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ORIGINAL ARTICLE

EVALUATION OF CARDIOVASCULAR DISEASES RISK FACTORS IN A GROUP OF MEN HOSPITALIZED AFTER MYOCARDIAL INFARCTION

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ABSTRACT

Background. Cardiovascular diseases (CVD) due to their large expansion and high mortality represent a serious problem for society. Ischemic heart disease and myocardial infarction is the leading cause of death and morbidity in both men and women in Europe, although is lower in women than in men.

Objective. To evaluate the occurrence of cardiovascular risk factors and the impact of selected dietary habits on lipid profile and body mass index in adult men hospitalized after myocardial infarction in the Cardiocenter Nitra in 2010-2020.

Material and Methods. This study was focused on a group of adult men (n = 193) in the age range of 25 to 85 years. Patients were selected using the method of random selection from the database of those hospitalized in the Cardiocenter Nitra in 2010-2020. We evaluated to influence of risk factors of cardiovascular diseases on lipid profile and BMI of men. The questionnaire for the detection of dietary habits and life style of respondents was used. It was applied individually by interviewer and was compiled by the Institute of Nutrition and Genomics. Data collection was carried out simultaneously with a somatometric and biochemical examination of the respondents ensured by the Cardiocenter Nitra. The following parameters were tested: total cholesterol (T-C), LDL cholesterol (LDL-C), HDL cholesterol (HDL-C) and triacylglycerols (TAG) and glucose (GLU) by automatic biochemical analyzer BioMajesty® JCA-BM6010/C. We used statistical analysis of Statistica Cz version 10 and one-way ANOVA, followed by Tukey's post hoc test.

Results. The most important risk factor is clearly the lifestyle of the respondents. Only 11% of the respondents had an optimal BMI, 51% were classified as overweight and up to 38% had a BMI higher than 30 $kg.m^{-2}$. Improper dietary habits and lack of physical activity contributed to the development of hypertension and hypercholesterolaemia in the majority of respondents. Statistically significant changes in HDL-cholesterol scores were found to be associated with respondents' BMI ($p< 0.01$).

Conclusions. Studied men after the myocardial infarction should attach particular importance to their diet and lifestyle, which significantly affect BMI, blood lipid parameters and the inflammatory process as risk factors responsible for the etiopathogenesis of cardiovascular diseases.

Key words: *myocardial infarct, risk factors, nutrition, lipid parameters, dietary habits*

INTRODUCTION

Cardiovascular diseases (CVD) are one of the leading causes of mortality and morbidity in the world [37]. Over the last decade, the number of CVD deaths worldwide has increased by 12.5%. There are various reasons for this progressive number of cardiovascular deaths. In 2016, the primary cause of the total CVD burden was coronary heart disease, which accounted for 49% of the total CVD burden, followed by stroke with 33% of the total CVD burden [32].

According to the WHO [41] the biggest danger in the world is coronary heart disease, which is responsible for 16% of all deaths in the world. The largest increase in deaths has been since 2000, rising by more than 2 million in 2019 to 8.9 million deaths. Stroke and chronic obstructive pulmonary disease are the leading causes of death, accounting for approximately 11% and 6% of total deaths in the world.

Ischemic heart disease and myocardial infarction are the leading cause of death and morbidity in both men and women in Europe, although the incidence and prevalence of coronary heart disease by age is lower in women than in men [36].

In addition to medical history and physical examination, myocardial ischemia may be associated with ECG changes and elevated biochemical markers such as cardiac troponins [29].

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Mortality after myocardial infarction has decreased significantly since the 1990s, while the number of patients recovering from myocardial infarction has increased. Nevertheless, in people who have recovered from the acute phase, myocardial infarction has a morbidity and mortality rate 1.5 - 15 times higher than in the general population, depending on gender and clinical manifestations. These individuals have a higher risk of subsequent myocardial infarction, angina pectoris, heart failure, and stroke [22, 25].

