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MONITORING OF RISK FACTORS OF CARDIOVASCULAR DISEASES IN ADULT MEN

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ABSTRACT
The study aims to evaluate the monitoring of risk factors of cardiovascular diseases in the young population, which significantly contribute to the origin and development of cardiovascular diseases, such as peripheral artery diseases, atherosclerosis, stroke, and others. We focused on a group of young adult men (n = 110) in the age range of 30 to 50 years, which we selected from the database of 800 patients hospitalized in the Cardio Center in Nitra during 2010 – 2020. When evaluating the influence of meat products consumption frequency on biochemical parameters and BMI, we recorded a statistically significant effect at the level of p <0.05 in the evaluation of meat products such as salami, brawn, and sausages. When consuming sausages, BMI values also increased with increasing frequency of consumption. The effect on BMI was also observed when eating salami, between consuming 1 – 2 times a week and not at all. We recorded a statistically significant effect (p <0.05) in frequent consumption of brawn (1 – 2 weeks) on the level of HDL cholesterol. The most frequent fish consumption was 1 – 2 times a month for freshwater (51.8%) and marine fish (56.3%). Daily consumption of fruit was reported in 64.6% of men, while daily consumption of vegetables was recorded in only 44.6% of men. In the lifestyle assessment, we focused on probands' time spent on physical activity. Only 35.5% of men stated that they spend more than an hour a day on physical activity. 40% of men from the surveyed respondents were active smokers. Another risk factor for cardiovascular diseases is stress, which significantly affected up to 42.7% of respondents. Nutrition and lifestyle play an important role in the prevention of cardiovascular diseases, which significantly affect blood lipid parameters, vascular endothelial elasticity, and factors determining the etiopathogenesis of cardiovascular diseases.

Keywords: cardiovascular disease; risk factor; nutrition; lipid parameter; dietary habits

INTRODUCTION
Cardiovascular disease (CVD) is a class of diseases constituting all conditions that affect the heart and the associated blood vessels, and it is currently the leading cause of death **(Villa et al., 2016; Lee and Chen, 2015)**. Cardiovascular events in young adults, particularly acute coronary syndrome, are considered to be critical health threats and a socio-economic burden, because such events may lead to devastating consequences including disability and mortality **(Tsai et al., 2018)**. While CVDs such as coronary heart disease and stroke manifest clinically in middle age or older adulthood, their origins begin much earlier **(Tarp et al., 2016; Ross, 1999)**. Risk factors for CVD are broadly classified as modifiable and non-modifiable risk factors. The latter include age, heredity, familial predisposition, gender, and ethnicity. Modifiable risk factors are divided into cardiometabolic factors such as hypertension, dyslipidemia, diabetes mellitus, and obesity (together constituting the metabolic syndrome) and lifestyle factors such as smoking, less activity, nutrition, and low socioeconomic status **(Kumar, 2014; Emery et al., 2018; Kataria et al., 2020)**. Since cardiometabolic risk factors for CVD have a significant genetic and familial basis, it might be relevant to especially target the young populations predisposed by family history of CVD risk **(Lin et al., 2020)**. Although women and men share most classic risk factors, the significance and the relative weighting of these factors are different. Some researchers have documented that age, hypertension, total cholesterol, and low-density lipoprotein (LDL-C) have a great influence on men. But smoking, diabetes, triglyceride, and high-density lipoprotein (HDL-C) levels mainly affect women **(Galiuto and Locorotondo, 2017; Gao et al., 2019)**.

Behaviors in young adulthood such as smoking, physical activity, and diet have a significant impact on lifespan and middle-aged cardiovascular health. Approximately 80% of premature CVD deaths could be prevented through regulation of these behaviors **(Alwan, 2011; Liu et al., 2012)**. Most young adults have a low short-term risk of CVD but many have a higher lifetime risk due to lifestyle risk factors **(Van der Pol-Harney et al., 2020)**. In Europe, CVD prevention has been a priority since the late 90s: guidelines focus on the promotion of a heart-healthy lifestyle and management of risk factors for patients with established CVD as well as for the general population and include health-risk behaviors, such as dietary changes, exercise, and cessation of smoking and alcohol consumption **(Perk et al., 2012; Kotseva et al., 2016; Abbate et al., 2020)**.

