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NUTRITION BASED ON DIFFERENT ORIGIN OF FATS AS A RISK FACTOR FOR CEREBROVASCULAR INSULT

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Cerebrovascular insult (CVI) is one of leading causes of mortality and morbidity worldwide, with significant influence of lifestyle on its development.

The aim of this study was to investigate the different risk factors and their impact on hyperlipidaemia in two ethnic groups of patients who were hospitalized after CVI during two years.

The total of 230 patients, 35-65 years old, with the ischemic CVI who had been hospitalized and treated at the Clinical Center Priština were included in our study. The patients were divided into two groups: group A (n=130)- Muslim patients, and group S (n=100) – Orthodox patients. Their antropometric and serum lipid parameters were measured and nutritional habits were assessed by food frequency questionnaire (FFQ).

The patients from both groups were classified as adipose, with BMI in males around 33, and in females 28-30. Percentage of body fat was also high in both groups, especially in women ($p<0.001$), without significant difference between groups A and S. Physical activity was very low in both studied groups. In the group A, 86.92% patients with CVI were physically inactive, while in the group S the percentage amounted to 92% ($p<0.001$). The number of smokers was rather high in both groups, particularly in group S (89%) and more than a half (53%) of examinees had been smoking for more than 10 years. Almost all smokers consumed more than 20 cigarettes per day (83%). In group A, there were 35% of non-smokers ($p<0.001$).

The average diastolic blood pressure value in the groups A and S (Table 6,7) was 97.97±4.75 mmHg and 100.82±6.71 mmHg, respectively, while systolic pressure was 174.27±3.18 mmHg in group A and 183.73±11.39 mmHg in group S.

In spite of different lifestyles in both groups, the studied risk factors were proved to have significant influence on the onset of hyperlipidemia. The S group patients whose diet was predominantly based on animal fats had significantly higher risk in comparison to the group whose diet was based on vegetable fats. Smoking habits and physical inactivity were widely present in both groups.

Our results suggest the need for target nutrition messages and behavioral interventions in developing prevention strategies for reduction of cerebrovascular risk factors. *Acta Medica Medianae 2011;50(2):5-11.*

Key words: *risk factors, diet, hyperlipidemia, cerebrovascular insult*

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Introduction

Cerebrovascular diseases currently have a dominant place in the structure of morbidity. Based on the World Health Organization (WHO) data, cerebrovascular insult (CVI) is the third leading cause of morbidity and mortality in the developed countries of the world, preceded only by ischemic heart diseases and malignant diseases (1). Thus, the disease is not only a therapy-related problem encountered by health services, but also, above all, epidemiological and rehabilitation one, since prevention of the onset of the disease represents a difficult task. Having in mind the consequences of the cerebrovascular insult, it also represents a major socioeconomic problem necessitating, as such, complex medical care and organization of the health service and community.

The onset of the disease is associated with a number of risk factors. They may be classified into three large groups: unchangeable risk factors (age, race, sex, religion, hereditary predisposition); documented risk factors (previous transitory ischemic attack, carotid artery disease, atrial fibrillation, hypertension, smoking, hyperlipidemia, diabetes mellitus), and potential risk factors (physical

inactivity, inadequate diet with resulting obesity, alcohol consumption, hyperhomocystei-nemia, hypercoagulability, hormonal therapy, oral contraceptives and inflammatory processes) (2).

The control of multiple risk factors is a key for prevention of cerebrovascular insult, taking into account the modification of lifestyle and appropriate pharmacological treatment (3,4). Intensive management of risk factors may reduce the risk of atherosclerosis of the cervicocranial and coronary blood vessels. The existing guidelines for prevention of ischemic insult developed by the American Heart Association are consistent with the former ones.

In Serbia, cerebrovascular insult is also one of the leading causes of mortality and morbidity not only in elderly but in younger adults as well.

Aim

The study was aimed at comparing two different ethnic groups of subjects with different lifestyles and dietary habits living in the same area, who were hospitalized after CVI, in order to investigate the relations between different risk factors and their influence on the development of cerebrovascular insult.

Material and methods

The study included 230 patients, aged 35-65, with ischemic CVI, treated at the Clinic of Neurology, Clinical-Hospital Center Priština, who were consequently recruited in the period of two years. Mixed population of patients was based on two different ethnic groups and religions (Ortodox and Muslim) and both sexes. The patients were divided into two groups: group A (n=130), Muslim patients whose diet was predominantly based on vegetable fats, and group S (n=100), Orthodox patients whose diet was predominantly based on the saturated fats.