Risk factors are generally classified as modifiable (habits, environment, etc.) or non-modifiable (age, gender, genetic predisposition). Influenceable factors are considered critical for prevention because specific, targeted interventions may be able to alleviate the risk burden [9, 26]. The cardiac function of the human heart changes with age. An age-related change in systolic function is, under normal conditions, mild but sudden under stress or in a state of pathogenesis. Gradually with age are reduce the heart's tolerance to stress and increases susceptibility to ischemia [7]. Gender is characterized by the biological characteristics of the individual, which are determined by chromosomal complement and sex hormones. The influence of these biological factors on the development of cardiovascular diseases is well known. Testosterone deficiency is generally associated with an increase in serious cardiovascular adverse events, particularly myocardial infarction and stroke in men [8].

A positive (parental) family history of cardiovascular disease, especially at baseline, is a widely accepted risk factor for cardiovascular events in offspring [11, 34]. Obesity is associated with the development of various lifestyle-related diseases and is also known to be a strong risk factor for CVD [14]. Obesity is associated with an increased risk of developing cardiovascular disease, especially heart failure and coronary heart disease. Mechanisms by which obesity increases the risk of CVD include changes in body composition that can affect hemodynamics and alter heart structure. Pro-inflammatory cytokines produced by adipose tissue alone may induce cardiac dysfunction and may promote atherosclerotic plaque formation [5, 21].

Dyslipidemia is a common cause of atherosclerosis. It is manifested by cardiac, vascular disorders, sudden stroke, arterial hypertension, myocardial infarction [10]. Psychosocial factors, such as low socioeconomic status, acute or chronic stress, and depression or anxiety, are highly prevalent in cardiac patients and are associated with behavioral and biological risk factors. Thus, they are associated with a higher risk of cardiovascular disease and an unfavorable course of the disease [1, 45].

Nutrition plays an important role in the development of CVD. Choosing healthy foods reduces cardiovascular risk by weight loss, lowering blood pressure, affecting blood lipid levels, blood glucose levels [3, 13].

Tobacco smoking continues to be a major risk factor for CVD and the leading avoidable cause of death worldwide [2, 17].

Barry et al. [2] performed a meta-analysis regarding the association between cardiorespiratory fitness and BMI on mortality, and found that overweight unfit individuals showed more than double the risk of mortality compared with non-obese fit individuals, while overweight individuals who were fit did not experience significant risk. This is known as the "fat but fit" phenomenon, in which a higher level of fitness tends to negate the adverse cardiovascular effects of obesity. The authors of this study concluded that unfit individuals have twice the risk of death regardless of BMI, while overweight/obese individuals who are fit have a mortality risk similar to their normal weight counterparts.

The aim of this study is to evaluate the occurrence of cardiovascular risk factors and the impact of selected dietary habits on lipid profile and BMI in adult men hospitalized after myocardial infarction.

MATERIALS AND METHODS

This study was focused on a group of adult men (n = 193) in the age range of 25 to 85 years. In the age categories: < 40 years - 3.1%, 40 – 49 years - 8.8%, 50 – 59 years - 32.6%, 60 – 69 years - 40.4% and 70 and over -15.1%. Patients were selected from the database of those hospitalized in the Cardiocenter, Nitra (Slovakia) in 2010 – 2020.

This study was approved by the Ethics Committee of the Specialized Hospital St. Zoerardus Zobor (protocol number 10.6.2014). Participants signed the written consent before participating in the study.

Patients were selected using the method of random selection (those whose health condition allowed them to cooperate). We evaluated to influence of risk factors of cardiovascular diseases on lipid profile and BMI of men. In addition to basic anthropometric parameters, we also evaluated social aspects, respondents' medical history and biochemical parameters. We used the questionnaire method for the detection of dietary habits and life style of respondents. The questionnaire was applied individually by interviewer and was compiled by the Institute of Nutrition and Genomics. The first part questions concerned of socio-demographic situation of the subjects, physical activity, use of tobacco and medical history. The second part concerned the analysis of selected dietary habits, including the number of meals, regularity and the eating frequency of selected group of food products.

