

Do and to what extent non-dietary factors affect nutritional habits of men with coronary heart disease?

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Abstract: **Purpose.** The aim of the study was to examine whether and to what extent non-dietary factors (such as: socio-demographic and economic factors, factors related to health status, personality features and self-knowledge about the disease as well as adherence to the nutritional recommendation in coronary heart disease (CHD)) affect nutrition of men with CHD. **Methods.** The research was carried out in 210 CHD patients aged 40-82 (mean age 63±9 years). All data were collected on the basis of a questionnaire; in the case of personality features, the Polish adaptation of the questionnaire NEO-FFI was used. Nutritional habits were analyzed on the basis of 3-day food records. Multifactor analyses were done with log-linear models. **Results.** Based on the final model, it could be concluded that nutritional habits of patients were related mostly to self-assessed adherence to dietary recommendation for CHD. Relatively, SES exerted lower influence had SES and the minor influence was observed for patients' age and openness to experience. **Conclusions.** In our study non-dietary factors affected nutritional habits of men with coronary heart disease. However, it should be emphasized that the impact was relatively small. Despite these results, the influence of non-dietary factors on nutritional habits should not be ignored in further studies as they can be a useful tool in dietary counseling.

Key words: nutrition, coronary heart disease (CHD), non-dietary factors, log-linear models

INTRODUCTION

Cardiovascular diseases (CVD) are the major contributor to the global prevalence of the non-communicable diseases [1, 2]. CVD account for almost 50% of all deaths in the developing countries [3]. In Poland, after year 1991, there was a decrease in mortality due to CVD but they are still a major cause of death for both men and women [4]. Premature mortality from CVD in Poland is 2.5 times higher than in the old European Union (EU) countries. Estimated data show that Poland only in the year 2018 will achieve the same mortality rate caused by CVD which was observed in the old EU countries in 2001 [5]. AHA statistics [1] showed that the leading cause of CVD worldwide mortality is coronary heart disease (CHD), similar situation is observed in Poland [4]. Nutrition is included in group of independent CVD risk factors [6]. Therefore, well-balanced diet is considered as one of the most important factors in the primary and secondary prevention of CVD. The effectiveness of healthy diet in secondary prevention was demonstrated in many studies [7, 8, 9]. However nutrition usually depends on many factors e.g. age, personality, nutritional knowledge, health, socio-demographic factors etc. The majority of studies focus on the influence of individual factors rather than the relationships between them. Multifactorial approach arising from the

knowledge about relationship between factors (if any) might be useful for dietitians in dietary counseling practice. Therefore, the main aim of this study was to examine whether and to what extent non-dietary factors affect nutritional habits of men with coronary heart disease.

METHODS

The research was carried out in 210 coronary heart disease (CHD) patients aged 40-82 (mean age of 63 years), residing in Warsaw, its suburbs, surrounding cities and villages. Patients were recruited in the years 2002-2005. Ethical approval was obtained from the Bioethical Commission at the Institute of Cardiology in Warsaw. Nutritional habits of participants were analyzed on the basis of 3-day food records (630 food records in total) and for each patient data from 3 days were averaged (n=210). Energy intake and nutritional value of diets were calculated using computer software *Diet 2.0 for planning and current assessment of individual intake* [10]. Thereafter, food records were analyzed with the Diet Quality Index (DQI) [11] which includes recommendations for reducing the consumption of total fat, saturated fatty acid and cholesterol as well as increasing the intake of vegetables and fruits, starches and other complex carbohydrates by eating breads, cereals and legumes. The DQI also recommends limiting the total daily intake of sodium and to increase calcium consumption. In the present study, the DQI was modified according to recommendation for hypolipemic diet ATP III [12]. The main modifications concerned the reduction of the intake of total fat

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Received: 2 June 2010; accepted: 30 June 2010



below 25% of energy, saturated fatty acid below 7% of energy and cholesterol below 200 mg per day.

Based on the DQI results, significant (based on the chi-square test, $p < 0.05$) factors as: socio-demographic and economic (age, place of dwelling), health status (past by-pass surgery and CHD duration), personality features (neuroticism, openness to experience) and adherence to the nutritional recommendation in CHD were selected and discussed [13].