Diagnosis of the cerebrovascular insult was based on the following methods: examination of the fundus oculi, electroencephalography (neurophysiological methods) and computed brain tomography (CBT) (neuroradiological method).

Dietary assessment

The subjects were interviewed face-to-face by a trained interviewer, using the constructed food frequency questionnaire in order to obtain the usual dietary patterns of especially fats and sweets′ consumption. A special emphasis was placed on the intake of vegetable and animal fats. It included questions about consumption of fried, fast and high fat foods such as tuna, fruits and vegetables, nuts and sweets, and the kind of meat and dairy products. The nutrition guideline of the European Stroke Organisation (ESO) was used as standard (5), but adjusted to usual nutrition in our region. The questionnaire also contained the questions related to age, educational level, socioeconomic status, religion, smoking habits and alcohol consumption, as well as physical activity. During the interviews, the photographs of household meal portions were used. The calculation in grams of nutrient intake was done on the basis of the quantity of food consumed by means of Nutritionist software using the values from the food composition database of the United States Department of Agriculture, USDA, Release, 11 (6).

Anthropometric assessment

After obtaining informed consent, weight was recorded without shoes and socks using a Seca 707 weighing machine (range: 0,1-150kg) with an accuracy of up to 100g. The machine was repeatedly checked using a standard weight after every ten measurements. Height was measured without shoes using a tape stadiometer with a minimum measurement of 1mm. BMI was calculated by dividing weight (kg) by height squared (m^2). Overweight and obesity were defined using recommended BMI cut off values for adults (7). Waist circumference was measured according to standard protocols with the subject standing; the values over 94 for males and 80 for women were considered as abdominal obesity (8). These waist circumference cut-off points had higher sensitivity, and a lower specificity in women (men) compared with the cut–offs proposed by Adult Treatment Panel III (ATP-III) (9). Nutritional status of the patients was assessed based on the body mass index (BMI) (kg/m^2) and waist circumference. All the patients underwent brachial arterial blood pressure measurements.

Biochemical measurements

After 12-14 hours of fasting, a venous blood sample was taken from each subject for the measurement of fasting blood sugar (FBS), total cholesterol (Chol), HDL-C, triglicerides (TG). Serum concentrations of Chol and TG were determined using standard laboratory procedures as previously described (10). LDL cholesterol was measured based on Friedwald equation (11). Serum HDL cholesterol was determined by measuring cholesterol concentration in the supernatant liquid precipitation of the other classes of lipoproteins with phosphotungstic acid and magnesium chloride (12).

Statistics

Statistical processing of the material was performed using Statistical Package for the Social Sciences (SPSS), version 10,0 and are represented as mean±standard deviation. The significance of the differences between means was calculated using the Student's t-test. Statistical significance was taken at $p<0.05$.

Results

Nutritional status was assessed using body mass index (Table 1). The patients from both groups

were classified as adipose, with BMI in males around 33, and in females 28-30. BMI and waist circumference as variables in nutritional assessment did not show statistically significant difference between the two groups of examinees. Percentage of body fat was also high in both groups, especially in women (p<0.001), with no significant difference between groups A and S (Table 1).

Physical activity (Table 2) was very low in both studied groups. In group A, 86.92% patients with CVI were physically inactive, while in group S the percentage amounted to 92% (p<0.001).

The number of smokers was rather high in both groups (Table 3), particularly in group S (89%) and more than a half (53%) of examinees had been smoking for more than 10 years. Almost all smokers consumed more than 20 cigarettes per day (83%). In group A there were 35% of non-smokers (p<0.001).

When comparing nutritional habits, dietary lipids were significantly higher in the group S (Table 4). Group S had higher values of energy, carbohydrate, protein, fat, saturated fatty acids, mean cholesterol, PUFA than group A.

All lipid parameters in all study groups were out of the normal ranges. However, lipid parameters were significantly higher in the group S, both in man and women (Table 5). In particular, the total cholesterol was high in the group S: 7.6±0.15 and 7.4±0.13 in the male and female patients, respectively. Mean value of the total cholesterol in the group A (Table 7) was 6.5±0.21 in males and 6.53±0.18 in females, confirming its important role in the development of CVI.

The average LDL cholesterol values were increased, particularly in the group S. The level of HDL cholesterol (Table 5) was low in both groups. LDL/HDL cholesterol and TC/HDL values are significant indicators of the atherosclerotic risk (13). TC/HDL-C values above 4.5 as well as LDL/HDL values above 2.31 in males and 2.05 in females are indicative of the increased risk of the coronary and cerebrovascular diseases (14). Both systolic and diastolic blood pressures, the well known risk factors for CVI, were also very high in both groups of patients.