Data collection was carried out simultaneously with a somatometric and biochemical examination of the respondents ensured by the Cardiocenter in Nitra. The lipid profile in blood serum was measured by automatic biochemical analyzer BioMajesty® JCA-BM6010/C (DiaSys Diagnostic System GmbH). Parameters, considered to be one of the major risk factors for cardiovascular diseases, were evaluated: total cholesterol (T-C), LDLcholesterol (LDL-C), HDL cholesterol (HDL-C), triacylglycerols (TAG) and glucose (GLU). The anthropometric parameters - body weight (kg) and height (cm) were measured on outpatient electronic medical scales (Tanita WB-3000, Tanita Co., Tokyo, Japan). BMI was calculated by dividing the body weight in kilograms by the square of the height in meters.

Statistical Analysis

The data were checked for normality using the *Shapiro-Wilk* test. Statistical analysis of Statistica Cz version 10 (TIBCO Software Inc., Palo Alto, CA, USA) and MS Excel 2010 was used. Data were expressed in numbers as mean±standard deviation (SD) and statistical comparisons were made between groups using one-way analysis of variance (one-way ANOVA) followed by *Tukey's* post hoc test. Significance was accepted when $p < 0.05$.

RESULTS AND DISCUSION

Age is one of the main uncontrollable risk factors for cardiovascular disease. In men, the risk age is > 50 years. In the monitored group, we recorded up to 88.1% of respondents in the category over 50 years old and 11.9% of men were younger than 49 years old (Table 2). Similar results were recorded by *Lisowska* et al., that myocardial infarction in young adults under 45 represents approximately 10% of all cases [19].

The average body height of the respondents reached 1.76 m. The height of the respondents ranged from 1.59 m to 1.92 m. The average body weight was 89.75 kg. Respondents' body weight values ranged from 60 kg to 135 kg. BMI (body mass index) from the data on body height and weight was calculated. The National Institutes of Health uses BMI to define a person as being underweight, normal weight, overweight, or obese [40]. The BMI of the respondents ranged from 21.95 $kg.m^{-2}$ - 41.76 $kg.m^{-2}$, while the average BMI of the respondents was 29.08 $kg.m^{-2}$ (Table 1). 38.3% of the respondents had obesity >30 $kg.m^{-2}$. Our survey confirms high prevalence of overweight and obesity among men with cardiovascular disease.

Social conditions and education play an important role in the prevention and treatment of cardiovascular diseases. Our group was dominated 57% of respondents with secondary education and 32% respondents of higher education. The fewest respondents stated that they completed only basic education 11%. There were employed 37.3% respondents and retired were 48.6%, the others were not economically active. One of the factors that may be related to CVD is marital status. The benefits of marriage on health and mortality have been demonstrated for both sexes, in different ethnic groups. A better prognosis is known in married people after myocardial infarction and after a stroke [42]. The majority of respondents 80 % stated that they share their household with their family and 20% respondents live alone (Table 2).

In addition to myocardial infarction, several respondents from the selected group also suffered from other associated diseases. Cardiovascular disease, hypertension and hypercholesterolemia were the most common co-diagnoses, affecting 46% of respondents. The second most common disease was diabetes mellitus, which occurred in 21% of respondents. Gastrointestinal disorders occurred in 14%, musculoskeletal disorders (12%) and oncological diseases in 3% of respondents.

Hyperglycemia is fasting blood glucose in values higher than 6-7 $mmol.l^{-1}$. After a meal and during the day, a serum glucose value of more than 8-10 $mmol.l^{-1}$ is considered hyperglycemia [27]. We recorded the blood glucose values measured in the blood serum of the respondents 76% of the respondents from the group of patients who had not been treated before had a blood glucose higher than 5.6 $mmol.l^{-1}$. and KVO.