In the present study, the number of non-dietary factors such as: socio-demographic and economic factors, factors related to health status, personality features and self-knowledge about the disease as well as adherence to the nutritional recommendation in CHD were taken into account. All data were collected on the basis of a questionnaire; in the case of personality features, the polish adaptation of the questionnaire NEO-FFI [14] was used. Adherence to nutritional recommendation was self-assessed by subjects.

The main aim of the study was to examine whether and to what extent these factors affect nutritional habits of men with CHD as well as to find the relationships between analyzed factors and the strength of their impact described by the multifactor analyses using log-linear models. For the verification of fitting in log-linear models coefficient of determination of Goodman were used.

In all of the analyzed models, there were enumerated values of the statistical importance and coefficients for the smallest model, in relation to, the accuracy of the adjustment of consecutively included factors was specified. Statistical analyses were performed using STATISTICA 5.1 PL with statistical difference at the 0.05 level of significance.

RESULTS

Only factors which substantially distinguished the examined group of men with the DQI were included into the log-linear models. The relationship between nutrition of patients and selected factors is presented in Figure 1.

The influence of these factors on nutritional habits was analyzed using two log-linear models (model I and II – Table 1, Fig. 2 and Table 2, Fig. 3).

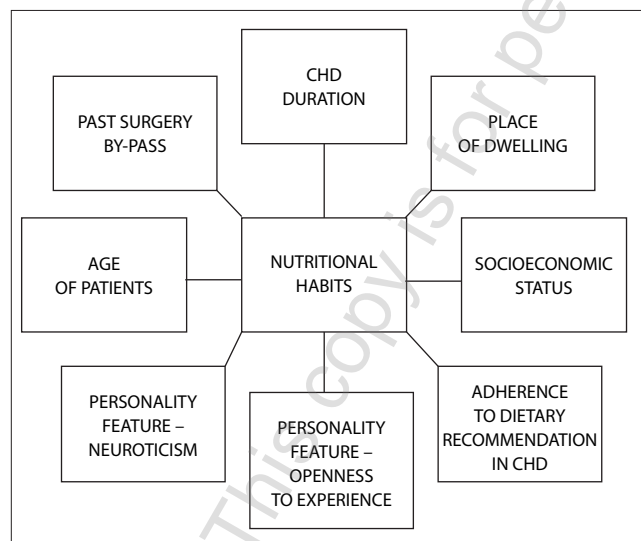


Figure 1 Total diagram of relationships – nutritional habits of examined men and selected factors.

In model I (Fig. 2), nutritional habits and factors such as age of patients, past surgery (by-pass) and CHD duration as well as place of dwelling and economic situation of examined men were included. In this model the number codes was ascribed as follow: nutrition factors (1), age of patients (2), past by-pass surgery (3), CHD duration (4), place of dwelling (5) and socioeconomic status (SES) (6).

Existing relationships between these factors in model I are presented in Table 1.

Table 1 Combinations of the selected statistics for verification of the hypothesis about the influence of the examined factors included in log-linear model I.

Model	G ² (M)	R ²	p	R ² × 100%
1 2 3 4 5 6*	92,19	0	0,998	-
12 3 4 5 6	89,76	0,026	0,998	2,6
13 2 4 5 6	90,41	0,019	0,998	1,9
16 2 3 4 5	87,81	0,048	0,998	4,8
24 1 3 5 6	84,31	0,085	0,999	8,5
34 1 2 5 6	85,65	0,071	0,999	7,1
45 1 2 3 6	86,19	0,065	0,999	6,5
12 13 16 24 34 45†	63,25	0,314	0,999	31,4

* model of total independence of examined factors; † the best model (selected with Statistica); G²(M) – value of chi-square the most credibility for analyzed model; R² – coefficient of Goodman determination; R² × 100% – describing a degree in which introduction of additional factors is improving adjustment of the model.

