. It is important to emphasize that SCORE calculation

Table 6. Correlation between selected clinical cardiometabolic risk factors and dietary intake.

	WC	FM	HDL	LDL	TG	SBP	FPG
Energy	0.49	0.36	–0.31	NS	NS	0.34	0.32
P	< 0.0001	0.030	0.003			0.001	0.042
Protein	0.49	0.32	NS	NS	NS	NS	NS
P	< 0.0001	0.028					
Animal protein	0.46	0.32	NS	NS	NS	NS	NS
P	< 0.0001	0.027					
Sucrose	0.55	0.39	–0.36	NS	0.49	NS	0.41
P	< 0.0001	0.003	0.012		0.005		0.022
Dietary fiber	–0.41	–0.47	NS	–0.43	–0.52	–0.38	–0.45
P	0.002	0.035		0.040	0.026	0.045	0.034
Fat	0.52	0.23	–0.39	NS	NS	0.31	NS
P	< 0.0001	0.031	0.002			029	
SFA	0.43	0.36	–0.35	0.30	NS	0.37	0.31
P	< 0.0001	0.001	0.042	0.037		0.018	0.039
P/S ratio	NS	NS	NS	NS	0.45	NS	NS
P					0.035		
Na	0.35	0.42	NS	0.33	NS	0.48	NS
P	0.010	0.033		0.044		0.007	
Ca	–0.38	–0.31	NS	NS	NS	–0.46	NS
P	0.044	0.039				0.006	

Data presented as r-Pearson linear correlation coefficient; WC — waist circumference; FM — fat mass; HDL — high-density lipoprotein; LDL — low-density lipoprotein; TG — triglycerides; SBP — systolic blood pressure; FPG — fasting plasma glucose; SFA — saturated fatty acids; P/S ratio — polyunsaturated/saturated fatty acids ratio; Na — sodium; Ca — calcium; NS — not significant

may underestimate the risk in patients with central obesity, sedentary lifestyle and a family history of premature CVD, which was the case in our population. Moreover, some patients had already been pharmacologically treated for either hypertension or dyslipidemia, yet still had not been provided with knowledge about lifestyle behavior changes. A similar observation was reported by Niknian et al. [15], who examined the association between the perceived and objective risk of a CV event (heart attack and stroke) and demonstrated that patients tended to underestimate their personal risk. Patients' attitude to health-related lifestyle might be changed by an adverse CV event, as evidenced by higher results reached in HBI by patients after myocardial infarction or heart transplantation [12, 16]. Intervention programs targeting diet in obesity-related hypertension aim to achieve long-term change in health-related behaviors [17]. However, there is no consensus about the most effective behavioral techniques for lifestyle modification. Moreover, the main emphasis is on the maintenance of lifestyle changes and prevention of relapse, whereas becoming aware of the problem by the patient arouses less interest.

In agreement with the available data, our results showed that cardiometabolic risk is strictly associated with excess body weight and poor diet quality [18]. There is growing evidence demonstrating that changing dietary habits to the typical Western diet increases the risk of chronic disease, including CVD and diabetes [19, 20]. Guo and Crockett [21] found that the likelihood of MetS was greater when the HEI score was lower. They reported that people consuming a poor diet (HEI < 50) were at a 3.6-fold higher risk of MetS than those who consumed a good diet (HEI > 80).

We also noted that poor diet quality and greater intake of high energy foods was associated with a frequent 'skipping breakfast' practice. Min et al. [22] confirmed the association between breakfast consumption and the risk of chronic diseases. Longitudinal breakfast skipping has detrimental effects on cardiometabolic risk factors, such as WC, FPG, LDL cholesterol, and total cholesterol (TC). Also, breakfast skipping led to an impaired fasting lipid profile and impaired postprandial insulin sensitivity. Surprisingly, MetS patients assessed their 'healthy eating habits' on the same level as people without metabolic abnormalities.

Admitted consumption of wholegrain products, vegetables and fruit was far from the recommended daily intake. Owing to the presence of nutritionally valuable compounds that include dietary fiber, trace minerals, phytoestrogens and antioxidants, wholegrain products are highly recommended as part of a cardioprotective diet plan [23]. It has been shown that a greater and regular consumption of wholegrain foods is associated with a lower risk of MetS and a lower CV mortality [24]. We also noted a negative correlation between fiber intake and WC, FM, triglicerides (TG) and LDL. These findings are consistent with the data from CARDIA study demonstrating that a high intake of fiber prevents from weight gain and lowers CV risk factors, such as high blood pressure and elevated TG, LDL and fibrinogen, more strongly than other dietary components [25].

It is generally agreed that the type of consumed fatty acids is more important that daily total fat intake [26]. The high intake of SFA is associated with high LDL and strongly correlates with coronary death rates. The European Society of Cardiology defined 10% of total energy as the upper limit of daily SFA intake [1]. In presented study, the average consumption of SFA was higher and positively correlated with WC, FM, LDL and SBP.

High intake of SFA was associated with low consumption of PUFA, which was reflected in the low P/S ratio. It is well documented that the recommended consumption of PUFA lowers TC: high density lipoprotein ratio, improves insulin sensitivity, normalizes blood pressure and reduces systemic inflammation [27]. Available data suggest that increasing the P/S ratio to 1.0 (approximately 1.0–1.5) would reduce the risk of atherosclerosis and MetS [28].

According to the Implementation of the European Union (EU) Salt Reduction Framework Results, salt intake in Poland is one of the highest in Europe — it was estimated that salt consumption in men (14.7 g/d) is almost twice as high as in women (8.6 g/d). Although our results revealed lower values it is still more than the daily recommended level. The results of a stimulated study for the United States population indicate that lowering salt consumption by 3 g/d could result in a 5.9% to 9.6% reduction in the incidence of coronary heart disease, a 5.0% to 7.8% reduction in the incidence of stroke and a 2.6% to 4.1% reduction in all-cause death rate [29].

Some authors reported a strong association between the psychosocial factors and the increased risk of developing CVD that might be mediated by a psychophysiological processes as well as by health-related behaviors [30]. Stressful situations, permanent stress and negative emotions are associated with a greater intake of food in general and of foods regarded as less healthful. We observed a similar relationship — our patients admitted that the consumption of sweets, snacks and fast foods increased in times of greater stress. Unhealthy eating habits are usually linked to other unhealthy behaviors, such as physical inactivity and smoking, which in turn leads to overweight and obesity.

It is important to mention that simultaneously with poor eating habits, 91% of patients did not meet the physical activity recommendations. Thorp et al. [31] provided evidence that the number of hours of inactivity (e.g. watching television, playing computer games) was positively associated with the components of MetS. In turn, Hsu et al. [32] found that involving moderate or vigorous physical activity of at least 150 min/week during leisure time lowered the prevalence of MetS.

Limitation of the study

A limitation of the study was non-random selection of the patients. Patients who were recruited to the registry already indicated their willingness to assess their health status. For this reason the applicability of these results to the general population of patients with MetS is limited. Another limitation we are aware of is underrepresentation of women in our study. Finally, although the questionnaires in this study showed adequate reliability, some of the questionnaires showed lower reliability. Subjects' responses could be inaccurate due to misunderstanding of the question, and even the manner in which the question was asked.

Prospective randomized study focused on lifestyle modification in patients with a discrepancy between health self-perception and medical recommendations can be the focus of future research.

Conclusions

There is a significant discrepancy between health perception and medical recommendations in patients with MetS. Effective patient education, taking into account a revision of the patients' knowledge on the principles of prophylaxis, may form the fundament for the changes in patient behavior, and CV risk reduction.

Conflict of interest: None declared

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