Table 1. Characteristics of study participants (n = 193)

Characteristics	Average ± SD	Min	Ma.
Age (years)	60.90 ± 10.86	25	85
Body height (m)	1.75 ± 0.07	1.59	1.92
Weight (kg)	89.56 ±13.32	60	135
BMI ($kg.m^{-2}$)	29.08 ± 3.58	21.95	41.67

Note: SD – standard deviation; Min – minimum value; Max – maximum value

Table 2. Demographic characteristics in study participants (n = 193)

Characteristics	%	Characteristics	%
Education:		*Family status:*	
basic	11.0	married	66.0
secondary	57.0	single	18.0
higher	32.0	widowed	16.0
Social status:		*Age categories*:	
employed	37.3	< 40 years	3.1
unemployed	16.1	40 – 49 years	8.8
retired	48.6	50 – 59 years	32.6
		60 – 69 years	40.4
		> 70 years	15.1

In the group of respondents who had previously been treated for cardiovascular disease, the blood glucose level was higher than the norm of 52.3% (Table 4).

Disorders of plasma lipid and lipoprotein metabolism (dyslipoproteinemia) represent a group of metabolic diseases characterized by elevated plasma lipid and lipoprotein levels or their inappropriate atherogenic composition. This is a disorder of synthesis or a disorder of their degradation. They are currently considered to be one of the most important risk factors for cardiovascular disease [12]. The optimal value of total cholesterol in an adult should not exceed 5.2 mmol.l^{-1}. An increased cholesterol level is considered to be from 5.2 to 6.2 mmol.l^{-1}. Values above 6.2 mmol.l^{-1} are considered high and above 7.8 mmol.l^{-1} a very high risk [27].

In the group of respondents without previous treatment, increased values of total cholesterol were measured in 24.4% and high-risk values in 13.4% respondents. In previous respondents, total cholesterol levels were elevated in 23.4% and very high cholesterol levels in 9.0% respondents. The optimal value of HDL-cholesterol in an adult male is 1.5 mmol.l^{-1}. If the values are lower than 1 mmol.l^{-1}, there is a greater presumption of the development of cardiovascular diseases [35]. In the case of people with a high cardiovascular risk, it is necessary to achieve LDL-cholesterol levels below 2.5 mmol.l^{-1} and in patients with a very high cardiovascular risk or diabetes, an even stricter value, less than 1.8 mmol.l^{-1} [35]. LDL-cholesterol levels > 2,5 were found in 36.1% respondents with previous treatment and 35.4% without previous treatment. The optimal value of TAG is considered to be <1.7 mmol.l^{-1}. The limit value is in the range of 1.7–2.3 mmol.l^{-1}. The high level of TAG is in the range of 2.3-5.6 mmol.l^{-1} [12]. We recorded the average, minimum and maximum value of lipid parameters of the respondents in Table 3.

Respondents stated that they regularly monitor blood pressure values. The optimal blood pressure value is considered to be a systolic blood pressure value of 120 mmHg and a diastolic blood pressure value of 80 mmHg. Hypertension (high blood pressure) is defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. Systolic blood pressure values below 90 mmHg and diastolic blood pressure values below 60 mmHg are considered low [16]. We observed high blood pressure 44.3% of respondents with previous treatment and 49.2% without treatment (Table 4).

Table 4 summarizes the most serious cardiovascular risk factors and percentages from the group of respondents after overcoming a myocardial infarction. Our survey confirms high prevalence of overweight (50.7%) and obesity (38.3%) among men with cardiovascular disease. Smoking, both active and passive, is an established vascular risk factor and one of the most serious global health problems and its harm to human health is of no doubt. It clearly leads to the progression of atherosclerosis. This risk increases with the number of cigarettes smoked per day [17]. The results of our research show that 38% of men currently smoke, up to 61 % of men smoked in the past and 23 % of men stopped smoking due to the disease.