The results showed that 31.4% of the variability in nutritional habits of examined men could be explained by the relationships between factors such as: age of patients, past by-pass surgery, CHD duration, place of dwelling and SES. The diversity of nutritional habits comparatively in the greatest extent was explained by SES (4.8%), subsequently by two other factors: age of patients (2.6%) and past by-pass surgery (1.9%). There were no relationships observed between nutrition and CHD duration or place of dwelling. On the contrary, associations between CHD duration and age of the participants (8.5%) and past by-pass surgery (7.1%) were found. The relationships between the listed factors are presented in Fig. 2.

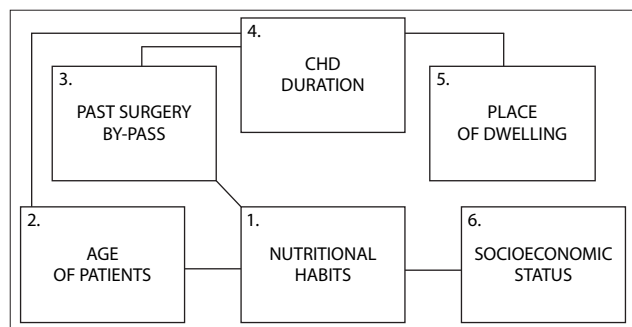


Figure 2 Diagram of relationships – nutritional habits of examined men and selected factors – log-linear model I.

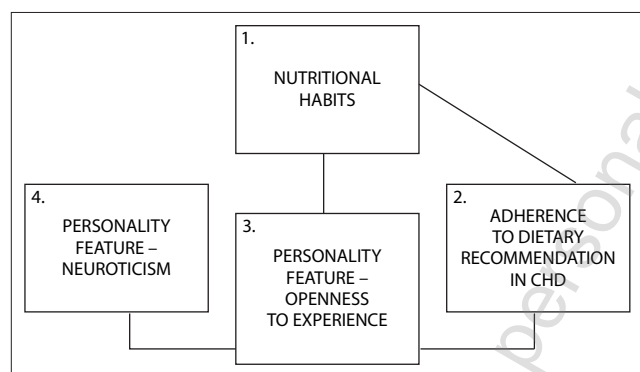
In model II (Fig. 3) nutrition factors and factors, such as adherence to dietary recommendation in CHD and personality features, such as openness to experiences and neuroticism of patients were included. In this model the number codes was ascribed as follow: nutrition (1), adherence to dietary recommendation in CHD (2), openness to experiences (3) and neuroticism (4). Existing relationships between factors included in model II are presented in Table 2.

Table 2 Combinations of the selected statistics for verification of the hypothesis about the influence of the examined factors included in log-linear model II.

Model	G ² (M)	R ²	p	R ² × 100%
1 2 3 4*	54,14	0	0,181	-
12 3 4	40,48	0,252	0,618	25,2
13 2 4	51,01	0,057	0,199	5,7
23 1 4	52,37	0,032	0,191	3,2
34 1 2	49,42	0,087	0,201	8,7
12 13 23 34 [†]	30,95	0,428	0,623	42,8

* model of total independence of examined factors; [†] the best model (selected with Statistica); G²(M) – value of chi-square the most credibility for analyzed model; R² – coefficient of Goodman determination; R² × 100% – describing a degree in which introduction of additional factors is improving adjustment of the model.

The results showed that 42.8% of the variability in nutritional habits of examined men could be explained by relationships between factors such as adherence to dietary recommendation in CHD and personality features (openness to experiences, neuroticism). In the greatest extent nutritional habits could be explained by self-assessed adherence to CHD dietary recommendations (25.2%); then by personality features – openness to experiences (5.7%). Moreover, the results showed that 3.2% of the variability in adherence to dietary recommendations in CHD could be explained by personality feature – openness to experiences, and in 8.7% changeability related to neuroticism of examined men. There was no direct relationship between nutritional habits and neuroticism of patients. The relationships between the listed factors are presented in Fig. 3.

