

## ADHERENCE TO NUTRITION GUIDELINES IN PATIENTS WITH CARDIOVASCULAR DISEASES AS A SECONDARY PREVENTION

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### ABSTRACT

**Background.** The appropriate nutrition is an important component of the secondary prevention of cardiovascular diseases (CVD).

**Objectives.** The aim of the study was to investigate if the patients with cardiovascular disease were informed of the role of appropriate nutrition in prevention or received nutrition guidelines and to assess the dietary intake compared to recommendations for patients with cardiovascular disease who received or not nutrition guidelines.

**Material and Methods.** The study was conducted among patients with cardiovascular disease ( $n = 127$ ) of cardiological hospital clinic, aged  $62 \pm 11$ . The questionnaire was used to obtain personal and anthropometric details, information if patients had received nutrition guidelines. The method of 3-day food records was used for dietary assessment.

**Results.** 20% of subjects had not received nutrition guidelines and almost 40% of subjects did not recognize the nutrition effect on cardiovascular disease development. Compared to the diets of the subjects who had not received nutrition guidelines, the diets of those who had received them were of significantly lower intake of: energy from saturated fatty acids (15%,  $p = 0.006$ ), cholesterol (21%,  $p = 0.012$ ) and higher intake (14-26%) of potassium ( $p = 0.003$ ), sodium ( $p = 0.013$ ), phosphorus ( $p = 0.044$ ), magnesium ( $p = 0.003$ ), iron ( $p = 0.005$ ), copper ( $p = 0.001$ ), zinc ( $p = 0.046$ ). Among the patients who had received nutrition guidelines, percentage of the subjects whose intake of nutrients was consistent with recommendations was higher.

**Conclusions.** Not all subjects had received nutrition guidelines. Diets of those who had received them were more balanced, but in neither group nutrition guidelines were complied with.

**Key words:** cardiovascular disease, dietary intake, second prevention

### STRESZCZENIE

**Wprowadzenie.** Prawidłowe żywienie jest ważnym elementem w ochronie wtórnej u pacjentów z chorobami układu sercowo-naczyniowego (CVD).

**Cel.** Celem badania była ocena czy pacjenci ze zdiagnozowanymi chorobami układu sercowo-naczyniowego zostali poinformowani o roli odżywiania podczas leczenia oraz czy otrzymali zalecenia żywieniowe w ramach profilaktyki wtórnej, jak też ocena porównawcza sposobu żywienia osób, które otrzymały lub nie zalecenia żywieniowe.

**Material i metody.** Badanie przeprowadzono wśród 127 pacjentów kliniki kardiologicznej jednego z warszawskich szpitali, pacjenci byli w wieku  $62 \pm 11$  lat. Informacje nt. danych socjo-demograficznych i antropometrycznych oraz otrzymania zaleceń żywieniowych zostały zebrane za pomocą autorskiego kwestionariusza. Badane osoby wypełniły również kwestionariusz 3-dniowego bieżącego notowania spożycia żywności w celu oceny sposobu żywienia.

**Wyniki.** Dwadzieścia procent osób nie otrzymało zaleceń żywieniowych, a prawie 40% osób nie dostrzegło wpływu żywienia na rozwój choroby. Odnotowano statystycznie istotne różnice w sposobie żywienia pomiędzy osobami, które uzyskały zalecenia żywieniowe a osobami, które takich zaleceń nie otrzymały, tj. niższy udział energii z nasyconych kwasów tłuszczowych (SFA) o 15%, niższe o 21% średnie spożycie cholesterolu oraz wyższe o 14-26% spożycie składników mineralnych, tj. potasu, sodu, fosforu, magnezu, żelaza, miedzi i cynku. Ponadto grupa osób, która otrzymała zalecenia żywieniowe charakteryzowała się lepszą realizacją norm na składniki żywieniowe i większą prawidłowością sposobu żywienia.

**Wnioski.** Pomimo kluczowej roli, jaką odgrywa żywienie w profilaktyce i leczeniu chorób układu sercowo-naczyniowego, nie wszystkie badane osoby otrzymały wskazówki jak powinny się odżywiać. Osoby, które otrzymały zalecenia żywieniowe odżywiały się lepiej od tych, którym takich zaleceń nie przekazano, jednak ich sposób żywienia również odbiegał od norm i zaleceń.