Epidemiological data strongly suggest that the lack of physical activity significantly contributes to the increasing incidence of chronic diseases, especially cardiovascular. The main interventions in secondary prevention after overcoming an MI includes: smoking cessation, changing dietary habits and weight control, increasing physical activity to 30 minutes of moderate-

Table 3. Characteristics of lipid profile in study participants (n = 193)

Parameters	Average ± SD	Min	Max
TC (mmol.l^{-1})	4.74 ± 1.16	1.99	7.8
LDL-C (mmol.l^{-1})	3.05 ± 0.99	0.61	5.62
HDL-C (mmol.l^{-1})	1.14 ± 0.36	0.52	2.82
TAG (mmol.l^{-1})	1.67 ± 1.00	0.45	7.39
GLU (mmol.l^{-1})	6.89 ± 2.51	4.11	24.12

Note: SD – standard deviation; Min – minimum value; Max – maximum value

Table 4. CVD risk factors in study participants

Risk factors	%	Risk factors	T %	NT %
BMI > 25 (kg.m^{-2}) BMI > 30 (kg.m^{-2}) - obesity	50.7 38.3	TC > 5,2 (mmol.l^{-1})	32.4	37.8
Smoking	38.0	HDL-C < 1 (mmol.l^{-1})	44.1	39.0
Physical activity <30 min per day	45.0	TAG < 1,7 (mmol.l^{-1})	35.1	42.7
Positive family history	42.0	GLU > 5,6 (mmol.l^{-1})	52.3	64.6
Stres	42.0	Blood pressure > 130/85 (mmHg)	44.3	49.2

Note: BMI – body mass index; TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TAG – triacylglycerols; GLU – glucose; T- previously underwent treatment for cardiovascular disease, NT – non treatment before IM

intensity exercise at least five times a week and arterial pressure control [20].

Current physical activity of our respondents is very limited due to the bad health condition. 45% of men report moderate physical activity < 30 minutes per day. 23% of men adjusted their physical activity and increased it to 30-60 min 3 times a week, the rest have almost no physical activity.

A family history of premature CVD is a simple indicator of the risk of developing CVD, which is a reflection of genetic influence and shared environmental influence among members households. In men, the family history of CVD in relatives of the first is monitored degree, before the age of 55 [31]. Our survey confirms a high genetic predisposition to CVD in 45% of men.

Obesity is one of the most common risk factors for cardiovascular diseases and diabetes. We compared the biochemical parameters of respondents with BMI below and above 30 $kg.m^{-2}$ in table 5. According to the average values, LDL-cholesterol and triacylglycerols were considered risk values. There were statistically significant changes in the evaluation of HDL-cholesterol in connection with the BMI of respondents ($p<0.01$). In the association between the age and the lipid profile of the respondents, we can state that almost 57.5% of the respondents were treated with statins before the myocardial infarction, therefore the lipid profile adjusted with age in average values in the reference range without statistically significant changes ($p>0.05$) (Table 5).

Among the many known risk factors affecting CVD, it plays a role nutrition plays an important role. In recent decades, numerous studies have allowed us to understand the relationship between diet and cardiovascular health. American Heart Association guidelines in the primary prevention of cardiovascular disease diseases emphasize the connection with CVD mortality of the most common way of eating with high intake of simple sugars, low-calorie sweeteners, trans-fats, higher intake of sodium and red meat, especially their products (bacon, salami, ham, sausages, sausages) [38]. Reducing excess calories and improving composition diet can prevent many primary and secondary cardiovascular events. In the monitored group of patients, 103 patients did not follow any diets and 90 patients followed diets (diabetic 46.79%, low-fat 34.85% and salt-restricted diet 18.36%).

Wang et al. [39] indicates in their meta-analysis that higher consumption of red meat and processed meat is associated with an increased risk of total, cardiovascular, and cancer mortality. Increased cardiovascular risk related to high consumption of red and processed meat has been linked to their high content of saturated fatty acids (SFA) and cholesterol [15, 33]. Nevertheless, findings from randomized controlled trials assessing the effect of red meat intake on CVD risk factors are inconsistent [28, 43].

We evaluated the impact of respondents' red meat consumption. Table 6 shows the effect of the frequency of consumption of meat on the lipid profile. Pork was consumed most often. 57.5% of the participants indicated that they consumed this meat 1 – 2 times per week, 10.9% consumed 3 – 4 times per week, 30.1% did not consume pork and only 1.5% of respondents ate pork occasionally. The majority of respondents (53.4%) did not consume beef at all or sometimes. Of the meat products, sausages and salami were the most consumed. 21% of respondents consumed sausages daily.