**Figure 3** Diagram of relationships – nutritional habits of examined men and selected factors – log-linear model II.

The final model (Fig. 4) included only factors such as: age of patients, SES, adherence (self-assessed) to dietary recommendation in CHD and personality features – openness to experience. In this model, the number codes was ascribed as follow: nutrition (1), age of patients (2), SES (3), adherence to dietary recommendation in CHD (4), openness to experience (5). Existing relationships between factors included in the final model are presented in Table 3.

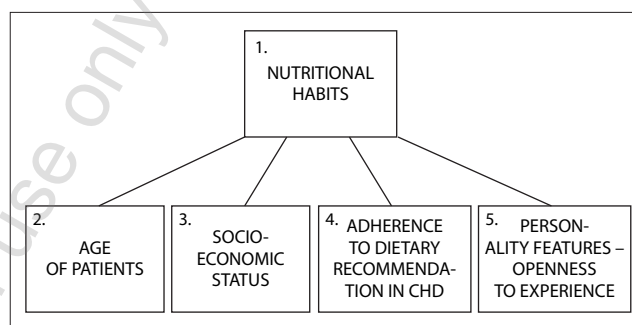
The results showed that 26% of the variability in nutritional habits of examined men might be explained by relationships between factors such as: age of patients, SES, adherence to CHD dietary recommendations and personality features – openness to experiences. Moreover, it was noted that the variability of nutritional habits comparatively in the greater extent was

Table 3 Combinations of the selected statistics for verification the hypothesis about the influence of the examined factors included in the final model.

Model	G ² (M)	R ²	p	R ² × 100%
1 2 3 4 5*	87,17	0	0,796	-
12 3 4 5	84,42	0,032	0,814	3,2
13 2 4 5	82,41	0,055	0,817	5,5
14 2 3 5	75,09	0,139	0,951	13,9
15 2 3 4	84,24	0,034	0,774	3,4
12 13 14 15 [†]	64,74	0,260	0,999	26,0

* model of total independence of examined factors; [†] the best model (selected with Statistica); G²(M) – value of chi-square the most credibility for analyzed model; R² – coefficient of Goodman determination; R² × 100% – describing a degree in which introduction of additional factors is improving adjustment of the model.

explained by adherence to CHD dietary recommendations (13.9%) self-assessed by patients. The second factor related to nutritional habits of the subjects was their socioeconomic status – the analysis showed that 5.5% of the variability in nutritional habits could be explained by it. Furthermore, the variability in nutritional habits might be explained by personality features – openness to experience and age of patients (respectively 3.4% and 3.2%). The relationships between examined factors in the final model are presented in Fig. 4.

**Figure 4** Nutritional habits and selected factors – the final model.

DISCUSSION

Many epidemiological studies have shown that diet rich in whole grains, lean meat, fish and fresh fruits and vegetables is associated with better health [2]. On the other hand, unhealthy diet rich in refined grains, added fat and sugar may lead to malnutrition [15] and diet rich in total fat, saturated fatty acids and cholesterol is associated with the development of many diseases [16], including heart diseases. Several factors have been found to correlate with nutrition [17].

In the present study, taking into account the impact of all factors analyzed in the final model on the quality of nutrition (by the DQI), it was found that the nutritional habits of men to the greatest extent was linked to the patients' self-assessed adherence to dietary recommendations in CHD.

Adherence to dietary recommendations is often associated with knowledge of the role of nutrition in disease. Patients' awareness about the importance of the diet in preventing the disease seems to play a significant role in the choice of their nutritional habits. There are studies showing the relationship between nutritional knowledge and food selection [18].

Nutritional knowledge may come from many sources e.g. nutritional counseling [19], nutritional information on food packaging [20] or advertisements of food products in magazines. Adams and White [21] showed that advertising in magazines contributes to nutritional knowledge and may play a role in food choice. However, not all studies confirm the correlation between nutritional knowledge and food selection [22]. With respect to patients with coronary heart disease and people from high CVD risk group, nutritional knowledge should come from professional nutritional counseling conducted by specialist in dietetics [23] because adequate diet is the integral element of the treatment of people with CVD.