**Słowa kluczowe:** choroby układu sercowo-naczyniowego, sposób żywienia, prewencja wtórna

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## INTRODUCTION

The cardiovascular diseases are considered the leading cause of premature death in Europe, as well as that of the loss of productivity during human life. Nutrition is one of the major factors in the development of atherosclerosis and cardiovascular disease (CVD), as a result. The high-energy intake and improper balance of the diet can result in too high cholesterol level in blood serum, hypertension, overweight and diabetes, thus increasing the risk of developing CVD [3, 21, 22]. The propagation by physicians of the healthy lifestyle and the principles of healthy nutrition is an important part in public health prevention. Persons with CVD should be subject to individual, specialized nutritional counseling adapted to the profile of risk factors. In addition to medication, a proper diet should be an important component in the treatment of CVD. Planning diet is necessary to construct determining health eating choices [23]. Both in national and international literature, there is a lack of scientific research that shows whether all patients with CVD receive and adhere to nutrition guidelines, and what is effect of nutritional recommendations on nutrition, also whether patients understand the relationship between nutrition and disease. Therefore, the objective of the study was to investigate whether patients with cardiovascular disease were informed of the role of appropriate nutrition in the secondary prevention of CVD, and received nutritional recommendations appropriate to their disease and to check whether patients comply with these recommendations by assessing their dietary intake and comparing with patients who had not received them.

## MATERIAL AND METHODS

### *Study population*

The study was conducted at the cardiological hospital clinic of a hospital in Warsaw, Poland, among 127 patients (32 women, 95 men, of average age  $62 \pm 11$  years) to improve the efficiency of treatment, which had started at least 6 weeks earlier. All subjects had been diagnosed by a cardiologist with a disease of the cardiovascular system, such as coronary disease, atherosclerosis, hypertension, previous myocardial infarction or stroke, and taken lipid-lowering drugs. The present study does not evaluate either the treatment of patients, or drug reactions. The patients were divided into two groups, the fact of having received or not the nutrition guidelines being the criterion.

The study was conducted after obtaining both the approval of the Ethics Committee from the Cardiology Institute in Warsaw and the informed consent of the subjects to take part in it and to share the results of their blood tests.

### *Data collection*

The subjects were asked to fill in a detailed questionnaire, which involved answering questions about personal (sex, age, place of residence, education) and anthropometric details (weight, height), the cause of disease, the subject's recognition of the effect of nutrition on the onset of the disease, and nutrition guidelines (whether the subject had received such recommendations, who from, in what circumstances, in what form, what information had been conveyed). Weight and height measurements derived from the questionnaire were used to calculate the body mass index (BMI), according to the formula [24]:

$$\frac{\text{body mass [kg]}}{\text{height [m]}^2}$$

### *Dietary assessment*

The dietary intake was assessed by 3-day food records method. The nutrition value of diets was calculated using a computer software, based on data tables of composition and nutritive value of food products [9]. The values obtained were reduced by food processing and serving losses. The serving size of consumed food was estimated using the 'Album of photographs of products and dishes' [19]. The calculated sodium content in the diet was not adjusted for salt added to food and/or salting on the plate, due to the difficulties in estimating these quantities by patients. Energy intake by subjects was compared with dietary reference values, regarding sex, age, body weight and physical activity [7]. Percentage of energy from protein, total fat, saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA) and carbohydrates, as well as cholesterol intake by each of the subjects were compared individually with the recommendations for dietary prevention of atherosclerosis by National Cholesterol Education Program (NCEP)– Step 2 and Adult Treatment Panel III (ATP III) [13]. The intake of dietary fiber was compared with the recommendation of The American Institute of Medicine [1], following guideline values: 15% of energy to source from protein, <30% from fat, <7% from SFA,  $\leq 10\%$  from PUFA, <20% from MUFA, >55% from carbohydrates, with cholesterol intake < 200 mg/d and dietary fiber 30-45 g/d. The intake of vitamins and minerals by each person was compared with dietary reference values: to Estimated Average Requirement (EAR) or Adequate Intake (AI), regarding age and sex [7].

### *Statistical analysis*

The results were subjected to statistical analysis using a computer software Statistica 10. In order to verify that the distribution was normal, the *Shapiro-Wilk* test was used. The significance of differences was assessed using *Student's* t-test for normal distribution

of data, the *Mann-Whitney U* test for nonparametric data and the  $\chi^2$  test for qualitative data. For all analyses, the significance level  $\alpha = 0.05$  was assumed.