Dyslipidemia is a major modifiable contributor to cardiovascular diseases **(Pan et al., 2016)**, elevated blood cholesterol accounts for nearly one-third of ischemic heart diseases **(Tripathy et al., 2017)**. Therefore, dyslipidemia constitutes a serious threat to population health and has become an important public health challenge **(Xing et al., 2020)**. Recommendations ESC/EAS 2019 for the management of dyslipidemias specified the content of cardiovascular risk categories, defined a new subcategory of CV risk, the so-called extremely high CV risk, introduced new, clearly lower target values for LDL-C, further strengthened the position of statins, removed several indication limitations for innovative pharmacotherapy. LDL-C target values range from 4.4 to 3.0 mmol.L^{-1} **(Semková a Pella, 2020)**. Overweight and obesity in childhood and adolescence are the most prevalent modifiable risk factor for later CVD. Long-term weight loss following lifestyle interventions in youth has generally been disappointing, but if overweight or obese children regain optimal body mass index by adulthood, cardiometabolic risks attenuate to baseline **(Juonala et al., 2011; Bekkering et al., 2020)**. Among the many established risk factors for CVD, diet plays an important role **(Forouzanfar et al., 2015)**. In the past several decades, numerous studies have enhanced our understanding of the relationship between diet and cardiovascular health **(Pan et al, 2018)**. Individual dietary choices are believed to play an important role in CVD, as indicated by recent studies that have evaluated the effects of various habitual dietary patterns on the cardiovascular health of numerous populations **(Pase et al., 2011; Tisdel et al., 2021)**. Individual diet indices differ in their components and weighting, but most emphasize the high intake of fruits and vegetables, whole grains, nuts; moderate intake of low/nonfat dairy and alcohol; and low intake of sodium, processed meats, added sugar, and saturated fat **(Kourlaba and Panagiotakos, 2009; Yu et al., 2018)**.

Scientific hypothesis

This study aims to evaluate the monitoring of risk factors for cardiovascular diseases in young adult men, which significantly contribute to the origin and development of cardiovascular diseases, such as peripheral artery diseases, atherosclerosis, stroke, and others.

MATERIAL AND METHODOLOGY

We evaluated to influence of risk factors of cardiovascular diseases on lipid profile and BMI of adult men in productive age. We focused on a group of adult men (n = 110) in the age range of 30 to 50 years, which we selected from the database of 800 patients hospitalized in the Cardio Center Nitra during the years 2010 – 2020. This study was approved by the Ethics Committee of the Specialized Hospital St. Zoerardus Zobor (protocol number 10.6.2014). Selected respondents have either overcome the myocardial infarction or were diagnosed with angina pectoris and hospitalized after a procedure so-called catheterization. We used the questionnaire method for the detection of dietary habits and lifestyle of respondents. The questionnaire was applied individually by a single interviewer and was compiled by the Department of Human Nutrition. The questionnaire included questions concerning the socio-demographic situation of the subjects, anthropometric parameters, physical activity, smoking, and the impact of stress in their lives. The questions concerning the analysis of selected dietary habits were focused on the number of the consumed meals, their regularity, and the eating frequency of selected groups of food products. Data collection was carried out simultaneously with a somatometric and biochemical examination of the respondents ensured by the Cardio Center Nitra. The lipid profile in blood serum was measured by automatic biochemical analyzer BioMajesty® JCA-BM6010/C (DiaSys Diagnostic System GmbH). The following parameters were evaluated: total cholesterol (T-C), LDL cholesterol (LDL-C), HDL cholesterol (HDL-C), and triacylglycerols (TG) because these parameters are considered to be one of the major risk factors for cardiovascular diseases. The anthropometric parameters - body weight (kg) and height (cm) were measured on outpatient electronic medical scales (Tanita WB-3000, Tanita Co., Tokyo, Japan). The body mass index (BMI) was calculated by dividing the body weight in kilograms by the square of the height in meters.

