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ORIGINAL PAPER

THE EFFECT OF EDUCATION ON LIFESTYLE CHANGES AND METABOLIC SYNDROME COMPONENTS

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Abstract

Aim: To assess the impact of education in adult patients meeting the criteria for metabolic syndrome (MS) on their lifestyle, blood pressure and selected anthropometric and laboratory indicators. *Design:* The study had an experimental character. *Methods*: The study group consisted of 55 patients before the education and 46 patients three months after the education who met the criteria for MS according to the International Diabetes Federation for European population. Their lifestyle was assessed by a modified version of the standardized questionnaire Health-Promoting Lifestyle Profile II. Blood pressure and selected anthropometric and laboratory indicators were also assessed. *Results*: In patients after education, the amount of fresh fruits, fresh vegetables, dairy products, whole grain products, and steamed vegetables in the diet statistically significantly increased ($p \leq 0.05$) and the proportion of white bread, processed meat, starchy foods and sweets significantly decreased. Significant improvement was observed in physical activity ($p \leq 0.05$). After the education, systolic blood pressure was significantly improved (-9.46 mm Hg, $p = 0.000$). In women, waist circumference (-5.09 cm, $p = 0.05$), levels of high-density lipoproteins cholesterol ($p = 0.022$) and glucose levels ($p = 0.048$) were improved, but we did not see significant changes in men. *Conclusion*: The results show the positive impact of education on patient adherence to recommendations relating to lifestyle changes and improvement of selected components of MS.

Key words: metabolic syndrome, education, nutrition, physical activity.

Introduction

Metabolic syndrome (MS) is defined as a cluster of metabolic and physiological perturbations that include abdominal obesity, elevated blood pressure (BP), elevated fasting glucose, and atherogenic dyslipidemia (Češka et al., 2010, p. 275; Grundy et al., 2005, p. 2735). MS is considered as one of the most important risk factors for cardiovascular diseases and type 2 diabetes mellitus (DM); it participates in the process of atherothrombogenesis, which is the main cause of high morbidity, disability and mortality in our population (Češka et al., 2010, p. 275). The prevalence of MS is increasing rapidly throughout the world, in parallel with high-calorie diet, sedentary lifestyle and increasing obesity.

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It is estimated that approximately 25% of adults in Europe and 32% of the USA population have MS; in older age, the prevalence of MS rises to 40% (Baráková, 2009, p. 20; Češka a kol., 2010, p. 275).

According to several authors (Češka a kol., 2010; Grundy et al., 2005; Heiner a kol., 2011; Svačina a kol., 2006), a key role in the management of patients with MS is to reduce and maintain an adequate body weight. This can be achieved by changing of eating habits, increasing physical activity, better stress management, and general participation in educational activities. Dietary therapy relates particularly to obesity and DM. Basic dietary measures in MS include regular food intake (up to 3–6 meals a day), even distribution of energy and carbohydrates throughout the day to avoid starvation and fluctuation of blood glucose in patients with DM, diet with plenty of fiber, vitamins and minerals, inclusion of fruits and vegetables, whole grains, potatoes and beans, reduced fat, restriction of salt, and sufficient intake of low-energy drinks (1.5 to 2 liters daily) (Beňo, 2008; Hainer a kol., 2011;

Svačina a kol., 2006). The Mediterranean diet is a dietary pattern that has already shown its cardioprotective effects (Kastorini et al., 2011; Kesse-Guyot et al., 2013). It is characterized by high consumption of monounsaturated primarily fatty acids, particularly from olives and olive oil, and encourages daily consumption of fruits, vegetables, whole grain cereals, and low-fat dairy products; weekly consumption of fish, poultry, tree nuts, and legumes; relatively low consumption of red meat, approximately twice/month; as well as moderate daily consumption of alcohol, normally with meals (Kastorini et al., 2011).