## RESULTS

The criterion for dividing the subjects into two groups was the fact of having received or not the nutrition guidelines - a significantly differentiating factor in the dietary intake. The nutrition guidelines had been provided at least six weeks before the study, as declared by those who had received them. In the group of those who had received nutrition guidelines, BMI was 27.6, i.e. 0.8 units lower, compared to those who had not received such recommendations. The difference between groups was not considered significant. In two groups, both the average age and the proportion of men and women, educational level, place of residence were very similar (Table 1).

The conducted studies (Table 2) reveal that 20% of subjects had not received nutrition guidelines and almost 39% had no recognition of the effect of nutrition on the development of the disease. Almost all subjects stated that nutrition guidelines had been received from physician, mainly verbally (73%). The information conveyed regarded mainly the food products recommendations and contraindications (87%).

Table 1. Characteristic of subjects who received nutrition guidelines (NG) or not received (NNG)

Characteristic of subjects	NG n = 102	NNG n = 25	P value
	Mean $\pm$ standard deviation		
Age (years)	62 $\pm$ 11	61 $\pm$ 11	NS
BMI (kg/m <sup>2</sup> )	27.6 $\pm$ 4.1	28.4 $\pm$ 3.2	NS
Percentage of subjects			
Sex			
Women	23	24	NS
Men	77	76	
Educational level			
Primary/professional school	22	28	NS
Secondary school/collage education	43	40	
High school	35	32	
Place of residence			
Country	10	8	NS
Town	90	92	

NS – no statistically significant ( $P > 0.05$ )

The differences in the daily intake of energy from protein, fat, carbohydrate, MUFA, PUFA and the daily fiber intake between the subjects who had received nutrition guidelines and those who had not received such recommendations were not statistically significant (Table 3).

Table 2. Subjects responses on causes of disease and receiving nutrition guidelines

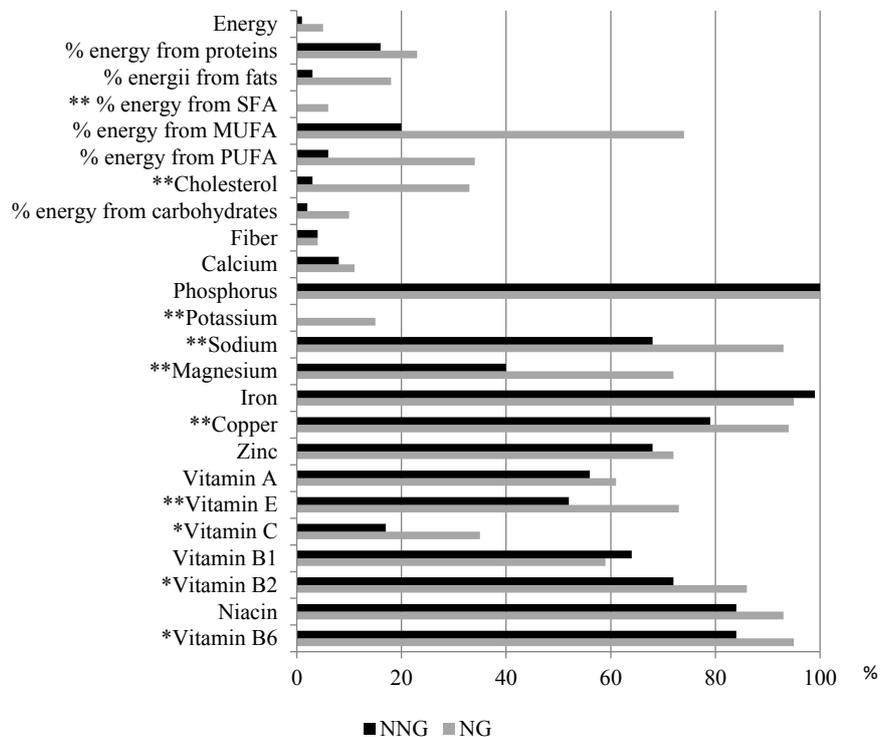
Question	%
<i>Causes of CVD</i>	
Improper diet	48
Smoking	41
Stress	38
Genetic factors	21
Obesity	12
Others	41
<i>Impact of nutrition on disease progress</i>	
Yes	61
No	17
I don't know	22
<i>Receiving nutrition guidelines</i>	
Yes	80
No	20
<i>Of whom received nutrition guidelines</i>	
Physician	97
Nurse	2
Dietician	1
Others	0
<i>Nutrition guidelines form</i>	
Verbal advice	73
Leaflet	27
<i>Nutrition guidelines contented</i>	
Recommended and no recommended products	87
Quantitative guides (g/day)	21
Information about cooking methods	51
Menus	23
Others	4