The results show, that most respondents consume red meat 1 – 2 times per week, while we did not notice a significant effect ($p >0.05$) of the type of pork and beef on the lipid profile. The highest TAG values were seen in respondents who consume pork 3 – 4 times per week. The effect of pork meat on LDL-C was the only

Table 5. Effect of BMI and age on respondents' lipid parameters

Respondents' BMI	TC $mmol.l^{-1}$ average ± SD	TAG $mmol.l^{-1}$ average ± SD	HDL-C $mmol.l^{-1}$ average ± SD	LDL-C $mmol.l^{-1}$ average ± SD
≤ 30 $kg.m^{-2}$	4.72±1.10	1.74±1.12	1.19± 0.42	3.02±1.05
> 30 $kg.m^{-2}$	4.83±1.34	1.83±1.10	1.10±0.32	3.11± 1.04
p-value	> 0.05	> 0.05	< 0.01	> 0.05
Age categories				
< 40 years	5.53±0.71	2.10±1.20	0.81±0.12	2.58±0.69
40 – 49 years	4.89±0.81	1.34±0.56	1.21±0.27	3.16±0.66
50 – 59 years	4.75±1.14	1.68±0.90	1.10±0.33	3.08±0.98
60 – 69 years	4.72±1.26	1.75±1.12	1.19±0.43	2.95±1.05
> 70 years	4.85±1.11	1.55±0.98	1.10±0.20	3.25±1.04
p-value	> 0.05	> 0.05	> 0.05	> 0.05

Note: BMI – body mass index; TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TAG – triacylglycerols; SD – standard deviation

statistically significant ($p < 0.05$). Of the meat products, frankfurters (hot dogs) and salamis were consumed the most, 3 – 4 times per week (61%). Approximately 10% of respondents consume frankfurters daily, which is associated with higher LDL-C and lower HDL-C levels. In the questionnaire we also asked about eating Slovak brand products such as sausages and head cheese. These products were less popular with respondents. They appeared in the respondents' menus only occasionally.

We recorded a significant effect ($p<0.05$) of the consumption of frankfurters on the LDL-C, HDL-C and TAG. Processed meats such as sausages have a higher content of saturated fatty acids and cholesterol than fresh red meat; reaching the proportion of fat in sausages more than 50% of weight [18]. 24% of respondent state that they did not consume sausage and head cheese, 33% respondents consume this product sometimes and 31% in frequency 3 – 4 times per week. However, respondents who did not consume sausage have, on average, a significantly higher TAG compared to less frequent consumption (Table 6).

Consumption of protective foods as fish, fruits and vegetables reduces the risk of cardiovascular disease. Increasing evidence links fish consumption to a low risk of CVD and mortality among the general population [6]. The evidence also shows an inverse relationship between fish consumption and the incidence of sudden cardiac death [23, 24]. The benefits to the heart associated with consuming fatty fish are likely to be associated with beneficial effects on a number of CVD risk factors, such as lowering triacylglycerols and improving HDL-C levels [4].

Fish consumption in Slovakia is low, which is confirmed by this research. Alarmingly up to 37% of respondents followed the recommended intake of fish (twice a week), the others consumed fish 1 – 3 times per month and occasionally. In the consumption of freshwater fish, we found a statistically significant effect ($p < 0.05$) on the level of triacylglycerols between

Table 6. Effect of frequency of red meat and processed meat consumption on lipid profile