Compliance with special dietary recommendations is usually related to the change of nutritional habits of all family members and requires their support. Support of the family next to the price of foods were listed by Verheijden et al. [24] as two significant predictors for intention to reduce fat consumption during nutritional counseling intervention study for lowering the cardiovascular risk. The price of food was associated with type of consumed products and SES of family. SES was the second factor which determined nutritional habits of examined men with CHD in the present study. Correlations between SES and food intake have been found in many studies [25,26]. People from groups with high SES compared to people with low SES usually consume more fresh fruits and vegetables [27], whole grains [28], lean meat and fish [29]. Moreover, populations with lower SES also have a higher intake of fatty meats instead of the recommended lean meat and their diet has more added fats and sugar [30, 31]. Examining the macronutrients intake several studies have reported correlation between higher fat intake in the low SES groups [28, 32], while others found no link between these factors [33]. Moreover some studies showed that among low SES people higher percent of energy come from saturated fat and cholesterol [32, 34], whereas others have not confirmed that [31, 35]. Results of many studies on the nutritional habits showed that people with low SES usually have not enough nutritional knowledge and motivation to change their nutritional habits [36]. That situation may be related to education because there is a positive relation between SES and level of patients' education and their incomes. The diet of higher nutritional quality is also associated with higher cost and the highest income level [37] and vice versa [17]. On the other hand there is a positive relation between the highest income level and higher education [35]. However, that relation was not observed among Canadian households [38].

The results of the present study showed that the nutrition of examined men was associated with openness to experiences. Openness to experience is one of the five personality features discovered by psychologists [39]. Openness involves active imagination, aesthetic sensitivity, attentiveness to inner feelings, preference for variety, and intellectual curiosity [40]. Openness to experience correlates with creativity [41] and is also associated with fluid intelligence [42]. People with high openness to experiences are flexible and open to experiences and learning. The results of previous study showed that openness to experiences is correlated with the level of education [43]. High level of education may be helpful to understand the essence of disease and to make people aware of advantages of healthy habits and potential danger related to wrong attitude to health and diet.

The last factor which correlated with nutritional habits in the present study was age of examined men. Diet quality is strongly associated with age for both men and women [17]. Age may be related to preferences of food consumption but quantity of intake may be lower in the elderly compared to others as a result from poor dental health or stomach diseases [44]. Although Steffen et al. [45] reported aged correlated with increasing intake of fruits and vegetables. Moreover, the number of meals and their regularity were related to age. Similarly, Polish studies showed that the elderly usually eat more meals and more regular comparing with other groups [46]. This situation is due to the greater amount of free time and pharmacotherapy, as in many situations taking a medicine should be preceded by a meal.

On the other hand, in the management of older people it should be taken into account that this population is usually more likely to be poor than other people especially when living in big cities because of high cost of living. The other important fact is that old people are sometimes isolated and often live alone. As a consequence they might not prepare diverse meals as it could be in full family. Moreover, nutritional habits may be connected to nutritional counseling. Type of education, especially for people suffering from different diseases e.g. CHD should be adjusted in content and form to individual personal knowledge and needs depending on age and education [47]. Some studies showed that TV programs, leaflets are more effective than others in the elderly [48].

Finally, the results of the present study indicate that many factors may modify nutritional habits and none of them, even if the impact is not significant (like in this study) should be disregarded in dietary counseling especially regarding people suffering from heart diseases. Healthy diet as an integral element of life style in this group may contribute to the better prognosis in the progress of disease.

CONCLUSION

As demonstrated in our study examined non-dietary factors affected nutritional habits of men with coronary heart disease. However, it should be emphasized that the impact was relatively small. Despite these results, the influence of non-dietary factors on nutritional habits should not be ignored in further studies and dietary counseling practice as they can modify the compliance to nutritional recommendations.