The daily diets in both groups demonstrated low energy intake, which did not cover the nutritional requirements of 95% of individuals who had received nutrition guidelines, and 99% of those who had not received such recommendations. The average BMI of the subjects (27.8) indicated overweight, so negative energy balance was actually advantageous. Percentage of energy from protein and fat was higher than recommended, approx. 24% and 20-25%, respectively, contribution percentage of energy from carbohydrates and the average intake of dietary fiber being lower than recommended approx. 17-21% and 37-40%, respectively. The recommended intake of calories from MUFA and PUFA was found in only small proportion of the respondents, especially in NNG group (Figure 1). Although the average percentage of energy from SFA and the average cholesterol intake was significantly higher than recommended in both groups, the patients who had received the nutrition guidelines demonstrated a significantly, 15% lower energy intake from SFA and 21% lower average intake of cholesterol, compared to those who had not received such recommendations.

Table 3. Daily dietary intake of energy and nutrients in subjects who received nutrition guidelines (NG) or not received (NNG)

Intake	NG (n = 102)			NNG (n = 25)			P value
	Mean ± SD	Median	Min-Max	Mean ± SD	Median	Min-Max	
Energy (kcal)	1604 ± 430	1527	933-2678	1708 ± 456	1624	1072-2769	NS
Protein (% of energy)	18.4 ± 3.3	17.9	11.4-32.6	18.7 ± 4.1	17.7	10.1-29.5	NS
Fats (% of energy)	36.0 ± 7.0	36.9	18.1-52.1	37.6 ± 6.7	38.6	24.2-51.5	NS
SFA (% of energy)	11.0 ± 3.0	11.3	4.4-6.3	13.0 ± 3.0	12.6	8.5-20.2	0.006
MUFA (% of energy)	14.9 ± 3.8	15.3	5.5-24.4	14.3 ± 3.3	14.4	8.5-21.0	NS
PUFA (% of energy)	6.8 ± 2.9	6.2	3.2-19.1	6.0 ± 2.2	5.4	3.5-10.7	NS
Cholesterol (mg)	238 ± 97	221	95-570	303 ± 123	251	138-581	0.012
Carbohydrates (% of energy)	45.6 ± 7.5	45.6	26.3-62.2	43.7 ± 8.1	44.1	27.7-59.3	NS
Fiber (g)	18.9 ± 6.6	19.2	6.4-39.0	17.9 ± 6.6	19.6	6.4-27.1	NS
Calcium (mg)	534 ± 269	468	204-1583	442 ± 230	410	145-981	NS
Phosphorus (mg)	1346 ± 338	1286	664-2100	1178 ± 383	1194	656-2313	0.044
Potassium (mg)	3529 ± 1001	3479	1343-6063	2830 ± 861	2786	1313-4366	0.003
Sodium (mg)	2430 ± 921	2248	749-6067	1934 ± 727	1884	987-3493	0.013
Magnesium (mg)	325 ± 102	308	136-640	265 ± 99	235	133-580	0.003
Iron (mg)	10.6 ± 3.0	10.1	4.5-18.9	8.9 ± 3.2	8.2	4.8-19.4	0.005
Copper (mg)	1.2 ± 0.4	1.2	0.5-2.3	1.0 ± 0.3	0.9	0.5-1.6	0.001
Zinc (mg)	11.1 ± 3.1	10.8	4.6-20.1	9.7 ± 2.9	9.4	5.7-17.5	0.046
Vitamin A (RE, µg)	757 ± 376	700	120-1867	612 ± 259	602	199-1129	NS
Vitamin E (TE, mg)	12.5 ± 4.9	11.8	3.9-27.3	10.9 ± 4.4	9.6	4.7-19.8	NS
Vitamin C (mg)	61.1 ± 34.8	52.4	7.3-188.4	48.9 ± 35.6	42.1	6.2-168.5	NS
Vitamin B <sub>1</sub> (mg)	1.2 ± 0.5	1.1	0.5-2.9	1.2 ± 0.4	1.1	0.5-2.4	NS
Vitamin B <sub>2</sub> (mg)	1.4 ± 0.3	1.3	0.6-2.4	1.2 ± 0.4	1.2	0.6-2.4	NS
Niacin (NE, mg)	20.7 ± 7.2	19.8	8.6-43.7	19.0 ± 6.9	19.0	8.6-36.3	NS
Vitamin B <sub>6</sub> (mg)	2.3 ± 0.7	2.3	0.9-4.9	2.0 ± 0.8	1.9	1.1-4.5	NS