Statistical Analysis

Statistical analysis was carried out using the program Statistica Cz version 10 (TIBCO Software Inc., Palo Alto, California, USA) and MS Excel 2010. Data were expressed in figures as mean ± standard deviation (SD) and statistical comparisons between groups were made utilizing one-way analysis of variance (one-way ANOVA) followed by Tukey's post hoc test. Significance was accepted when $p < 0.05$.

RESULTS AND DISCUSSION

Basic characteristics of study participants

From the group of adult men, 110 patients met the required criteria with a mean age of 43.94 ±5.9 years. From the obtained individual values, we calculated the basic characteristics of males (Table 1).

The body mass index BMI is one of the easiest indices obtained and is one of the most commonly used methods to determine adiposity associated with risk factors CVD **(Sheibani et al., 2020)**. We divided the BMI values into four groups according to **Zheng et al. (2021)**. Category from BMI <18.5 kg.m^{-2} - malnutrition, BMI 18.5 – 24.9 kg.m^{-2} - normal weight, BMI 25 – 29.9 kg.m^{-2} - overweight, BMI ≥30 kg.m^{-2} – obesity. Obese probands with a BMI ≥ of 30 kg.m^{-2} (41.8%) had the largest proportion in the observed group. In the group BMI 25 – 29.9 kg.m^{-2} with overweight we recorded 39.1% participants. The demographic characteristics of the study participants show that the majority of participants were married (61.9%) and completed their studies (59.1%).

A study to examine the relationship between lipid profile and incidence of CVD in young adults is associated with high, low LDL cholesterol levels HDL cholesterol levels, and high levels of triacylglycerols with an increased incidence of heart failure.

Table 1 Basic characteristics of study participants.

Characteristic	category	%	Characteristic	category	%
Age (yrs)	30 – 34	10.9	**Education**	basic	5.4
	35 – 39	14.6		apprenticeship	18.2
	40 – 44	12.7		graduation	59.1
	45 – 50	61.8		**higher**	17.3
BMI (kg.m^{-2})	<18.5	2.7	**Family status**	**married**	61.9
	18.5 – 24.9	16.4		**divorced**	35.6
	25 – 29.9	39.1		single	2.5
	≥ 30	41.8			

Table 2 Basic characteristics of biochemical parameters of study participants.

Parameters	Average ± SD	Min	Max
GLU (mmol.L^{-1})	6.34 ±1.7	4.26	12.31
TC (mmol.L^{-1})	4.73 ±1.2	1.99	6.94
HDL-C (mmol.L^{-1})	1.45 ±0.4	0.55	2.44
LDL-C (mmol.L^{-1})	2.95 ±0.9	1.04	4.47
TG (mmol.L^{-1})	1.71 ±0.9	0.43	5.78

Note: SD – standard deviation; Min – minimum value; Max – maximum value; TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TG – triglycerides; GLU – glucose.

Table 3 Incidence of risk factors of study participants.

Risks factors	%	Risks factors	%
BMI ≥25 **(kg.m^{-2})**	79.1	**TC** ≥5.2 **(mmol.L^{-1})**	40.9
Smoker	40.9	**HDL-C** <1.0 **(mmol.L^{-1})**	40.9
Physical activity <30 min/day	25.2	**TG** ≥1,7 **(mmol.L^{-1})**	46.4
Positive family history of CVD	40.0	**GLU** ≥5.6 **(mmol.L^{-1})**	62.7
Stres	42.7	Blood pressure > 130/85 mmHg	61.6

Table 4 Effect of the frequency of consumption of selected processed meat on lipid profil and BMI of probands.