REFERENCES

1. Thom T, Haase N, Rosamond W, Howard VJ, Rumsfeld J, Manolio T, Zheng ZJ, Flegal K, O'Donnell C, Kittner S, Lloyd-Jones D, Goff DC Jr, Hong Y, Adams R, Friday G, Furie K, Gorelick P, Kissela B, Marler J, Meigs J, Roger V, Sidney S, Sorlie P, Steinberger J, Wasserthiel-Smoller S, Wilson M, Wolf P; American Heart Association Statistics Committee and Stroke Statistics Subcommittee: Heart disease and stroke statistics – 2006 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2006, **113**, 85-151.
2. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Report of Joint WHO/FAO Expert Consultation. Geneva 2003 Practice. *Eur Heart J* 28, 2375-2414.
3. Forman D, Bulwer BE: Cardiovascular disease: optimal approaches to risk factor modification of diet and lifestyle. *Curr Treat Options Cardiovasc Med* 2006, **8**, 47-57.

4. Wojtyniak B, Stokwiszewski J, Goryński P, Poznańska: Długość życia i umieralność ludności Polski. In: Wojtyniak B, Goryński P (ed) Sytuacja zdrowotna ludności Polski. Narodowy Instytut Zdrowia Publicznego-PZH, Warszawa, 2008, pp 47-55. (in Polish). (Life span and mortality rate among the Polish population. In: Wojtyniak B., Goryński P (Ed.): Health situation of the Polish population. *National Institute of Public Health (PZH)*, Warsaw 2008, 47-55).
5. Wojtyniak B, Goryński P, Seroka W: Stan zdrowia ludności Polski na podstawie danych o umieralności. Przedwczesna umieralność w Polsce na tle sytuacji w Unii Europejskiej. In: Wojtyniak B, Goryński P (ed) Sytuacja zdrowotna ludności Polski. Zakład Statystyki Medycznej-PZH, Warszawa, 2003, pp 47-55. (in Polish). (State of health of Polish population based on data concerning mortality. Premature mortality in Poland on the background of the situation in the European Union. In: Wojtyniak B., Goryński P. (Ed.): Health situation of the Polish population. *Department of Medical Statistics National Institute of Hygiene*, Warsaw 2003, pp. 47-55).
6. Pyorala K, de Backer G, Graham I, Poole-Wilson P, Wood D: Prevention of coronary heart disease in clinical practice. Recommendations of the Task Force of the European Society of Cardiology, European Atherosclerosis Society and European Society of Hypertension. *Eur Heart J* 1994, **15**, 1300-1331.
7. Singh RB, Rastogi SS, Verma R, Laxmi B, Singh R, Ghosh S, Niaz MA: Randomized controlled trial of cardioprotective diet in patients with recent acute myocardial infarction: results of one year follow up. *Brit Med J* 1992, **304**, 1015-1019.
8. De Logeril M, Renaud S, Mammelle S, Salen P, Martin JL, Monjaud I, Guidollet J, Touboul P, Delaye J: Mediterranean alpha-linolenic acid-rich diet in secondary prevention of coronary heart disease. *Lancet* 1994, **343**, 1454-1459.
9. Watts GF, Lewis B, Brunt JNH, Lewis ES, Coltart DJ, Smith LD, Mann JI, Swan AV: Effects on coronary artery disease of lipid-lowering diet, or diet plus cholestyramine, in the St. Thomas' Artherosclerosis Regression Study (STARS). *Lancet* 1992, **339**, 129-133.
10. Charzewska J, Rogalska-Niedźwiedz M, Szponar L, Rybaczuk M: Pakiet Dieta 2.0 do planowania i bieżącej oceny żywienia indywidualnego. Warszawa 2002 (in Polish). (Package Diet 2.0 for planning and current evaluation of individual nutrition. Warsaw 2002).
11. Popkin BM, Siega-Riz AM, Haines PS: A comparison of dietary trends among racial and socio-economic groups in the United States. *N Engl J Med* 1996, **335**, 716-720.
12. Adult Treatment Panel III: Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Final Report (ATP III). National Institute of Health, 2002
13. Harton A, Narojek L, Solik-Tomassi A: Quality of nutrition (DQI) of patients with coronary heart disease. *Pol J Hum. Nutr Metab* 2007; XXXIV:237-243 (in Polish, English abstract).