NS – no statistically significant difference ( $P \geq 0.05$ ), SFA - saturated fatty acids, MUFA - monounsaturated fatty acids, PUFA polyunsaturated fatty acids, RE – all-trans retinol equivalent, TE – RRR- $\alpha$ -tocopherol equivalent, NE – nicotinamide equivalent.



\*difference between groups ( $P < 0.1$ ), \*\*statistically significant difference between groups

( $P \leq 0.05$ ), SFA - saturated fatty acids, MUFA - monounsaturated fatty acids, PUFA - polyunsaturated fatty acids

Figure 1. Percentage of the subjects who received nutrition guidelines (NG) or not received (NNG) whose intake of energy, macronutrients, vitamins and minerals was consistent with nutrition guidelines

Statistically significant differences in the intake of minerals were also found between the groups. The subjects who had received nutrition guidelines displayed a significantly, 19-26% higher intake of potassium, magnesium, sodium (food products-derived), copper and iron, and 14% higher intake of phosphorus and zinc. A statistically insignificant average daily intake of calcium and vitamin C and A was found to be 21-25% higher, while riboflavin, niacin, vitamin B6 and E 9-17% higher among those who had received nutrition guidelines. It can be summarized that the diet of patients who had received nutrition guidelines was better-balanced in terms of nutrient content.

## DISCUSSION

Due to the important role of nutrition in the secondary prevention of CVD, it is essential for all patients to receive personalized, specialized nutrition guidelines. The present study shows that only 80% of subjects had received such recommendations. The National Multicenter Health Survey (WOBASZ), which was conducted in 2003-2005 using a representative sample of the Polish population (13545 persons, including 6392 men and 7153 women, aged 20-74 years), revealed a still lower percentage of persons subject to nutrition guidelines. It was found that in persons with hypercholesterolemia, nutrition guidelines had been provided for 20% of men and 23% of women with low global risk (GR) of death from CVD, and 36% of men and 47% of women with a high GR. Obese person had received nutrition guidelines more frequently [12]. According to study by *Szponar* and *Krzyszzycha* [18] among 152 residents of Polish Lublin region (93 women and 59 men), of the principles of atherosclerosis prevention, using an anonymous questionnaire, 50% of subjects had been health-educated, while only 29% had been informed of CVD by the physician. At the same time 93% of respondents acknowledged the effect of nutrition on the development of the disease.

The daily rations of food in both groups demonstrated too high percentage of energy from protein and fats, and too low from carbohydrates. Similar results were obtained by other authors in studies both of patients with CVD and of the healthy individuals [6, 16, 17, 20, 21]. In those studies, the percentage of energy from SFA (10,5-14%) is comparable to the results obtained in the present study. Such percentage of energy from SFA exceeds the level not only recommended for persons with CVD (< 7%), but also for the healthy ones (<10%). The calories from MUFA and PUFA in food rations were not adequate, similar to *Makarewicz-Wujec* et al. [11] and WOBASZ II results [21]. It has been proved based on epidemiological and clinical study that with each 1% of the calorie intake from SFA is replaced with PUFA, risk CVD is reduced by 2-3% *Astrup* et al. [2].