Sausage	**GLU** mmol.L^{-1}	**TC** mmol.L^{-1}	**HDL-C** mmol.L^{-1}	**LDL-C** mmol.L^{-1}	**TG** mmol.l^{-1}	**BMI** kg.m^{-2}
1-2 times per week	6.3 ±1.5	4.6 ±0.4	1.2 ±0,4	2.8 ±1,0	1.5 ±0,8	20 ±8.3 ^{a}
1-2 times per mounth	6.2 ±1.4	4.8 ±1.2	1.1 ±0,3	3.0 ±0,9	1.9 ±1,0	29.3 ±4.5 ^{b}
no consume	6.7 ±2.1	4.8 ±1.2	1.0 ±0,3	3.0 ±0,9	1.8 ±0,8	33.1 ±4.9 ^{c}
p-value	p >0.05	p >0.05	p >0.05	p >0.05	p >0.05	p <0.05
Salami						
1-2 times per week	6.4 ±1.8	4.8 ±1.3	1.2 ±0.4	2.9 ±1.0	1.9 ±0.9	30.7 ±7.5 ^{a}
1-2 times per mounth	6.5 ±2.0	4.5 ±1.1	1.1 ±0.3	2.9 ±0.8	1.5 ±0.8	28.5 ±4.0
no consume	5.9 ±0.8	4.7 ±1.0	1.2 ±0.3	3.0 ±0.9	1.2 ±0.6	28.3 ±6.1^{b}
p-value	p >0.05	p >0.05	p >0.05	p >0.05	p >0.05	p <0.05
Brawn						
1-2 times per week	7.4 ±2.6 ^{a}	4.5 ±1	0.9 ±1.3 ^{a}	3.0 ±0.9	1.7 ±0.7	30.2 ±6.5
1-2 times per mounth	6.0 ±1.4 ^{b}	4.6 ±1.1	1.1 ±0.3	2.8 ±0.9	1.7 ±1.0	30.3 ±7.3
no consume	6.5 ±1.5	5.1 ±1.4	1.3 ±0.5 ^{b}	3.2 ±1.0	1.8 ±0.8	29 ±6.1
p-value	***p* <0.05**	p >0.05	***p* <0.05**	p >0.05	p >0.05	p >0.05

Note: SD – standard deviation; TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TG – triglycerides; [a] Significant difference between 1-2 times/week and 1-2 times/mounth, [b] Significant difference between 1-2 times/mounth and no consume, [c] Significant difference between 1-2 times/ week and no consume.

The accumulation of triacylglycerols in cardiac muscle tissue may induce lipotoxic cardiomyopathy and cardiac steatosis. The latest recommendations emphasize the importance of early screening for lipid profile in young people because cumulative exposure to dyslipidemia in adolescence increases the future risk of CVD **(Kaneko et al., 2021)**. An overview of the average values of biochemical parameters can be found in Table 2. We monitored levels of glucose, total cholesterol, HDL cholesterol, LDL cholesterol, and triacylglycerols.

Cardiovascular disease (CVD) can be thought of as a continuum that begins with the presence of cardiovascular risk factors and proceeds via the progressive vascular disease to target organ damage, end-organ failure, and death **(Dzau et al., 2006)**.

Current epidemiologic predictions show that the world is heading for a vascular tsunami of pandemic proportions. The number of people at high risk from cardio-vascular disease is increasing **(Dalhöf, 2010)**.

Table 5 Effect of the frequency of physical activity on lipid profil and BMI of probands.

	GLU mmol.L-1	TC mmol.L-1	HDL-C mmol.L-1	LDL-C mmol.L-1	TG mmol.l-1	BMI kg.m-2
15-30 minutes per day	6.65	4.40	1.01	2.70	1.65	32.20
30-60 minutes per day	6.74	4.26	1.06	2.60	1.57	30.31
>60 minutes per day	6.32	5.05	1.28 [a]	3.17	1.80	27.80 [a]
no physical activity	5.73	4.95	1.15	3.17	1.76	30.29
p-value	p >0.05	p >0.05	***p* <0.05**	p >0.05	p >0.05	***p* <0.05**

Note: SD – standard deviation; TC – total cholesterol; (LDL-C) – LDL cholesterol; (HDL-C) – HDL cholesterol; TG – triglycerides; [a]Significant difference between 15-30 minutes/day and >60 minutes/day.