Frequency of consumption	n (%)	TC mmol.l^{-1} average ± SD	LDL-C mmol.l^{-1} average ± SD	HDL-C mmol.l^{-1} average ± SD	TAGmmol.l^{-1} average ± SD
Pork					
1-2 times per week	98(50.7)	4.69±1.12	3.00±0.96	1.15±0.38	1.63±0.99
3-4 times per week	8 (4,1)	4.94±1.49	3.14±1.05	1.10±0.30	1.72±0.73
no consumption	0	4.84±1.12	3.19±1.03	1.10±0.32	1.61±1.12
p-value		>0.05	<0.05[b]	>0.05	>0.05
Beef					
1-2 times per week	49 (25.4)	4.82±1.18	3.14±0.09	1.14±0.34	1.61±0.90
3-4 times per week	6 (3.1)	4.55±0.99	2.86± 1.07	1.23±0.50	1.46±0.41
no consumption	10 (5.2)	4.79±1.26	3.03±0.97	1.10±0.30	1.88±1.30
p-value		>0.05	>0.05	>0.05	>0.05
Salami					
1-2 times per week	96 (49.7)	4.70±1.19	2.98±1.04	1.15±0.39	1.71±0.95
3-4 times per week	23 (11.9)	4.72±1.24	3.12±0.97	1.15±0.24	1.44±0.89
sometimes	11 (5.7)	5.21±1.00	3.45±0.92	1.04±0.26	1.70±0.68
no consumption	13 (6.7)	4.92±1.16	3.16±0.83	1.11±0.83	1.96±1.75
p-value		>0.05	>0.05	>0.05	>0.05
Frankfurters					
daily	30 (15.5)	5.04±0.85	3.48±0.91	1.03±0.14	1.50±0.51
3-4 times per week	28 (14.5)	4.68±1.14	2.95±1.03	1.17±0.42	1.74±0.87
3-4 times per month	56 (29.0)	4.40±1.04	2.79±0.78	1.23±0.78	1.27±0.53
no consumption	11 (5.7)	5.02±1.39	3.24±1.05	1.02±0.28	1.99±1.55
p-value		>0.05	<0.05[c]	<0.05[d]	<0.05[d]
Slovak brand products (sausage, head cheese)					
3-4 times per week	58 (30.0)	4.64±1.01	3.00±0.85	1.14±0.34	1.61±0.75
sometimes	31 (16.1)	4.87±1.22	3.16±1.08	1.14±0.32	1.39±0.53
no consumption	33 (17.1)	4.86±1.24	3.03±1.09	1.09±0.45	2.05±1.15
p-value		>0.05	>0.05	>0.05	<0.01[d]

Note: TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TAG – triacylglycerols; SD – standard deviation; [b] Significant difference between 1 – 2 times per week and no consumption, [c] Significant difference between daily consumption and 3-4 times per month, [d] Significant difference between non consumption and 3-4 times per month

the respondents who did not consume fish and the respondents who consumed it 1 – 3 times per month. We also found a statistically significant effect ($p < 0.05$) on the level of HDL-C between the respondents who consumed it 1 – 3 times per month and sometimes. We found the highest statistically significant effect ($p < 0.01$) on the level of HDL cholesterol between of respondents who consumed freshwater fish 1 – 2 times per week and sometimes. The different frequencies of sea fish consumption showed non-significant changes regarding the lipid profile (Table 7).

Fruits are similarly recommended on various heart-healthy diets due to their antioxidant and anti-inflammatory effects, high satiety profile and generally low glycemic index. In particular, berries (blueberries, currants) are associated with flavonoids called anthocyanins, which regulate endothelial function and glycemic metabolism. More than 3 portions of berry consumption per week are associated with a reduction in blood pressure and a reduced risk of diabetes type 2 [30]. The fruit was in the menu of each of the respondents. 60% of respondents consume fruit every day, 21% of respondents stated that they consume fruit 1 – 2 times a week, 17% of respondents consume fruit 3 – 4 times a week and the others consume fruit only occasionally (Table 7).

According to *Yahia* et al. [44] a diet rich in vegetables is an important factor in the prevention of cardiovascular diseases. 3 portions of vegetables and fruits a day achieved a positive effect. The relative risk can be minimized to a large extent by increasing the consumption of vegetables and fruits by up to 10 servings per day. The inverse relationship between vegetable and CVD intake was more evident in smokers who consumed at least 2.5 servings of fruits and vegetables per day compared to less than 1 serving/day. The level of fruit and vegetable intake showed a significant inverse relationship with CVD risk factors.