Physical activity is fundamental for the treatment of obesity and other components of MS. A sharp rise in the incidence of MS for 30 years in the developed countries of Europe and especially North America is caused by the change of lifestyle that allows limitation of physical activity and availability of high-energy foods and drinks. Most patients with MS are capable of a certain physical activity in respect of the comorbidity. For the effectiveness of physical activity, its frequency, intensity and duration are important. Regular physical activity changes body composition. It leads to a decrease in fat mass and an increase in muscle mass. For the common practice, 30 to 60 minutes of daily physical activity of moderate intensity for almost all days of the week are to be recommended to patients with MS. This represents the minimum level of physical activity, which can have positive effects on the components of MS (Cho et al., 2009; Thomson et al., 2003).

Cognitive behavioral therapy (CBT) has an important place in the treatment of MS (Adachi, 2005; Corbalán et al., 2009; Grave et al., 2011; Tsiros et al., 2008). CBT aims to eliminate or alleviate the symptoms of the disease, without any profound changes in personality of patients who are aware of the need to change their inappropriate lifestyle. CBT is based on behavioral techniques which include self-monitoring (composition of diet, exercise, analysis of moments of boredom), active control of stimuli (high-risk situations with inappropriate food intake, elimination of inappropriate purchases, stress management), positive reinforcement (remuneration, family support), and on cognitive techniques (cognitive restructuring, removal of self-blame, positive thinking) (Adachi, 2005; Corbalán et al., 2009; Grave et al., 2011; Tsiros et al., 2008).

Aim

To assess the impact of education in adult patients meeting the criteria for MS from the Vranov nad Topľou District on (i) lifestyle changes involving diet, physical activity, stress management, and personal responsibility for health; (ii) clinical parameters: body weight, waist circumference, hip circumference, waist-to-hip ratio (WHR), and systolic and diastolic BP; and (iii) laboratory tests: total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), and blood glucose.

Methods

Design

This study was experimental. A sample of patients meeting the criteria for MS was exposed to education. The effectiveness of education was assessed using a lifestyle questionnaire, clinical and laboratory parameters (see Data collection) prior to and three months after education. The study was conducted in the outpatient and inpatient departments of the Vranov Hospital with consent from the management between October 2012 and the end of January 2013.

Sample

The group consisted of patients who met the criteria for MS for the European population according to the International Diabetes Federation (IDF) – the presence of the basic criterion, that is, abdominal obesity defined by waist circumference ≥ 94 cm in men and ≥ 80 cm in non-pregnant women, and of at least two of the following four criteria: fasting blood glucose above 5.6 mmol/L or previously diagnosed type 2 DM, hypertrigylceridaemia ≥ 1.7 mmol/l or specific treatment, decreased levels of HDL-C < 1.03 mmol/l (men), < 1.29 mmol/L (women) or specific treatment, and systolic/diastolic BP ≥ 130/≥ 85 mm Hg or specific treatment. The other inclusion criteria were age between 18 and 70 years, willingness to cooperate, and signed informed consent. A condition for remaining in the sample was that the patients' pharmacological treatment was not changed during the study.

The sample comprised 56 patients who underwent individual education. After the education, feedback was obtained from 44 patients. The average age of respondents was 48.11 ± 11.70 and 47.77 ± 10.98 years at the beginning of and after the education, respectively, with no statistically significant difference ($p = 0.884$). The group mostly consisted of women, the greatest proportions of patients were married and had secondary education (Table 1). Statistically significant differences were not observed in the composition of the group in terms of gender, marital status or education level before and after the education.

