Cardioprotective diet: prevalence, associations and prevention reserves

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Most traditional risk factors for cardiovascular disease (CVD) are diet dependent and are caused by an imbalanced nutrition. A healthy diet and individual eating habits have a significant protective effect against CVD.

Aim. To study the prevalence of dietary habits with protective effects against CVD in the adult population.

Material and methods. The analysis was performed using data of representative samples in 13 Russian regions of male and female population aged 25-64 years (n=19520; men — 7329, women — 12191). The response rate was about 80%. The diet was assessed by the frequency of consumption of certain foods. The cardioprotective diet included: daily consumption of vegetables and fruits, weekly — fish products, the use of only vegetable oils in cooking, and consumption of low-fat dairy. The presence of all 4 eating habits was considered Ideal Diet (ID), 1-3 habits — Intermediate Diet (ImD), none of listed habits — Bad Diet (BD).

Results. The ImD was the most common — 85,8%. However, there were slight regional differences — from 80,1% in the Ivanovo Oblast to 91,0% in the Tyumen Oblast (p<0,001). The prevalence of ID was 7,0%; more common — among women (p<0,001), urban residents (p<0,001), people with higher education (p<0,001) and unemployed participants (p=0,016). It increases with age (p<0,001). The highest rate of ID was noted in St. Petersburg (13,8%) and Primorsky Krai (10,5%), the lowest — in the Volgograd (3,6%) and Tyumen Oblasts (3,5%), in the Republic of North Ossetia (3,4%). BD was more common in men (p<0,001), among people aged 25-34 years (p<0,001), less educated (p<0,001) and low-income (p <0,001) people. The prevalence of BD in the general population was 7,2% and varies from 3,1% in the Voronezh Oblast to 13,6% in the Volgograd Oblast. Individuals with hyperglycemia (50%), abdominal obesity (20%) and general obesity (18%), dyslipidemia (15%) and history of CVD (22%) were more likely to have ID. Persons with hyperglycemia (17%), abdominal obesity (13%), general obesity (11%), dyslipidemia (8%) and history of CVD (9%) were more likely to have ImD.

Conclusion. A low prevalence of cardioprotective diet in the population was revealed. Only individual habits are widespread; however, a small part of Russians follow all cardioprotective habits.

Key words: cardioprotective diet, nutrition, protective eating habits, dietary habits.

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Cardiovascular disease (CVD) is the leading cause of death in Russia and in the world. Most conventional CVD risk factors (RF) are diet-dependent and are caused by imbalanced nutrition. Epidemiological studies revealed nutritional factors with a protective effect against CVD [1, 2]. Such dietary factors are determined at the levels of certain nutrients, basic food groups, and food habits. This made it possible to create recommendations for target population levels [3], develop special diets, such as DASH diet [4], and use protective properties of food in guidelines on management of CVD and diabetes [5-7], as well as in prognostic indices and indicators of ideal cardiovascular health [8] and a healthy lifestyle [9].

According to experts of the World Health Organization (WHO), about a third of all CVD are due to inappropriate feeding with inadequate consumption of fruits and vegetables and excessive intake of animal fats [10]. Whereas daily taking recommended amount of vegetables and fruits and adequate consumption of animal fats reduce all-cause and cardiovascular mortality [11, 12]. The daily intake of vegetables and fruits is the most significant protective factor of nutrition. Thus, according to the World Bank experts, among 7 factors specifying premature mortality and the loss of healthy life years in Russia, along with already formed diet-related RF, such as hypertension (HTN), hypercholesterolemia (HCE) and overweight, there is behavioral habit — insufficient consumption of fruits and vegetables [13]. Dietary patterns with high intake of fruits and vegetables and low amount of animal fats are associated with lower cardiovascular, cancer, and all-cause mortality [14-16].

One of the first significant initiatives was organized by the American Heart Association, proposing 7 indicators to assess ideal cardiovascular health [8]. The proposed concept of ideal cardiovascular health pays more attention to a healthy lifestyle and RF, increasing morbidity and mortality, rather than the disease itself. It is this approach that seems appropriate also in assessing the resources and priorities of prevention programs.

The aim was to study the prevalence of dietary habits with protective effects against CVD in the adult population.