Discussion

It has been established that development of CVI is closely correlated with several leading risk factors, such as hypertension, diabetes and dyslipidemia. Obesity defined as BMI above 30 kg/m2 is considered to be an independent risk factor in the onset of CVI (15,16). Physicians Health Study has evidenced that increase of BMI influences the increase of risk for ischemic insult, regardless of hypertension, diabetes and cholesterol.

Several studies have indicated that abdominal obesity is highly correlated with CVI (17), which is defined as waist circumference >94cm in males and >80cm in females (7,9). Reduction of body mass significantly improves blood pressure, glucose and serum blood lipids (17). Excessive fat in the abdominal wall of the studied patients (central distribution of the fatty tissue) is associated with high levels of serum HDL cholesterol.

Table 1. Body mass index (BMI), waist circumference (WC) and fat % in the tested patients

	BMI			WC(cm)			Fat %		
	Group A	Group S	p	Group A	Group S	p	Group A	Group S	p
M	33,69±1,02	33,16±1,91	p<0.01	99,01±4,45	100,49±5,00	p<0.01	32,90±1,64	35,20±2,60	p<0.001
F	27,97±1,01	29,87±0,99	p<0.001	85,82±2,80	87,87±2,82	p<0.001	47,50±1,90	49,40±3,13	p<0.001
T	31,89±2,86	32,08±2,28	ns	94,85±7,33	96,33±7,40	p<0.01	80,40±3,54	84,60±5,70	p<0.001

Table 2. Different types of physical activity in spare time

Physical activity	Group A		Group S		Total	
	Number	%	Number	%	Number	%
Inactivity	113	86.92	92	92.0	205	89.14
Low physical activity	7	5.38	3	3.0	10	4.34
Moderate physical activity	10	7.70	5	5.0	15	6.52
Total	130	100.0	100	100.0	230	100.0

Table 3. Length of smoking habit and number of cigarettes smoked per day

Length of smoking	Group A		Group S		Total		*p*
	Number	%	Number	%	Number	%	
10 years	26	20.00	36	36.0	62	26.95	*p<0,01*
More than 10 years	58	44.62	53	53.0	111	48.26	*NS*
Non-smokers	46	35.38	11	11.0	57	24.78	*p<0,001*
20 cigarette	39.23	83	83.0	134	58.26		*p<0,001*
> 20 cigarette	33	25.38	6	6.0	39	16.95	*p<0,001*

Table 4. Daily nutrient intake in composition of everyday meal of tested patients

Nutrient intake	Gender	Group A	Group S	*p*
Energy (kcal)	Male	2565±659	2985±659	*p<0,001*
	Female	2243±376	2379±334	*p<0,01*
Protein (% of energy)	Male	11.3±1.8	11.1±1.8	*NS*
	Female	11.8±1.9	11.3±1.8	*NS*
Carbohydrate (% of energy)	Male	59.8±5.7	57.4±6.5	*p<0,05*
	Female	60.1±7.2	58.6±6.3	*p<0,05*
Fat (% of energy)	Male	29.1±8.2	33.4±7.4	*p<0,01*
	Female	28.5±6.7	32.5±7.2	*p<0,01*
Fibers (g)	Male	7.4±2.8	8.4±2.8	*p<0,05*
	Female	8.2±2.6	8.9±2.9	*NS*
Cholesterol (mg)	Male	194±153	320±192	*p<0,001*
	Female	222 ± 172	343 ± 150	*p<0,01*
Saturated fat (mg/dl)	Male	20.2 ± 1.98	22.3 ± 10.1	*p<0,01*
	Female	16.8±6.5	24.5±9.4	*p<0,001*
Monounsaturated fat (mg/dl)	Male	10.3±8.4	8.1±9.2	*p<0,01*
	Female	6.7±5.6	5.4±4.3	*NS*
Polyunsaturated fat (mg/dl)	Male	3.4±4.2	5.2±6.4	*p<0,05*
	Female	3.6±2.8	5.9±4.2	*p<0,05*

NS – not statistically significant

Table 5. Comparison of risk factors for cerebrovascular insult between group A and group S