Table 1 Demographic characteristics of the sample

		Before education N (%)	After education N (%)	p-value
Gender	Male	17 (30.4)	12 (27.9)	0.554
	Female	39 (69.6)	31 (72.1)	
Marital status	Living with a partner	43 (76.8)	31(73.8)	0.735
	Living without a partner	13 (23.2)	11 (26.2)	
Education	Primary school	3 (5.4)	2 (4.8)	0.993
	Lower secondary school	15 (26.8)	11 (26.2)	
	Higher secondary school	22 (39.3)	17 (40.5)	
	University – degree I	3 (5.4)	3 (7.1)	
	University – degree II or higher	13 (23.2)	9 (21.4)	

Education

The aim of education of patients with MS was an effort of knowledge modification, acceptance, achieving and maintaining changes in diet, physical activity and increasing personal responsibility for health. The educational session lasted approximately 60 minutes and was carried out individually. Both traditional (e.g. motivational interviewing, demonstration or lecture) and alternative teaching methods (e.g. "true and false", "pros and cons", "stick to your plan" or synectics) were applied in the course of education (Nemcova et al., 2010). Educational sheets, cards with appropriate and inappropriate meals, appropriate and inappropriate physical activity, sample menu and diary monitoring of nutrition and physical activity were developed and used during the education. The education was conducted in the outpatient and inpatient departments of the Vranov Hospital during hospitalization in accordance with the patients' condition and prior to its termination.

At the beginning, the relationships between diet, physical activity, levels of fat, blood glucose, body weight, BP and others were explained to the patients. In terms of diet, the needs to increase consumption of cereal products, fiber, fruits and vegetables, substitute full-fat and high-fat foods with medium- and low-fat products, reduce the energy content of foods and beverages, reduce portion sizes, avoid eating in the evening and night hours, shop with a list of items, avoid fasting, etc. were stressed. Educational sheets with appropriate and inadequate foods and a sample menu were prepared for patients to help them in changing their eating habits. Behavioral techniques, including self-monitoring and stimulus control, were performed. To facilitate self-monitoring, a diet diary was designed for patients, who could record mealtimes, types of food, portion sizes, and situations and daily activities related to food intake. Stimulus control focused on the analysis of situations that lead to increased consumption of food, namely emotional tension, stress, social situations (e.g. shopping without a list of items, fasting, celebration, food preparation, watching TV or being on the Internet) and preparing a plan for these situations. The education in the area of physical activity was focused on the needs to reduce sedentary lifestyle (watching TV, Internet) and increasing physical activity, for instance through walking, cycling, brisk walking or climbing stairs. The main objective was the inclusion of physical activity of mild to moderate intensity into a daily routine (e.g. brisk walking) of at least 20 to 30 minutes, unless it is contraindicated by disease. Educational sheets with suitable and unsuitable sporting activities and a "pros and cons" exercise were prepared for the patients. Together with the patients, we focused on describing a typical daily routine, considered the "pros and cons" and planned inclusion of physical activity (at least 20–30 minutes of brisk walking) during the day. To facilitate self-monitoring, a diary was given to patients to record the date, time, type of daily activity and physical activity.

Data collection

Instruments

For the evaluation of lifestyle, the standardized Health-Promoting Lifestyle Profile II questionnaire was modified (Walker, Sechrist, Pender, 1987). The instrument is freely available for non-commercial purposes, such as research. The questionnaire did not undergo any linguistic validation. We selected some items related to diet, physical activity, stress management, personal responsibility for health and satisfaction with health from this questionnaire. Some questions about diet and sedentary lifestyle, culturally modified items and the Likert scale were added. The overall reliability of the used questionnaire expressed by Cronbach's alpha reached an appropriate value of 0.657.

Clinical parameters

The clinical measurements included height (m), weight (kg), body mass index (BMI), waist circumference (cm), hip circumference (cm), WHR, and systolic and diastolic BP (mm Hg).

Laboratory tests

Total cholesterol (mmol/L), TG (mmol/L), HDL-C (mmol/L), LDL-C (mmol/l) and blood glucose (mmol/L) levels were evaluated in this study.