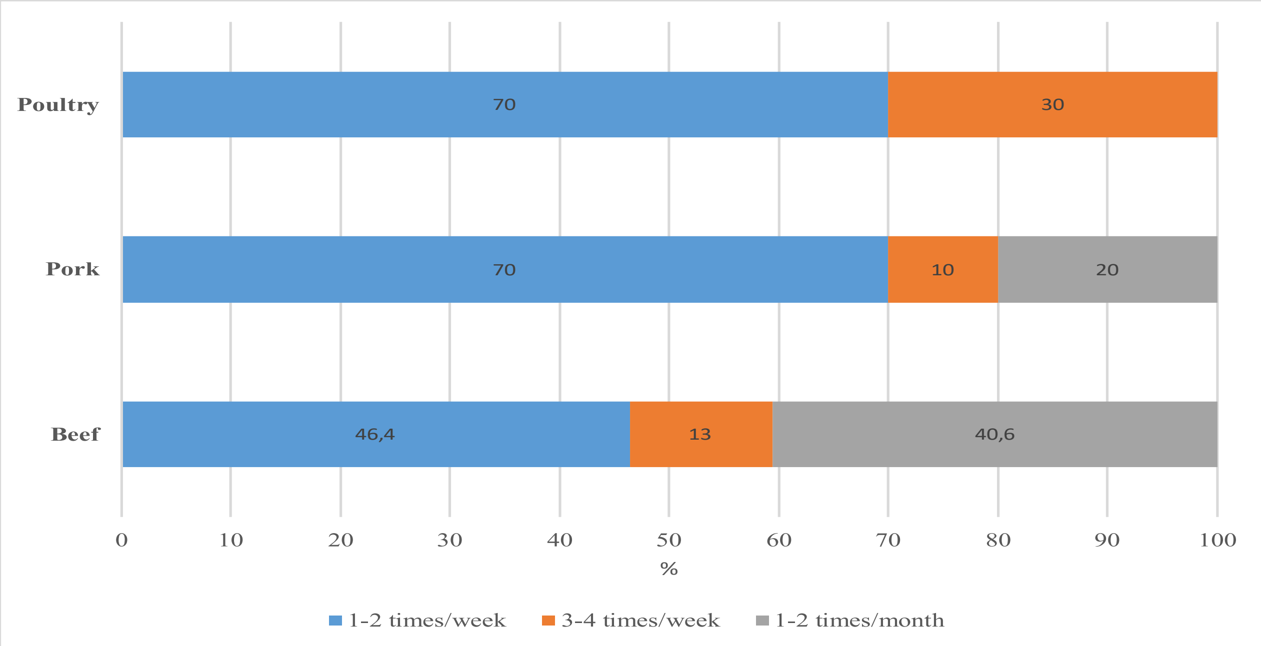

Figure 1 Percentages of consumption frequencies meat of probands.