Material and methods

The analysis was performed using data of representative samples in 13 Russian regions (Voronezh, Ivanovo, Volgograd, Vologda, Kemerovo, and Tyumen oblasts; Samara, Orenburg, Vladivostok, Tomsk, and St. Petersburg; Republic of North Ossetia-Alania, Krasnoyarsk Krai) of male and female population aged 25-64 years (n=19520; men — 7329, women — 12191) as a part of ESSE-RF study. The medical ethics committees of all participating centers approved this study. All participants signed informed consent. The response rate was about 80%.

To assess nutrition and eating habits, we used standard questionnaire on the frequency of taking basic food groups (red meat, poultry, fish and seafood, sausage products and deli meats, pickled products, cereals and pasta, raw vegetables and fruits, legumes, pastry products and sweets, dairy products: milk, kefir, yogurt, sour cream/cream, cottage cheese, cheese) according to 4 consumption criteria — "not use/rarely"; "1-2 times/month"; "1-2 times/week" and "daily/almost daily". High-fat dairy products were defined in accordance with regulatory documents [17]. Criteria for assessing the adequacy of consumption and adherence to a healthy diet were given according to WHO guidelines [18].

The following eating habits were included the cardioprotective diet: daily consumption of vegetables and fruits, weekly — fish products, the use of only vegetable oils in cooking, and intake of dairy products, at least 2 of which were low-fat. The presence of all 4 eating habits was considered Ideal Diet (ID), 1-3 habits — Intermediate Diet (ImD), none of listed habits — Bad Diet (BD).

The income level was estimated by the answer to the question — "How do you assess your family's wealth compared to others?". The answers "very poor" and "relative poor" were classified as "low income", and the answers "average", "relatively wealthy" and "very wealthy" — as "moderate or high income".

HTN was recorded with a systolic blood pressure (BP) ⩾140 mm Hg and/or diastolic BP ⩾90 mm Hg, or in case of regular antihypertensive therapy.

Obesity was established with a body mass index (BMI) ⩾30 kg/m^2. Abdominal obesity (AO) was diagnosed with waist circumference >102 cm in men and >88 cm in women.

HCE was diagnosed with a total cholesterol >5,0 mmol/l, or in case of lipid-lowering therapy. Hypertriglyceridemia (HTG) was established with triglycerides >1,7 mmol/l. Hyperglycemia (HG) was revealed with fasting blood glucose >6,1 mmol/l, or in case of glucose-lowering therapy.

The category "CVD in history" included respondents who noted in form one of the following conditions: stroke, myocardial infarction, coronary artery disease, arrhythmias, and other heart diseases.

Statistical processing included univariate assessment of statistical significance of differences using the Pearson's chi-squared test. For a multivariate assessment of associations between RF and eating habits, we used logistic regression adjusted for age, marital status, occupation, income level, and place of residence. The odds ratio (OR) and the 95% confidence interval (CI) were calculated. Statistical analy-

Characteristics of subjects (%, n)

		BD	ImD	ID	p
Total sample		7,2 (1411)	85,8 (16738)	7,0 (1371)	–
Sex	women	5,8 (708)	86,0 (10481)	8,2 (1002)	<0,001
	men	9,6 (703)	85,4 (6257)	5,0 (369)	
Age	25-34 years old	10,1 (418)	84,7 (3512)	5,2 (218)	<0,001
	35-44 years old	7,9 (307)	85,8 (3348)	6,3 (248)	
	45-54 years old	6,5 (356)	86,1 (4674)	7,4 (402)	
	55-64 years old	5,5 (330)	86,2 (5204)	8,3 (503)	
Family	no	7,3 (503)	85,2 (5884)	7,5 (518)	0,14
	yes	7,2 (908)	86,0 (10854)	6,8 (853)	
	not married	8,1 (236)	85,0 (2478)	6,9 (202)	0,056
	married/civil marriage	7,2 (908)	86,0 (10854)	6,8 (853)	
	divorced/separate	6,5 (167)	85,3 (2199)	8,2 (212)	
	widower/widow	7,1 (100)	85,5 (1207)	7,4 (104)	
Education	lower than higher	8,1 (891)	86,3 (9529)	5,6 (623)	<0,001
	higher	6,1 (520)	85,1 (7209)	8,8 (748)	
Job	no	6,4 (300)	86,1 (4058)	7,5 (352)	0,016
	yes	7,5 (1111)	85,6 (12680)	6,9 (1019)	
Income	low	11,2 (235)	84,2 (1767)	4,6 (96)	<0,001
	moderate or high	6,8 (1176)	85,9 (14971)	7,3 (1275)	
Place of residence	urban	7,0 (1103)	85,6 (13541)	7,4 (1173)	<0,001
	rural	8,3 (308)	86,3 (3197)	5,4 (198)	
Region	Krasnoyarsk Oblast	7,4 (102)	87,3 (1196)	5,3 (72)	<0,001
	Primorsky Krai	4,0 (76)	85,5 (1627)	10,5 (200)	
	Volgograd Oblast	13,6 (160)	82,8 (974)	3,6 (42)	
	Vologodskaya Oblast	5,3 (80)	87,2 (1322)	7,5 (114)	
	Voronezh Oblast	3,1 (46)	87,9 (1301)	9,0 (133)	
	Ivanovo Oblast	10,5 (182)	80,1 (1387)	9,4 (162)	
	Kemerovo Oblast	4,1 (60)	87,6 (1287)	8,3 (122)	
	Samara Oblast	11,4 (174)	84,5 (1293)	4,1 (63)	
	St. Petersburg	4,5 (65)	81,7 (1193)	13,8 (202)	
	Orenburg Oblast	3,6 (52)	90,6 (1309)	5,8 (84)	
	Tomsk Oblast	10,6 (155)	84,3 (1234)	5,1 (75)	
	Tyumen Oblast	5,5 (75)	91,0 (1248)	3,5 (48)	
	Republic of North Ossetia	11,5 (184)	85,1 (1367)	3,4 (54)	