Data analysis

Absolute values (N) and percentages were calculated for nominal variables. The mean (M) and standard deviation (SD) were calculated for interval or ordinal variables. Chi-square tests (Pearson's chi-square; at extremely low frequency of less than 5 in 20% of tables, continuity correction, Fisher's test or likelihood ratio) were used to measure the association between nominal variables. The Mann-Whitney U test, in view of the size of the sample < 50, was used to test the differences in lifestyle, clinical parameters and laboratory tests before and after the education. The results were processed with The Statistical Package for the Social Sciences (SPSS) version 20.

Results

Eating habits were monitored in patients meeting the diagnostic criteria for MS before and after the education (Table 2). We studied the intake of food and beverages using the Likert scale, where 1 – never or very rarely, 2 – a few times a month, 3 – 2 to 3 times a week, 4 – 5 to 6 times a week, and 5 – every day. The proportion of fresh fruit and vegetables, dairy products, whole grain products and steamed vegetables significantly increased, while the proportion of white bread, processed meat, starchy foods and sweets significantly decreased.

The frequency of physical activity (Table 3) was monitored using the Likert scale, where 1 – never, 2 – rarely 3 – sometimes, 4 – often, and 5 – very often. Physical activity lasting for 20 minutes 3 times a week and 30 to 40 minute walks increased significantly after the education. Statistically significant changes were not found in other exercise habits and leisure time activities. It should also be added that the respondents spent most of their free time passively (watching TV, being on the Internet, reading books, etc.).

Selected strategies of coping with stress (e.g. acceptance of changes that cannot be controlled, maintaining a balance between work and rest, relaxation for 15–20 minutes a day, overcoming fatigue by moving) were followed on the Likert scale, where 1 – never, 2 – rarely, 3 – sometimes, 4 – often, and 5 – very often. Only the strategy "overcoming fatigue by moving" was statistically significantly improved (mean value 2.41 ± 1.01 before education vs. 2.91 ± 0.91 after education, p = 0.012).

Table 3 Physical and leisure time activities before education and 3 months after education

		N	Mean	Standard deviation	p-value
Physical activities 3x per week for 20 minutes (brisk walking, cycling)	Before education	56	2.14	1.24	0.006
	After education	44	2.73	1.13	
30- to 40-minute walks	Before education	56	2.29	0.87	0.000
	After education	44	3.36	0.72	
Moderately strenuous exercise	Before education	56	1.77	0.95	0.088
	After education	44	2.09	1.03	
Physically strenuous exercise	Before education	56	1.11	0.37	0.268
	After education	44	1.23	0.57	
Watching TV	Before education	56	3.64	1.03	0.665
	After education	44	3.57	0.97	
Being on the Internet	Before education	56	2.32	1.28	0.627
	After education	44	2.45	1.32	
Reading books, crossword puzzles	Before education	56	3.11	1.22	0.620
	After education	44	3.25	1.24	

Table 2 Eating habits in patients before education and 3 months after education

		N	Mean	Standard deviation	p-value
Fresh vegetables	Before education	56	3.30	1.19	0.001
	After education	44	4.09	0.91	
Fresh fruits	Before education	56	3.71	1.09	0.001
	After education	44	4.41	0.69	
Milk	Before education	56	2.34	1.44	0.133
	After education	44	2.66	1.22	
Dairy products	Before education	56	2.95	1.31	0.009
	After education	44	3.59	1.09	
White bread	Before education	56	2.68	1.49	0.011
	After education	44	1.91	1.05	
Whole grain products	Before education	56	3.61	1.23	0.013
	After education	44	4.23	0.86	
Meat (pork, beef)	Before education	56	3.39	0.95	0.486
	After education	44	3.50	0.85	
Processed meat (salami, sausages, pâté)	Before education	56	3.21	1.09	0.014
	After education	44	2.68	0.80	
Starchy foods	Before education	56	2.41	0.56	0.031
	After education	44	2.16	0.53	
Steamed vegetables	Before education	56	2.30	0.93	0.000
	After education	44	2.98	0.82	
Side dishes (rice, potatoes, pasta, dumplings, etc.)	Before education	56	3.57	0.85	0.662
	After education	44	3.41	1.06	
Sweets	Before education	56	2.79	1.23	0.005
	After education	44	2.11	0.99	
Salted crackers	Before education	56	1.96	0.83	0.235
	After education	44	1.77	0.80	
Sweetened beverages	Before education	56	1.86	1.18	0.075
	After education	44	1.43	0.76	
Juices	Before education	56	1.71	0.97	0.787
	After education	44	1.64	0.87	