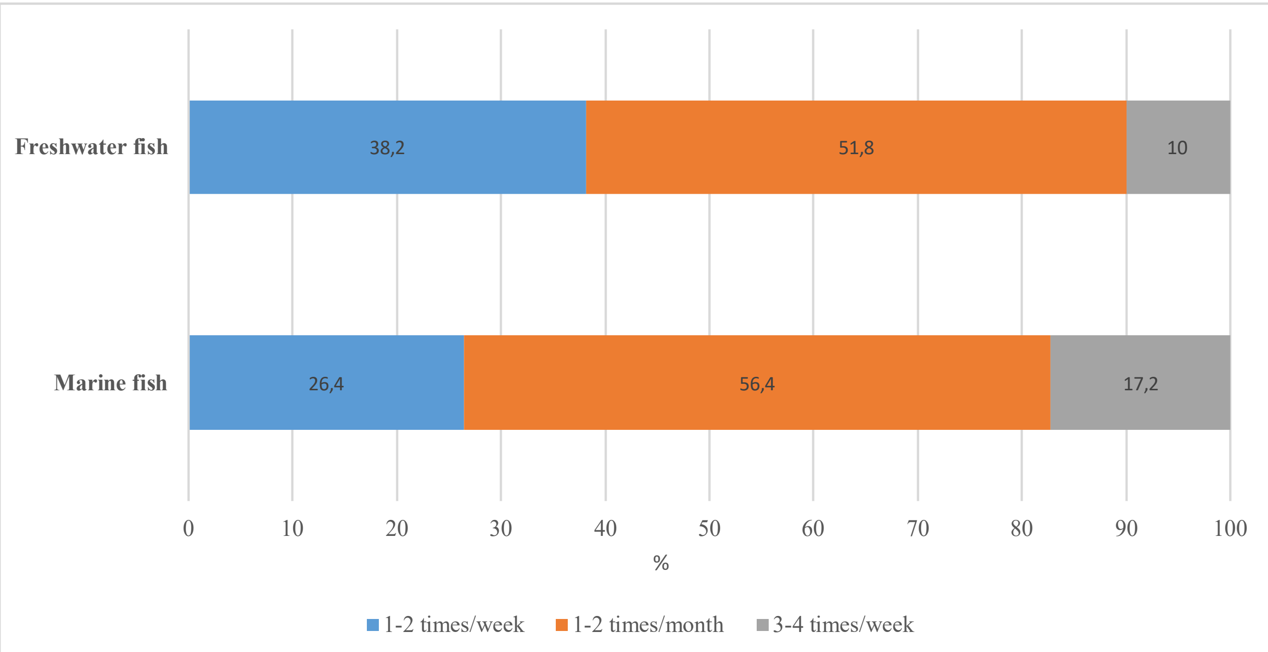

Figure 2 Percentages of consumption frequencies fish of probands.

Table 3 shows the most serious risk factors for CVD according to the NCEP III. **(American Medical Association, 2001)** and the percentage of men in the study a set of probands. The most common risk factor in men was BMI ≥25 $kg.m^{-2}$, which we recorded 79.1% of probands. Elevated fasting glucose was observed in 62.7% of probands. Total cholesterol values ≥5.2 $mmol.L^{-1}$ we recorded 40.9% of men and HDL cholesterol <1.0 $mmol.L^{-1}$ was recorded in 40.9% of men. Increased concentration of triacylglycerols ≥1.7 $mmol.L^{-1}$had 46.4% of probands. Blood pressure > 130/85 mmHg had 61.6% of probands. **Wright et al. (2007)** observed the association of cardiovascular disorders with a positive family history of CVD risk. Positive family history of CVD risk affects the response to stress, which may, in turn, contribute to the risk of future CVD. 40% of men said it occurred in their family myocardial infarction or stroke. 40% of men from the surveyed probands were active smokers. Another risk factor for cardiovascular diseases is stress, which significantly affected up to 42.7% of probands (Table 3).

The frequency of consumption of selected products of study participants

Among the various foods, meat plays a key role in human diets, since it is the richest source of proteins, essential amino acids, minerals, vitamins, and other micronutrients **(Lafarga and Hayes, 2014)**. However, several studies have reported that diets high in red and processed meats are associated with metabolic syndrome and cardiovascular disease **(Simpson et al., 2019)**.

The most preferred meat in the monitored group of probands was poultry meat, which consumes 70% of participants 1 – 2 times a week and 30% of participants 3 – 4 times a week (Figure 1).

Kopčeková et al. (2015) have recorded of patients with cardiovascular diseases consumption of meat 3-4 times per week in 60.28% of men and **Schmid et al. (2017)** found out that, the consumption frequency of beef, pork, and poultry of elderly Swiss population is the highest, with ≥50% of the participants consuming these types of meats at least once a week.

Hassannejad et al. (2021) found that total red meat intake had a significant, direct association with lipid profile. **Cocate et al. (2015)** showed that those in the highest tertile of red meat consumption (≥81.5g/day) had a greater occurrence of hypertriglyceridemia. However, epidemiological studies reveal no authoritative connections between the intake of red and processed meat and the occurrence of CVD **(Delgado et al., 2021)**.

Our results show, that in the evaluation of the influence of the frequency of consumption of meat products on biochemical parameters and BMI, we recorded a statistically significant effect at the level of p <0.05 of meat products such as salami and brawn. We also recorded a statistically significant effect (p <0.05) of regular consumption of sausages (1 – 2 times a week compared to y 1 – 2 times a month and no consume) on BMI of probands (Table 4). In the consumption of salami, we found a statistically significant effect (p <0.05) on the level of triacylglycerols in the group of probands who consumed salami 1-2 times a week and no consumption. HDL cholesterol levels were lower in probands who consumed brawn 1-2 times a week than in probands who did not consume. The highest TC, LDL-C, and TG values were seen in the male who consumes meat products 1 – 2 times per week. **Kontogianni et al. (2008)** found that a high intake of red meat (more than 8 servings/month) was associated with an increased risk of an acute coronary syndrome, but low income (less than four servings/month) showed no association.