Parameters	Gender	Group A	Group S	*p*
		X ± SD	X ± SD	
Total cholesterol (mmol/l)	Male	6.5 ± 0.21	7.6 ± 0.15	*p<0,001*
	Female	6.53 ± 0.18	7.4 ± 0.13	*p<0,001*
LDL (mmol/l)	Male	3.69 ± 0.13	4.02 ± 0.22	*p<0,001*
	Female	3.7 ± 0.13	4.3 ± 0.03	*p<0,001*
HDL(mmol/l)	Male	0.88 ± 0.16	0.91 ± 0.16	*p<0,001*
	Female	0.95 ± 0.18	0.69 ± 0.14	*p<0,001*
Triglyceride (mmol/l)	Male	2.52 ± 0.19	2.9 ± 0.15	*p<0,001*
	Female	2.6 ± 0.2	2.9 ± 0.12	*p<0,001*
LDL/HDL ratio	Male	2.52 ± 0.19	2.9 ± 0.15	*NS*
	Female	2.6 ± 0.2	2.9 ± 0.12	*NS*
TC/HDL ratio	Male	7.38	8.44	*NS*
	Female	6.84	10.72	*NS*
Systolic BP(mmHg)	Male	174.21 ± 3.18	183.73 ± 1.39	*p<0,01*
	Female	174.59 ± 2.99	179.39 ± 2.97	*p<0,01*
Diastolic BP (mmHg)	Male	97.31 ± 1.98	100.05 ± 2.14	*p<0,01*
	Female	95.67 ± 2.23	98.12 ± 2.24	*p<0,01*

NS – not statistically significant

The intraabdominal fatty tissue is highly metaboli-cally active, i.e., increased turnover within the tissue leads to the increased concentration of the free fatty acids in the portal circulation, with the liver metabolism change which has adverse effects on HDL cholesterol metabolism. The former has influenced the results of analysis of the "protective HDL cholesterol" in both groups of our patients since they were rather low. Thus, the maintenance of body mass within the optimal BMI values ranging between 18.5 and 24.9kg/m^2 has a crucial role in the prevention of CVI (18).

Insufficient physical activity has made in the studied patients favorable conditions for obesity, increased blood pressure and presence of hyperlipidemia. The meta-analysis demonstrated that moderate physical activity reduces the risk by 20%, while increased physical activity reduces it by 27% (16-18). In reduction of risk for the onset of CVI, physical activity three times a week for at least 30 minutes will significantly increase oxygen consumption within 10 weeks (19,20). The updated American College of Sports Medicine recommendations propose moderate-intensity physical activity (brisk walking with noticeably accelerated pulse rate) 5 days per week or 20 min of vigorous-intensity activity (jogging) 2 days per week or combinations of moderate and high-intensity activity to promote or maintain health (20).

Recent meta-analyses have indicated that the risk for the onset of CVI is twice as high in smokers in comparison to non-smokers (21). The risk tends to increase with the number of cigarettes smoked per day. Increased blood pressure also strongly influences the development of the process of atherosclerosis and the resulting onset of cerebrovascular insult. Adams et al. indicated that in approximately 30-40% of all cases, a reduction of CVI risk was achieved by reduction of blood pressure (22).

The analysis of the habits related to alcohol consumption revealed a difference related to the type of the alcoholic beverages consumed by the subjects. Group A was mostly inclined to consumption of bear, coffee and strong Russian tea, while group S mostly consumed brandy, as well as coffee rather frequently. Alcohol influences the cardiovascular system by provoking atrial fibrillation by its arrhythmogenic system, thus causing cardiomyopathy (23). Additionally, alcohol also induces the onset of hypertension (24). Alcohol consumption is also associated with blood coagulability disorders through reduction of fibrinolytic plasma activity. It also reduces regional brain flow by its toxic effect on the cerebral metabolism, inducing vasospasm and hemoconcentration (23). Today`s evidence provide support to the association of moderate alcohol intake and lower relative stroke risk. There is no reason to recommend alcohol use to those who do not drink. The most recent public health recommendations state that men should consume less than two drinks and women less than one drink per day to help prevent stroke (24).

Numerous studies have been performed on the influence of cholesterol intake by food and consequential development of the cerebrovascular diseases (25). A direct correlation between the extent of its dietary intake and blood level has been established. It has been evidenced that each 100mg increase of dietary cholesterol per day leads to increase of blood cholesterol level by 0.21-0.26 mmol/L. Soya proteins lead to reduction of the total cholesterol level and LDL cholesterol by 20-25%. Therefore, it is recommendable to replace a part of animal proteins with vegetable proteins, primarily soya proteins. Fish was not included in diet of this group of patients, although fish contains omega-3 fatty acids that have protective effects against atherosclerosis owing to their antithrombotic effects (26). Beneficial effects such as reducing blood pressure, heart rate, serum triglycerides, prothrombotic activity, inflammation and arrhythmias, improving endothelial function, insulin sensitivity, paraoxonase concentrations and plaque stabilization attribute to them (27). Eggs were highly distributed in the diet of both groups, although their cholesterol content is very high. Intake of fruits and vegetables was insufficient in all patients, in spite of their well known protective effects against CVI. Fruits and vegetables contain useful dietary fibers whose role is important in reduction of cholesterol and triglyceride levels (28). Other sources rich in these fibers are unprocessed cereals (brown bread, oats and whole rice), which were included in minimal quantities in nutrition of both groups, since they preferred the products made of white flour. Both groups have high dietary glycemic load from refined carbohydrates, which increases the risk of CHD. Fung et al. (29) examined the association of the Dietary Approaches to Stop Hypertension (DASH)-style diet, which is high in fruits and vegetables, moderate in low-fat dairy products and low in animal proteins and the incidence of stroke during the 24 years of follow up in the Nurses Health Study cohort. The DASH score and the risk of stroke correlated inversely.