Patients' personal responsibility for health (search for health information, discussing health issues with a doctor/nurse, a change in attitudes to health based on a doctor's/nurse's advice, reporting changes in health/physical symptoms) was assessed on the Likert scale, where 1 – never, 2 – rarely 3 – sometimes, 4 – often, and 5 – very often. After the education, the search for information about one's health status was significantly increased (3.04 ± 1.04 vs. 3.45 ± 0.76, p = 0.054 – borderline). Patients' attitudes to health statistically significantly improved (3.02 ± 1.04 vs. 3.80 ± 0.73, p = 0.000) and reporting of changes in health/physical symptoms also increased significantly (2.50 ± 0.91 vs. 3.18 ± 0.87, p = 0.000).

From the objective parameters, BP was evaluated. After the education, systolic BP decreased significantly – by 9.46 mm Hg (134.46 ± 11.36 vs. 125.00 ± 7.78 mm Hg, p = 0.000). Diastolic BP did not change (80.86 ± 11.01 vs. 79.32 ± 5.87 mm Hg, p = 0.404).

The anthropometric measurements included body weight, BMI, waist and hip circumference, and WHR. Three months after the education, a reduction in body weight of 4.97 kg was recorded in our sample, but without statistical significance (91.02 ± 16.23 vs. 86.23 ± 5.87 kg, p = 0.165). BMI decreased too, but not significantly (31.82 ± 5.09 vs. 30.58 ± 5.55 kg/m^2, p = 0.247). In accordance with the IDF criteria, waist and hip circumference and WHR were

evaluated in relation to gender (Table 4). Statistically significant improvement was observed only in women, with a waist circumference reduction of 5.09 cm.

Changes in laboratory parameters in relation to gender are shown in Table 5. For men, we found only a trend of improvement in the parameters without statistical significance. In women, the levels of HDL-C and blood glucose were significantly improved.

Table 4 Waist and hip circumference and WHR before education and 3 months after education

		Male				Female			
		N	Mean	Standard deviation	p-value	N	Mean	Standard deviation	p-value
Waist circumference (cm)	Before education	17	107.94	10.39	0.413	39	102.26	10.19	0.050
	After education	13	106.38	11.08		31	97.23	16.96	
Hip circumference (cm)	Before education	17	111.88	13.03	0.785	39	112.58	12.05	0.284
	After education	13	112.54	11.38		31	109.35	14.84	
WHR	Before education	17	0.97	0.08	0.414	39	0.89	0.05	0.110
	After education	13	0.95	0.06		31	0.87	0.48	

Table 5 Laboratory tests before education and 3 months after education according to gender

		Male				Female			
		N	Mean	Standard deviation	p-value	N	Mean	Standard deviation	p-value
Total cholesterol	Before education	17	5.77	1.26	0.825	38	5.65	1.13	0.110
	After education	12	5.60	0.93		30	5.15	0.92	
TG	Before education	16	1.96	0.46	0.164	32	1.66	0.48	0.152
	After education	12	1.58	0.66		25	1.49	0.37	
HDL-C	Before education	16	1.14	0.27	0.100	34	1.28	0.22	0.020
	After education	12	1.33	0.38		26	1.42	0.25	