The frequency of vegetable consumption in the monitored group of respondents was as follows: 55% of respondents consume vegetables daily, 22% of respondents consume vegetables 3 – 4 times a week, 17% of respondents consume vegetables 1 – 2 times a week and others (6%) consume vegetables occasionally. The different frequencies of consumption fruit and vegetables showed non-significant changes regarding the lipid profile.

Table 7. Effect of frequency of protective food consumption on lipid profile

Frequency of consumption	n (%)	TC mmol.l^{-1} average ± SD	LDL-C mmol.l^{-1} average ± SD	HDL-C mmol.l^{-1} average ± SD	TAG mmol.l^{-1} average ± SD
Freshwater fish					
1-2 times per week	81 (41.7)	4.66±3.25	2.99±0.89	1.11±0.29	1.58±1.06
1-3 times per month	73 (37.8)	4.80±1.31	3.11±1.10	1.11±0.35	1.53±0.92
sometimes	24 (12.4)	5.17±1.04	3.16±1.11	1.37±0.53	2.00±0.82
no consumption	14 (7.3)	4.27±0.68	2.81±0.74	1.10±0.32	2.29±1.03
p-value		>0.05	>0.05	<0.01[b], <0.05[c]	<0.05[d]
Sea fish					
1-2 times per week	49 (25.4)	4.74±1.15	2.95±0.99	1.15±0.45	1.86±1.31
1-3 times per month	34 (17.6)	4.72±1.38	3.05± 1.15	1.09±0.32	1.47±0.83
sometimes	27 (14.0)	4.77±1.01	3.02±0.84	1.17±0.35	1.46±0.66
no consumption	29 (15.0)	4.81±1.10	3.27±0.94	1.15±0.24	1.95±0.93
p-value		>0.05	>0.05	>0.05	>0.05
Fruit					
daily	116 (60.1)	4.77±1.23	3.06±1.00	1.10±0.31	1.64±0.85
3-4 times per week	33 (17.1)	4.60±1.14	3.03±0.86	1.12±0.29	1.86±1.64
1-2 times per week	40 (20.7)	4.83±1.04	3.06±1.11	1.26±0.51	1.66±0.79
p-value		>0.05	>0.05	>0.05	>0.05
Vegetables					
daily	106 (54.9)	4.73±1.17	3.05±1.06	1.13±0.40	1.65±0.98
3-4 times per week	42 (21.8)	4.75±1.06	3.07±0.88	1.12±0.25	1.57±0.63
1-2 times per week	32 (16.6)	4.79±1.27	3.01±0.94	1.18±0.35	1.84±1.30
p-value		>0.05	>0.05	>0.05	>0.05

Note: TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TAG – triacylglycerols; SD – standard deviation; [b] Significant difference between consumption 1 – 2 times per week and sometimes, [c] Significant difference between consumption 1-3 times per month and sometimes, [d] Significant difference between non consumption and 1-3 times per month

CONCLUSION

A detailed examination of all the facts reported by the patients in the questionnaire led us to the conclusion that the development of cardiovascular diseases is mainly due to the influence of controllable risk factors. The most important risk factor is clearly the lifestyle of the patients. Only 11% of the respondents had an optimal BMI. 51% were classified as overweight and up to 38% had a BMI higher than 30 $kg.m^{-2}$. Improper dietary habits and lack of physical activity contributed to these unfavorable results, which also contributed to the development of hypertension and hypercholesterolaemia in the majority of respondents. The statistically significant changes in HDL cholesterol scores were found to be associated with respondents' BMI ($p < 0.01$). Nutrition and lifestyle play an important role in the prevention of cardiovascular diseases, which significantly affect blood lipid parameters, the inflammatory process, vascular endothelial elasticity and factors determining the etiopathogenesis of cardiovascular diseases.

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Conflict of interest statement

The authors declare no conflict of interest.

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