It is related with the proven effect of SFA intake on LDL-C level in blood serum [4, 10, 14]. The reduction of LDL-C level in persons with the risk of, or diagnosed with CVD, applying a proper diet rich in long-chain n-3 fatty acids, may lower the risk of cardiac sudden death [4]. Antioxidant vitamins such as vitamin A, C and E, and carotenoids that prevent oxidative modification of LDL particles are important components of the healthy diet for persons with the risk of CVD Oxidized LDL (oxLDL) plays a vital role in the development of atherosclerosis. Therefore, the consumption of antioxidants contained in fruits and vegetables protects against CVD [8]. The role of vitamin E in the prevention of heart disease is emphasized [15]. B vitamins, especially B<sub>6</sub>, B<sub>12</sub> and folic acid are necessary to control the homocysteine metabolism, and minerals such as potassium, magnesium, calcium; lower arterial pressure and have a good effect on the functioning of heart [7, 20]. The present study reveals that the group of subjects who had received nutrition guidelines featured a higher proportion of those with sufficient intake of vitamins and minerals, compared to the group of subjects who had not received such recommendations. Subjects who had not received nutrition guidelines observed similar to those of WOBASZ study (magnesium, vitamin B6) or lower average intake of vitamins and minerals (the biggest difference for vitamin A of 53% and C 39%). Subjects who had received such recommendations had similar average intake of vitamin B<sub>6</sub>, E and calcium, higher intake of magnesium (24%) and lower average intake of vitamin A, C and riboflavin (42%, 24% and 12%, respectively) [20, 21]. It should be noted that the intake of dietary fiber of persons with CVD was too low, which seems disadvantageous, considering its contribution to the prevention of heart diseases. Similar results obtained *Makarewicz-Wujec* et al. [11] in patients with heart failure and *Wańkiewicz* et al. [21] in the adult Polish population. Obtained results showed that dietary habits of the patients with CVD isn't differ from the majority of the Polish adults. Despite heart diseases, dietary habits didn't meet recommendations. The studies by *Sygnowska* and *Wańkiewicz* [17] of the quality of nutrition of persons with hypercholesterolemia, based on diet and medication, revealed that, despite recognition of incorrect cholesterol concentration in the blood, only 18% of subjects applied a diet, 13% diet and drugs, and 61% did not take any action. Additionally, the dietary intake of those having declared observing the diet was closer to the recommended value [17]. *Makarewicz-Wujec* et al. [11] confirmed that the diet of heart failure patients was inconsistent with ESC/EAS guidelines for intake of SFA and dietary fibre. In practice, persons with CVD should include in diet protective foods like fruits, vegetables, legumes, nuts and fish. CVD rates are clearly lower in vegetarians and consumers of the Mediterranean diet [5].

Nutrition is one of the major modifiable risk factor for cardiovascular disease. Providing knowledge of cardiovascular disease (CVD) risk factors, including diet, is the main component of prevention programs, which aim decrease CVD incidence and mortality. *Waśniowska et al.* [22] point out on a need to differentiate intervention and prevention programs in dependence on educational level and sex. Their results indicated an inverse relation between the knowledge of CVD risk factors and the risk of death in men with secondary education or higher.

Despite the vital role of nutrition in the secondary prevention of CVD, not all subjects received nutrition guidelines and the majority do not adjust their diet to recommendations. Although none of the subjects strictly complied with the recommendations, diets of those who had received such recommendations were more proper than the diets of those who had not received them. Particular attention should be given to proper balance of the diet of persons with CVD, in terms of energy structure of diet, cholesterol, dietary fiber, calcium, potassium, magnesium, iron and antioxidant vitamins. There is a necessity to intensify nutrition education and motivation of persons with CVD to comply with nutrition guidelines in order to increase the effectiveness of the secondary prevention of the cardiovascular diseases.

## CONCLUSIONS

Despite of the key role of nutrition in the prevention and treatment of cardiovascular diseases not all but only 80% of subjects had received nutrition guidelines and almost 40% of subjects did not recognize the nutrition effect on cardiovascular disease development. Patients who had not received nutrition guidelines characterized significantly lower intake of: energy from saturated fatty and cholesterol but higher intake of minerals. Among the patients who had received nutrition guidelines, percentage of the subjects whose intake of nutrients was consistent with recommendations was higher, but in neither group nutrition guidelines were complied with. Dietary habits of the patients with CVD isn't differ from the majority of the Polish adults. There is a need to increase nutrition education and motivation in subjects with cardiovascular diseases to follow nutritional guidelines to increase the effectiveness of secondary cardiovascular disease prevention.

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### Conflict of interests

*None declared.*

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