Discussion

Several studies (Babio et al., 2009; Fappa et al., 2008; Kastorini et al., 2011; Kesse-Guyot et al., 2013) have demonstrated that education of patients or intervention programs aimed at correcting dietary habits and physical activity are associated with a lower risk of metabolic syndrome components or MS improvements. The aim of education of patients with MS was an effort to modify knowledge, accept, achieve and maintain changes in diet and physical activity, and increase personal responsibility for health. Educational sessions took place individually. We encouraged patients to increase the intake of fresh fruits and vegetables, whole grain cereals, legumes, fish, nuts and low-fat dairy products, reduce the consumption of white bread, starchy foods, sweets and processed meat, and substitute animal fat in the diet with olive oil. In the area of physical activity, we recommended reducing sedentary lifestyle and increasing the activity of mild to moderate intensity, lasting at least 30 minutes per day.

Three months after the education, the amount of fresh fruits and vegetables, dairy products, whole grain products and steamed vegetables significantly increased and the proportion of white bread, processed meat, starchy foods and sweets in the patients' diet significantly decreased. Similarly, other studies (Babio et al., 2009, p. 563–568; Gerstel et al., 2013, p. 81–82; Kesse-Guyot et al., 2013, p. 677–682) point out the importance of education and patients' adherence to recommendations relating to lifestyle changes (diet or physical activity), in order to improve body weight, BMI, waist circumference, total cholesterol, TG, and HDL-C.

Physical activity, parallel to diet, is an important factor to reduce the risk of MS or to improve components of MS. In the area of physical activity, we saw a statistically significant increase in the frequency of movement – more than 20 minutes 3 times a week and more frequent inclusion of walks into the daily routine. In other exercise habits and leisure time activities, there were no statistically significant changes. It should also be added that the respondents in our sample spent most of their free time passively, especially watching TV. Many studies (Gerstel et al., 2013, p. 81–82; Cho et al., 2009, p. 786–790; Laaksonen et al., 2002, p. 1614–1615; Mujica et al., 2010, p. 151) suggest the importance of physical activity. Increased levels of physical activity (duration and intensity) are proportionally related to the reduction of the risk of

MS. Moderate physical activity and walking in a fast pace for at least 30 minutes a day are of great importance (Lakka, Laaksonen, 2007). On the contrary, sedentary lifestyle, long time spent watching TV, videos or a computer are associated with increased prevalence of MS (Dunstan et al., 2005, p. 2254–2258, Ford et al., 2012, p. 608–612).

Some studies (Chandola et al., 2006; Räikönen, 2007, p. 874–875) also point out the role of psychological and social factors (depressive symptoms, frequent and intense feelings of anger, tension and severe stressful life events) in the development of metabolic syndrome. In the field of stress management, only the strategy of overcoming fatigue by movement improved significantly after the education in our sample. Inclusion of relaxation into the daily routine showed only a trend of improvement (not a significant one) after the education.

We recorded no statistically significant changes, only a trend of improvement in body weight and BMI in our sample. After the education in men, we did not observe any statistically significant improvement in waist and hip circumference or WHR. After the education in women, we observed statistically significant improvement in waist circumference, a trend of improvement in hip circumference, but no significant changes in WHR. After the education, systolic BP improved significantly, while diastolic BP values did not change in the whole group. In men, the laboratory indicators of MS did not improve significantly; the results indicated only a trend of improvement in the laboratory tests. In women, there was a significant improvement in HDL-C and blood glucose, while in the level of LDL-C, a trend of improvement was recorded. Results of other studies (Kastorini et al., 2011, p. 1299–1313; Oliveira et al., 2012) also demonstrated a positive relationship between the change in diet – higher intake of fruits and vegetables, fiber and dairy products, and reduced symptoms of MS or a lower risk of MS. A meta-analysis by Kastorini et al. (2011, p. 1299–1313) revealed the protective role of Mediterranean diet ingredients for MS; laboratory and anthropometric parameters (waist circumference, HDL-C, TG, systolic BP, diastolic BP and glucose) improved in patients. Structured educational programs, aimed at increasing physical activity (and improving eating habits) had a clear impact on improvement of anthropometric and laboratory indicators of MS (Gerstel et al., 2013, p. 81–82; Mujica et al., 2010, p. 151).