As for the oil type, sunflower oil was predominantly used by A group subjects, as well as animal lards mostly prepared of sheep whole milk, while olive oil, which is famous for its beneficial effects on HDL cholesterol and cardiovascular system, was not used.

Group S had a bad habit of consuming primarily meats with high content of fats, particularly pork meat, lard, bacon and meat products, as well as the preference for consumption of whole milk and dairy products made of it. Consuming food rich in cholesterol leads to the accumulation of LDL particles in the plasma and accelerated atherosclerotic process (30). Our findings of different relationships between red versus processed meat consumption, with the incident of stroke, support the need to better characterize which particular components of meats may increase cardiometabolic risk. The observed substantially higher sodium and nitrate preservative levels in processed meats could plausibly contribute to increased stroke incidence. Dietary sodium significantly increases blood pressure, and habitual consumption may also worsen arterial compliance and promote vascular stiffness. Nitrates and their byproducts promote atherosclerosis and vascular dysfunction, reduce insulin secretion, and impair glucose tolerance (30). Additionally, group S have higher values of energy, carbohydrate, protein, fats, etc. than group A, but also higher levels of serum lipids. On the other hand, the majority of A group patients reported frequent consumption of hot peppers containing an alkaloid – capsaicin, which increases blood pressure.

Conclusion

Our results indicate that the risk factors were similar in both groups, including obesity, smoking, reduced HDL cholesterol level and high total cholesterol level, insufficient physical activity and alcohol consumption, even though differences between the two groups of patients as well as differences between male and female subjects are evident. Our findings highlight the importance of separate consideration of health effects, underlying the mechanisms of different types of

dietary habits. Also, we should identify critical gaps in our understanding of how meat consumption influences cardiometabolic risk, including potential effects of red meat consumption on stroke incidence and of specific ingredients that could be underlying these relationships. On the basis of our findings and available data, future research should focus particularly on reducing unhealthy life habits and processed meat consumption, including consideration of recommendations for specific quantitative limits. We concluded that changes in lifestyle, nutritional habits and physical activity are needed in both ethnic groups.

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ISHRANA BAZIRANA NA RAZLIČITIM VRSTAMA MASTI KAO FAKTOR RIZIKA ZA CEREBROVASKULARNI INSULT

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Cerebrovaskularne bolesti (CVI) su vodeći uzrok mortaliteta i morbiditeta u svetu i signifikantno utiču na kvalitet života. Cilj rada bio je da se utvrde različiti faktori rizika i njihov uticaj na pojavu hiperlipidemija u okviru dve etničke grupe bolesnika hospitalizovanih od CVI, u periodu od 2 godine. Ispitano je 230 bolesnika, 35-65 godina starosti, sa ishemičnim CVI, koji su lečeni u Kliničko-bolničkom centru Priština. Bolesnici su selektovani u dve grupe: grupa A (n=130)-muslimanske i grupa S (n=100)-pravoslavne veroispovesti. Ispitivani su njihovi antropometrijski parametri i lipidni status, kao i navike u ishrani pomoću odgovarajućeg upitnika (FFQ). Uprkos različitim životnim stilovima u obe grupe, proučavani faktori rizika pokazali su signifikatan uticaj na pojavu hiperlipidemija. Bolesnici iz grupe S, čija je dijeta bila pretežno bazirana na masnoćama životinjskog porekla, imala je značajno veći rizik u poređenju sa grupom čija je dijeta bila bazirana na biljnim uljima, grupa A. Pušačke navike i fizička neaktivnost bile su znatno prisutne u obe grupe ispitanika. Naši rezultati sugerišu potrebu za ciljanom ishranom i promenom ponašanja i navika u ishrani u razvoju preventivnih strategija za redukciju cerebrovaskularnih faktora rizika. *Acta Medica Medianae 2011; 50(2):5-11.*

Ključne reči: *faktori rizika, dijeta, hiperlipidemija, cerebrovaskularni insult*