sis was performed using the software package Statistica 10. Differences were considered significant at p<0,05.

Results

The characteristics of participants are presented in Table 1. The ImD was the most common — 85,8%. However, there were slight regional differences — from 80,1% in the Ivanovo Oblast to 91,0% in the Tyumen Oblast. The prevalence of ID was more common among women, urban residents, people with higher education and unemployed participants. It increases with age. The highest rate of ID was noted in St. Petersburg and Primorsky Krai, the lowest — in the Volgograd and Tyumen Oblasts, in the Republic of North Ossetia. BD was more common in men, among people aged 25-34 years, less educated and low-income people. The prevalence of BD in the general population varies from 3,1% in the Voronezh Oblast to 13,6% in the Volgograd Oblast. Of the 13 regions examined, 5 was characterized by BD prevalence >10%, i.e., every

Table 2

Prevalence of risk factors among people with protective eating habits, %

Para-meter	Use of only vegetable oils			Daily consumption of vegetables/fruits			Recommended fish consumption			Low-fat dairy products		
	No, n=1391	Yes, n=18129	p	No, n=7883	Yes, n=11637	p	No, n=6795	Yes, n=12725	p	No, n=8867	Yes, n=10653	p
HTN	41,9	48,0	<0,001	45,6	48,9	<0,001	43,7	49,6	<0,001	47,5	47,5	0,99
Obesity	26,5	32,5	<0,001	29,3	33,9	<0,001	28,9	33,7	<0,001	31,3	32,7	0,038
AO	28,0	37,4	<0,001	32,7	39,5	<0,001	32,9	38,8	<0,001	35,0	38,2	<0,001
HG	12,8	13,8	0,28	12,3	14,8	<0,001	10,3	13,8	<0,001	12,8	14,6	<0,001
HTG	26,2	26,1	0,96	26,4	25,9	0,45	25,8	26,3	0,46	26,5	25,8	0,28
HCE	51,2	56,9	<0,001	54,7	57,7	<0,001	54,2	57,7	<0,001	54,8	57,9	<0,001
CVD	25,4	30,7	<0,001	27,6	32,1	<0,001	30,2	30,3	0,81	28,8	31,6	<0,001

10th resident of this region did not have even one of the protective eating habits.

In the Russian population, protective eating habits are more often observed in individuals with dietary RF (Table 2). This is more often seen in relation to the recommended intake of vegetables/fruits and fish products, as well as the use of vegetable oils in cooking, less often in low-fat dairy products. Taking low-fat dairy products is characteristic of only people paying attention to the dietary fats and having lipid metabolism disorders and/or obesity. However, this was noted only in relation to dairy products, while the consumption of animal fats remains without adequate attention. So, the habit of using only vegetable oils in cooking was more often observed among people with HTN, obesity, AO, HCE and history of CVD, while among people with HG and HTG it does not differ from people without RF. Also, there was no difference in the level of fish intake depending on HTG and history of CVD. The most common protective eating habit among people with dietary RF was daily consumption of fruits and vegetables, with the exception of people with HTG. The most motivated for the healthy diet were people with obesity, AO and HCE. Among them, all four mentioned protective habits were more often present.