The limitations of this study include the size and sampling (not randomized). We also had no control group of patients not exposed to education. Therefore, our results cannot be generalized to the entire population and are valid only in our sample of patients meeting the criteria for MS. Certain restrictions may also related to the questionnaire we used and modified, as well as their lower return rate. For higher credibility, it would be advisable to test the effect of education longitudinally.

Conclusion

The non-pharmacological therapy of MS is based primarily on reducing and maintaining reasonable body weight, which can be achieved by changing eating habits, increasing physical activity and better stress management. Despite some limitations of this study, it may be said that the education contributed to increased personal responsibility for health and better patients' adherence to the recommended lifestyle in terms of diet, physical activity etc. This was followed by a positive effect on MS components. The educational role of nurses is therefore crucial in the management of patients with MS.

Ethical aspects and conflict of interest

The study was approved by the Vranov Hospital management. All patients were informed about the aim, content and course of study. They were assured that no risks were connected with the research and that they could withdraw at any time without giving a reason. All participants gave their informed consent to the study and their anonymity was preserved.

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Author contribution

Both authors have contributed significantly to manuscript preparation. Study conception and design (MSS, JH), data collection, patients' education (JH), data analysis (MSS), interpretation (MSS, JH), manuscript draft (MSS, JH), critical revision of the manuscript (MSS), final approval of the manuscript (MSS).

References

Adachi Y. Behavioral therapy for obesity. *Japan Medical Association Journal*. 2005;48(11):539–544.

Babio N, Bullo M, Basora J, Martınez-Gonza´lez MA, Fernandez-Ballart J, Marquez-Sandoval F, Molina C, Salas-Salvado J on behalf of the Nureta-PREDIMED investigators. Adherence to the Mediterranean diet and risk of metabolic syndrome and its components. *Nutrition, Metabolism & Cardiovascular Diseases*. 2009;19(8):563–570.