14. Zawadzki B, Strelau J, Szczepaniak P, Sliwiska, M: Inwentarz osobowości NEO-FFI Costy i McCrae – adaptacja polska. Pracownia Testów Psychologicznych PTP, Warszawa 1998 (in Polish). (Costa and McCrae's Personality Inventory NEO-FFI – Polish adaptation. Laboratory for Psychological Tests, Warsaw 1998).
15. Andrieu E, Darmon N, Drewnowski A: Low-cost diets: more energy, fewer nutrients. *Eur J Clin Nutr* 2006, **60**, 434-436.
16. Mendoza JA, Drewnowski A, Christakis DA: Dietary energy density is associated with obesity and the metabolic syndrome in U.S. adults. *Diabetes Care* 2007, **30**, 974-979.
17. Thiele S, Mensink GBM, Beitz R: Determinants of diet quality. *Public Health Nutrition* 2004, **7**, 29-37.
18. Wardle J, Parmenter K, Waller J: Nutrition knowledge and food intake. *Appetite* 2000, **34**, 269-275.
19. Räsänen M, Niinikoski H, Keskinen S, Heino T, Lagström H, Simell O, Helenius H, Rönnemaa T, Viikari J: Impact of nutrition counseling on nutrition knowledge and nutrient intake of 7- to 9-y-old children in an atherosclerosis prevention project. *Eur J Clin Nutr* 2004, **58**, 162-172.
20. Satia JA, Galanko JA, Neuhauser ML: Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *J Am Diet Assoc* 2005, **105**, 392-402.
21. Adams J, White M: Socio-economic and gender differences in nutritional content of foods advertised in popular UK weekly magazines. *Eur J Public Health* 2009, **19**, 44-149.
22. Peltzer K: Nutrition knowledge and food choice among black students in South Africa. *Cent Af J Med* 2002, **48**, 4-8.
23. ESC Guidelines. Graham I, Atar D, Borch-Johnsen K, Boysen G, Burell G, Cifkova R et al. European guidelines on cardiovascular disease prevention in clinical practice: executive summary. Fourth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice. *Eur Heart J* 2007, **28**, 2375-2414.
24. Verheijden MW, van der Veen JE, van Zadelhoff WM, Bakx C, Koelen MA, van den Hoogen HJ, van Weel C, van Staveren WA: Nutrition guidance in Dutch family practice: behavioral determinants of reduction of fat consumption. *Am J Clin Nutr* 2003, **77**(suppl), 1058-1064.
25. Mishra G, Ball K, Arbuckle J, Crawford D: Dietary patterns of Australian adults and their association with socioeconomic status: results from the 1995 National Nutrition Survey. *Eur J Clin Nutr* 2002, **56**, 687-693.
26. Larrieu S, Letenneur L, Berr C, Ritchie K, Alperovitch A, Tavernier B, Barberger-Gateau P: Sociodemographic differences in dietary habits in a population-based sample of elderly subjects: the 3C study. *J Nutr Health Aging* 2004, **8**, 497-502.
27. Giskes K, Turrell G, Patterson C, Newman B: Socio-economic differences in fruit and vegetable consumption among Australian adolescents and adults. *Public Health Nutr* 2002, **5**, 663-669.
28. Smith AM, Baghurst KI: Public health implications of dietary differences between social status and occupational category groups. *J Epidemiol. Community Health* 1992, **46**, 409-416.
29. Perrin AE, Simon C, Hedelin G, Arveiler D, Schaffer P, Schlienger JL: Ten-year trends of dietary intake in a middle-aged French population: relationship with educational level. *Eur J Clin Nutr* 2002, **56**, 393-401.
30. Linseisen J, Bergström E, Gafá L, González CA, Thiébaud A: Consumption of added fats and oils in the European Prospective Investigation into Cancer and Nutrition (EPIC) centres across 10 European countries as assessed by 24-hour dietary recalls. *Public Health Nutr* 2002, **5**, 1227-1242.
31. Hulshof KF, Brussaard JH, Kruizinga AG, Telman J, Lowik MR: Socio-economic status, dietary intake and 10 y trends: the Dutch National Food Consumption Survey. *Eur J Clin Nutr* 2003, **57**, 128-137.