The presence of dietary RF increased adherence not only to certain protective eating habits, but also to their complex. It is these associations that were noted in the logistic regression analysis. Thus, participants with HG (by 50%), AO (by 20%), obesity (by 18%), dyslipidemia (by 15%), and history of CVD (by 22%) more often adhered to ID. Similar but less pronounced associations were observed among individuals with ImD. Thus, individuals with HTN (by 17%), AO (by 13%), obesity (by 11%), dyslipidemia (by 8%) and history of CVD (by 9%) more often

adhered to ImD. The highest adherence to the cardioprotective nutrition was observed among subjects with HTN, both to the ID and ImD. The results of the logistic regression are presented in Table 3.

The structure of most common model (ImD) is shown in Figure 1, and the prevalence its components is presented in Figure 2. The habit of using only vegetable oils is a mainstay of ImD. Also, more than half of people with ImD adhered to recommended intake of fish products, fruits and vegetables. Despite the fact that in the ImD structure, the intake of low-fat dairy products is less common compared to other components, in general, this parameter is quite high for the population. Further analysis revealed that such a high percentage of taking low-fat dairy products related only certain products. Thus, the intake of low-fat cottage cheese and sour cream was observed in 58,8% and 52,5%, respectively, and low-fat liquid dairy products (milk, kefir, yogurt) and cheese only in 28,8% and 29,8%, respectively.

A combination of 3 components was noted in less than a third of subjects with ImD, and a combination of 2 components — less than half (41,1%). Rather large proportion of individuals adhered to ImD had only one eating habit — 27,8%.

Discussion

Current analysis was performed using the same criteria as in the national cross-sectional population study FINRISK, conducted in Finland in 2007 among a population aged 25-74 years [19]. Given the high similarity of eating habits in Russia and Finland, it was interesting to compare it in relation to cardioprotective effects and evaluate the contribution of Finnish population preventive programs in changing dietary patterns. It is worth emphasizing that the prevalence of ID in the Finn-

Table 3

Associations of diets with risk factors

Parameter	ID, n=2782		ImD, n=18149	
	OR (95% CI)	p	OR (95% CI)	p
HTN	1,05 (0,90; 1,17)	0,31	1,04 (0,97; 1,11)	0,26
Obesity	1,18 (1,07; 1,30)	0,0012	1,11 (1,03; 1,18)	0,0032
AO	1,20 (1,08; 1,32)	<0,001	1,13 (1,05; 1,20)	<0,001
HG	1,50 (1,30; 1,72)	<0,001	1,17 (1,06; 1,29)	0,0014
HTG	1,05 (0,95; 1,16)	0,36	1,02 (0,95; 1,09)	0,57
HCE	1,07 (0,76; 1,17)	0,17	1,01 (0,95; 1,07)	0,77
HDL	1,15 (1,03; 1,29)	0,014	1,08 (1,01; 1,16)	0,047
LDL	1,02 (0,93; 1,13)	0,62	1,02 (0,96; 1,08)	0,53
History of CVD	1,22 (1,10; 1,35)	<0,001	1,09 (1,02; 1,17)	0,017

Note: adjusted for gender, age, educational status, marital status, occupation, income level, place of residence, region; reference group — individuals with BD.

Abbreviations: CI — confidence interval, HDL — high density lipoproteins, LDL — low density lipoproteins.
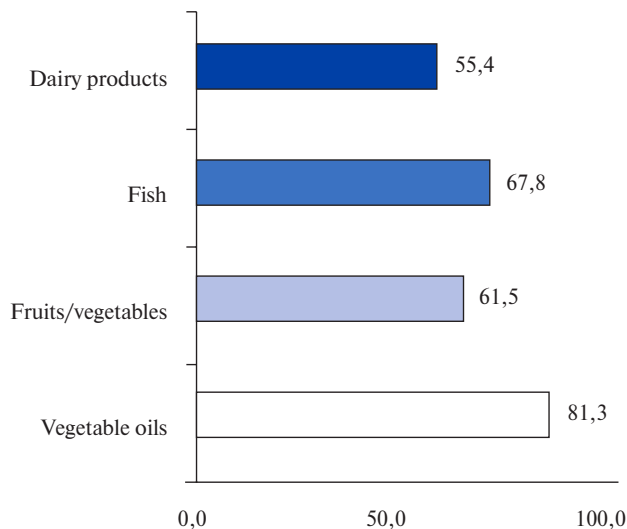