Baráková A. Epidemiologická situácia v SR – choroby obehovej sústavy a ich rizikové faktory. *Via practica*. 2009;6(1):17–21. (in Slovak)
Beňo I. *Náuka o výžive*. Martin: Osveta; 2008. (in Slovak)
Corbalán, MD, Morales EM, Canteras M, Espallardo A, Hernańdez T, Garaulet M. Effectiveness of cognitive–behavioral therapy based on the Mediterranean diet for the treatment of obesity. *Nutrition*. 2009;25(7–8):861–869.
Dunstan DW, Salmon J, Owen N, Armstrong T, Zimmet PZ, Welborn TA, Cameron AJ, Dwyer T, Jolley D, Shaw JE. Associations of TV viewing and physical activity with the metabolic syndrome in Australian adults. *Diabetologia*. 2005;48(11):2254–61.
Fappa F, Yannakoulia M, Pitsavos Ch, Skoumas I, Valourdou S, Stefanadis Ch. Lifestyle intervention in the management of metabolic syndrome: could we improve adherence issues? *Nutrition.* 2008;24(3):286–291.
Ford ES, Harold WK III, Ali HM., Umed AA. Sedentary behavior, physical activity, and the metabolic syndrome among U.S. adults. *Obesity Research*. 2005;13(3):608–614.
Gerstel E, Pataky Z, Busnel C, Rutschmann O, Guessous I, Zumwald C, Golay A. Impact of lifestyle intervention on body weight and the metabolic syndrome in home-care providers. *Diabetes and Metabolism*. 2013;39(1):78–84.
Grave RD, Calugi S, Centis E, Ghoch ME, Marchesini G. Cognitive-Behavioral Strategies to Increase the Adherence to Exercise in theManagement of Obesity. *Journal of Obesity*. 2011;2011:348293.
Grundy SM, Cleeman JI, Daniels SR, Donato KA, Eckel RH, Franklin BA. Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. *Circulation*. 2005;112(17):2735–2752.
Hainer V et al. *Základy klinické obezitologie*. Praha: Grada Publishing a.s., 2011. (in Czech)
Chandola T, Brunner E, Marmot M. Chronic stress at work and the metabolic syndrome: prospective study. *British Medical Journal.* 2006;332(7540):521–525.
Cho ER, Shin A, Kim J, Jee SH, Sung J. Leisure-time physical activity is associated with a reduced risk for metabolic syndrome. *Annals of Epidemiology*. 2009;19,(11):784–792.
Kastorini CM, Milionis HJ, Esposito K, *Giugliano D, Goudevenos J, Panagiotakos DB.* The effect of Mediterranean diet on metabolic syndrome and its components. *Journal of the American College of Cardiology.* 2011;57(11):1299–1313.
Kesse-Guyot E, Ahluwalia N, Lassale C, Hercberg S, Fezeu L, Lairon D. Adherence to Mediterranean diet reduces the risk of metabolic syndrome: A 6-year prospective study. *Nutrition, Metabolism and Cardiovascular Diseases*. 2013;23(7):677–683.
Laaksonen DE, Lakka HM, Salonen JT, Niskanen LK, Rauramaa R, Lakka TA. Low levels of leisure-time physical activity and cardiorespiratory fitness predict development of the metabolic syndrome. *Diabetes Care*. 2002;25(9):1612–1618.
Lakka TA, Laaksonen DE. Physical activity in prevention and treatment of the metabolic syndrome. *Applied Physiology, Nutrition and Metabolism*. 2007;32(1):76–88.
Mujica V, Urzua A, Leiva E, Dıaz N, Moore-Carrasco R, Vasquez M, Rojas R, Icaza G, Toro C, Orrego R, Palomo I. Intervention with education and exercise reverse sthe metabolic syndrome in adults. *Journal of the American Society of Hypertension*. 2010;4(3):148–153.
Nemcová J, Hlinková E, Kelčíková S, Lepiešová M, Pokorná A, Tomašíková M, Urbanová E. *Moderná edukácia v ošetrovateľstve*. Martin: Osveta; 2010. (in Slovak)
Oliveira EP, McLellan KCP, de Arruda Silveira LV, Burini RC. Dietary factors associated with metabolic syndrome in Brazilian adults. *Nutrition Journal*. 2012;11:13.
Räikkönen K, Matthews KA, Kuller LH. Depressive Symptoms and Stressful Life Events Predict Metabolic Syndrome Among Middle-Aged Women. *Diabetes Care*. 2007;30(10):872– 877.
Svačina Š. et al. *Metabolický syndrom*. 3. vyd. Praha: Triton, 2006. (in Czech)
Thompson PD, Buchner D, Pina IL, Balady GJ, Williams MA, Marcus BH, Berra K, Blair SN, Costa F, Franklin B, Fletcher GF, Gordon NF, Pate RR, Rodriguez BL, Yancey AK, Wenger NK; American Heart Association Council on Clinical Cardiology Subcommittee on Exercise, Rehabilitation, and Prevention; American Heart Association Council on Nutrition, Physical Activity, and Metabolism Subcommittee on Physical Activity. Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: a statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation.* 2003;107(24):3109–16.
Tsiros MD, Sinn N, Brennan L, Coates AM, Walkley JW, Petkov P, Howe PRC, Buckley JD. Cognitive behavioral therapy improves diet and body composition in overweight and obese adolescents. *The American Journal of Clinical Nutrition*. 2008;87(5):1134–40.
Walker SN, Sechrist KR, Pender NJ. The Health-Promoting Lifestyle Profile II; 1987 [cited 2012 Sept 11]. Available from: http://www.unmc.edu/nursing/Health_Promoting_Lifestyle_Profile_II.htm