Over the last few decades, the nutritional benefits of fish and polyunsaturated fatty acids on cardiovascular health have garnered great public health attention. Long-chain omega-3 polyunsaturated fatty acids (PUFAs) may prevent CVD by rendering antiarrhythmic effects and reduced blood viscosity, inhibiting platelet aggregation, lowering blood viscosity, suppressing inflammation, improving blood vessel function reducing plasma fibrinogen and insulin resistance **(Rhee et al., 2017)**.

Figure 2 shows the consumption of fish of study participants. They consumed freshwater fish more often, their consumption 1 – 2 times/week was reported by 38.2% of men, and 26.4% by sea fish. Most men consume fish 1-2 times/month in freshwater and marine fish. **Alhassan et al. (2017**) found that consuming fatty fish in the range of 20-150g/day leads to a significant reduction in plasma triacylglycerols and an increase in HDL cholesterol.

Many studies have shown a positive effect of fruit and vegetable consumption on some risk factors for CVD, such as lipid concentrations, inflammatory markers, and blood pressure **(Gan et al., 2015)**. As many as 64.6% of probands our study stated that they consume fresh fruit daily. 18.2% of probands consume 3-4 times/week and 17.3% consume fruit 1 – 2 times/week. 44.6% of men reported daily consumption of vegetables. 22.7% consumed vegetables 3 – 4 times/week and 23.6% consumed 1 – 2 times/week.

Lifestyle and its effect on biochemical parameters of study participants

In the lifestyle of the probands, we focused on their physical activity, smoking, stress factors, and sleep. Current physical activity guidelines for the secondary prevention of CVD prescribe at least 6500 – 8500 steps per day and 150 min of moderate-intensity aerobic exercise training per week, spread over at least five days **(Piepoli et al., 2016)**. **Williamson et al. (2021)** substantiate that as even modest levels of physical activity are associated with health benefits, the dose-response relationship observed between physical activity and CVD risk indicates that improving physical activity levels in small increments can also help mitigate CVD risk.

We found that only 35.5% of men engage in physical activity for more than an hour a day. 18.2% of men perform 30 – 60 min. physical activity a day, 20.5% only 15 – 30 min. a day, and 20.9% of men do not engage in any physical activity. The effect of the frequency of physical activity on the lipid profile and BMI of study participants is shown in Table 5. We recorded statistically significant results between frequency of physical activity 15-30 minutes/day and >60 minutes/day on the HDL cholesterol and BMI of probands (p <0.05).

According to **Nayeri and Middlekauff (2020)** nicotine, although not a carcinogen, is sympathomimetic. The increased sympathetic tone is known to increase cardiac risk through many potential mechanisms, including increased heart rate and blood pressure, vasospasm, and arrhythmias, and may contribute to inflammatory atherosclerosis. We found that 40% of men from the surveyed respondents were active smokers.

Another risk factor for cardiovascular diseases is stress, which significantly affected up to 42.7% of probands. Psychologically stressful experiences evoke changes in cardiovascular physiology that may influence risk for cardiovascular disease **(Ginty et al., 2017)**.

CONCLUSION

Nutrition and lifestyle play an important role in the prevention of cardiovascular diseases, which significantly affect blood lipid parameters and factors determining the etiopathogenesis of cardiovascular diseases. Men aged 30-50 are often an underestimated group in cardiovascular disease because cardiovascular disease is most common in the elderly. From the point of view of the effect of risk factors on CVD, it is important to focus on early intervention in lifestyle changes of the young population to reduce the effect of these factors. The sooner the effect of risk factors can be reduced or eliminated, the lower the risk of CVD. In preventing CVD, we evaluated several risk factors, whose impact has been confirmed by many studies.

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