Figure 1. Structure of the components of Intermediate Diet (%).
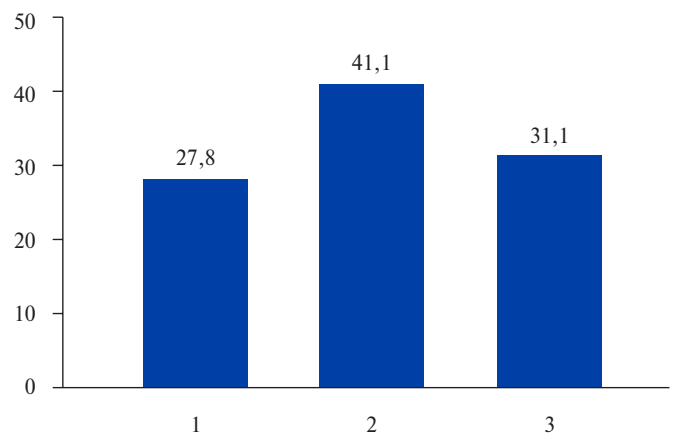

Figure 2. Combination of components of Intermediate Diet (%).

ish population is many times higher — 12,6% among women and 24,1% among men vs 8,2% and 5,0%, respectively, in Russia. It is interesting to note that in Russia a more protective dietary pattern is observed in women, while in Finland — in men. Differences were revealed also revealed in relation to ImD and BD. Thus, according to the FINRISK 2007 study, the proportion of people adhered to ImD was 73,5% among women and 65,3% among men [19], while in Russia this indicator is much higher — 86,0% and 85,4%, respectively, and do not have sex differences. BD among women in Russia (5,8%) is observed less common than in Finland (13,9%) [19], while among men the indicators are comparable — 9,6% vs 10,6%, respectively. Of course, the lower proportion of women with BD is due to the widespread habit of using vegetable oils in cooking [20]. But higher ID and lower ImD proportions in the Finnish population indicate a higher prevalence of protective eating habits, which may reflect the effectiveness of national preventive projects and programs. Moreover, in Finland there is a higher proportion of people not only with certain eating habits, but also with protective dietary pattern in general. In Russia, the modification of dietary habits towards a

healthy model only observed in individuals with developed dietary RF for CVD, which this study confirmed.

The structure of ImD makes it possible to identify "problems" of Russian eating habits and priorities for preventive activities. The low prevalence of subjects with three and two components in ImD allows us to conclude that the prospects for increasing the proportion of people with ID are very low. This because these people need to not only learn about the effectiveness of one or two eating habits, but also introduce them into daily practice to belong to ID group. Of course, the daily intake of certain foods should be a priority in a healthy diet. Therefore, it is advisable to shift the emphasis of specialists to the popularization of daily consumption of fruits and vegetables and the use of low-fat dairy products. The popularization of taking fish and fish products also remains relevant, however, it should be borne in mind that the recommended levels of consumption differ significantly. So, the recommended level of fish consumption is at least 2 per week (200 g), while for fruits and vegetables — 5 per day (400 g) [18]. Particular attention of people should be attracted to the use of low-fat dairy products, since these foods are consumed daily. Russians choose low-fat dairy products of only certain forms (sour cream, cottage cheese), which are consumed much less than liquid dairy products (milk, kefir, yogurt, etc.). They prefer milk and dairy products with higher fat content, which significantly increases the atherogenesis. The relevance of changing this habit is also emphasized by the fact that dairy products are the "basis" for the creation of certain dietary pattern in Russia [21], which further justifies drawing attention to raising public awareness of the need for using only low-fat dairy products [18].

Currently, studies on developing population-based Healthy Eating Index is conducted in Russia [22]. However, the developed methods have significant differences with the presented results. So, it is proposed to use quantitative components for calculating the Index, while in this analysis we used frequency characteristics, which are easier to collect in most epidemiological and clinical studies. Although the methodological differences do not allow a comparison of the results, it should be emphasized that the development of different approaches for assessing dietary patterns is necessary for prediction and determining the priorities of population-based prevention programs.

Conclusion

This study identified very low prevalence of cardioprotective eating habits in the Russian population. Only certain habits are widespread, of which so far, the dietary pattern is formed in a small number of Russians. At the same time, relevant points were also noted for the popularization of cardioprotective eating habits, which specifies the focus and scope of preventive counseling and set specific tasks for population-based preventive programs and public health.

Relationships and Activities: none.

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