32. Friel S, Kelleher CC, Nolan G, Harrington J: Social diversity of Irish adults nutritional intake. *Eur J Clin Nutr* 2003, **57**, 865-875.
33. Lindström M, Hanson BS, Brunner E, Wirfält E, Elmståhl S, Mattisson I, Ostergren PO: Socioeconomic differences in fat intake in a middle-aged population: report from the Malmo Diet and Cancer Study. *Int J Epidemiol* 2000, **29**, 438-248.
34. Dubois L, Girard M: Social position and nutrition: a gradient relationship in Canada and the USA. *Eur J Clin Nutr* 2001, **55**, 366-373.
35. Kant AK, Graubard BI: Secular trends in the association of socioeconomic position with self-reported dietary attributes and biomarkers in the US population: National Health and Nutrition Examination Survey (NHANES) 1971-1975 to NHANES 1999-2002. *Public Health Nutr* 2007, **10**, 158-167.
36. Dibsdall LA, Lambert N, Bobbin RF, Frewer LJ: Low-income consumers' attitudes and behaviour towards access, availability and motivation to eat fruit and vegetables. *Public Health Nutr* 2003, **6**, 159-168.
37. Townsend MS, Aaron GJ, Monsivais P, Keim NL, Drewnowski A: Less-energy-dense diets of low-income women in California are associated with higher energy-adjusted diet costs. *Am J Clin Nutr* 2009, **89**, 1220-1226.
38. Ricciuto LE, Tarasuk VS: An examination of income-related disparities in the nutritional quality of food selections among Canadian households from 1986-2001. *Soc Sci Med* 2007, **64**, 186-198.
39. McCrae RR, John OP: An introduction to the Five-Factor Model and its applications. *J Pers* 1992, **60**, 175-215.
40. Costa PT, McCrae RR NEO personality Inventory professional manual. Odessa, FL: Psychological Assessment Resources, 1992.
41. McCrae R: Creativity, divergent thinking, and openness to experience. *J Pers Soc Psychol* 1987, **52**, 1258-1265.
42. Geary DC: The origin of mind: Evolution of brain, cognition, and general intelligence. Washington, DC: American Psychological Association, 2005.
43. Harton A, Pilska M, Narojek L: Nutritional habits and personality of men with coronary heart disease. *Physiological Determinants of Progress In Diet Therapy SGGW* 2004, **2**, 527-532 (in Polish, English abstract).
44. Assmann G, Carmena R, Cullen P, Fruchart JC, Jossa F, Lewis B, Mancini M, Paoletti R: Coronary heart disease: reducing the risk: a worldwide view. International Task Force for the Prevention of Coronary Heart Disease. *Circulation* 1999, **100**, 1930-1938.
45. Steffen LM, Jacobs DR, Stevens JJ, Shahar E, Carithers T, Folsom AR: Associations of whole-grain, refined-grain, and fruit and vegetable

- consumption with risks of all-cause mortality and incident coronary artery disease and ischemic stroke: the Atherosclerosis Risk in Communities (ARIC) Study. *Am J Clin Nutr* 2003, **78**, 383-390.
46. Sadowska J, Sliwiska U: Ocena sposobu żywienia stanu odżywienia osób w wieku podeszłym, zamieszkałych na terenach wiejskich. *Pol J Hum Nutr Metab* 2005, **3**, 187-202 (in Polish, English abstract). (Evaluation of the mode of nutrition and nutritional status among elderly inhabitants of the rural areas. *Pol J Hum Nutr Metab* 2005, **3**, 187-202).
47. Narojek L: Niektóre aspekty uwarunkowań zachowań żywieniowych. Prace IŻŻ, Warszawa, 1993 (in Polish). (Selected aspects of the conditioning of nutritional behaviours. Reports from the Institute of Food and Nutrition, Warsaw 1993).
48. Jezewska-Zychowicz M: Informacja żywieniowa w kontekście potrzeb konsumenta. *Pol J Hum Nutr Metab* 1996, **23**, 83-89 (in Polish, English abstract). (Nutritional information in the context of consumers' demand. *Pol J Hum Nutr Metab* 1996, **23**, 83-89).

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