

PUBLIC HEALTH

Medicina (Kaunas) 2012;48(4):211-7

Diet and Dyslipidemias in a Lithuanian Rural Population Aged 25–64: the CINDI Survey

Janina Petkevičienė¹, Jūratė Klumbienė¹, Vitalija Ramažauskienė¹, Vilma Kriaucionienė¹, Edita Šakytė¹, Vilius Grabauskas²

¹Health Research Institute, Medical Academy, Lithuanian University of Health Sciences,

²Department of Preventive Medicine, Medical Academy, Lithuanian University of Health Sciences, Lithuania

Key words: diet; dyslipidemias; 24-hour recall; food frequency questionnaire.

Summary. The aim of the study was to evaluate the dietary intake of a Lithuanian rural population and to assess the relationship between diet and dyslipidemias.

Material and Methods. A cross-sectional health survey was carried out in 5 municipalities of Lithuania in 2007. The random sample was obtained from lists of 25- to 64-year-old inhabitants registered at primary health care centers ($n=1739$). The food frequency questionnaire and 24-hour recall was used for the evaluation of nutrition habits. The levels of serum lipids were determined using enzymatic methods. Factor analysis was employed in order to reduce the number of food items. The scores of food factors were used in linear regression analysis of associations between nutrition and serum lipid levels.

Results. The diet of the study population was very high in fat, especially in saturated fatty acids. The content of cholesterol in the diet of men was higher than recommended. The main sources of fat and protein were meat, milk, and their products. Cereals were the main source of carbohydrates. The major proportion of monosaccharide and disaccharides was derived from confectionary and fruits. The mean serum total cholesterol level was 5.60 mmol/L in men and 5.51 mmol/L in women.

Conclusions. Healthier food patterns were associated with the lower levels of total, low-density lipoprotein cholesterol, and triglyceride.

Introduction

Epidemiological data have clearly demonstrated that the high levels of total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C), and the low level of high-density lipoprotein cholesterol (HDL-C) are the risk factors for cardiovascular diseases (CVD) (1, 2). The intake of saturated fatty acids (SFA) and dietary cholesterol has been linked to the increased levels of serum TC and LDL-C. Unsaturated fatty acids have a beneficial effect on lipid levels (3, 4). Many studies confirmed that the improvement in the quality of fat intake, in particular reduction of saturated fatty acids and cholesterol intake, contributed to decline in serum cholesterol level (5, 6).

In Lithuania, the transition period from a centralized to a market-oriented economy was characterized by changes in lifestyles of the Lithuanian population, including their nutritional habits. The availability and variety of foods increased considerably. Different kinds of vegetable oil, margarine, and skimmed milk, as well as fresh fruits and vegetables, become easily accessible. On the other hand,

food prices increased dramatically during the economic transition period. Market globalization and aggressive advertising reduced the demand for local traditional foods and had an impact on the dietary choices of people. Dietary changes may affect the lipid profile of the Lithuanian population and the prevalence of CVD.

There is a lack of studies analyzing the association between nutrition and dyslipidemias in Lithuania. The National Nutrition Surveys were carried out in 1997, 2002, and 2007 (7, 8). However, the prevalence of CVD risk factors has not been evaluated in these surveys. Monitoring of CVD risk factors and health behaviors, including nutrition, is one of the objectives of the Lithuanian Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) program.

The aim of this study was to evaluate the dietary intake of the adult population in 5 Lithuanian rural municipalities and to assess the relationship between diet and dyslipidemias.

Material and Methods

This study used the data of the cross-sectional Lithuanian CINDI survey carried out in 5 municipalities (Kaišiadorys, Kretinga, Kupiškis, Joniškis, and Varėna), randomly selected from the main

Correspondence to J. Petkevičienė, Health Research Institute, Medical Academy, Lithuanian University of Health Sciences, Eiveniu 4, 50028 Kaunas, Lithuania
E-mail: janpet@vector.kmu.lt

administrative areas of Lithuania. The survey was conducted in 2007. The random sample was obtained from lists of 25- to 64-year-old inhabitants registered at the primary health care centers of the municipalities included. In total, 1739 persons (741 men and 998 women) participated in the survey.

The survey methods strictly followed the World Health Organization (WHO) CINDI protocol (9). Health examinations included interviews, clinical examinations, and laboratory tests.

The Lithuanian Bioethics Committee approved the survey. Written informed consent for participation in the study was obtained from all participants.

Dietary Assessment. A 24-hour dietary recall was used for the assessment of dietary intake. Trained dietary interviewers collected the data. The participants were asked to recall what they had eaten during the previous 24 hours. The interviews were conducted on all days of a week except Sundays. Food models, a validated picture book, and household measures were used to quantify the sizes of food portions. The survey was carried out during the whole year, so the seasons were equally represented. The nutrient values of food were calculated using the Lithuanian Food Composition Tables (10). Under-reporters were defined by cutoff for energy intake recommended by Willet (11). Women with an energy intake of less than 500 kcal/day or higher than 3500 kcal/day were excluded from the analyses as well as men with an energy intake of less than 800 kcal/day or more than 4500 kcal/day (altogether 55 persons).

The food classification prepared by the European Food Safety Authority was used to evaluate the consumption of different foods and to estimate the main sources of nutrients (12).

The questions addressing the frequency of consumption of main food items (potatoes, porridges and cereals, fresh vegetables, fruits and berries in the summer and winter, boiled vegetables, cheese and white cheese, meat and meat products, chicken, fish, juices and sweets, etc.) were included in the questionnaire. The choices of possible answers

were as follows: daily, 4–6 times a week, 2–3 times a week, once a week, 1–2 times per month, and rarely or never.

Laboratory Analyses. Blood samples for the measurements of lipid levels were taken in the morning after fasting for at least 12 hours. TC, LDL-C, HDL-C, and triglyceride (Tg) levels were determined using conventional enzymatic methods.

Statistical Analysis. Statistical analysis was performed using the statistical software package SPSS 19.0 for Windows. The data were weighted to match the age distribution of the Lithuanian population aged 25–64 years in 2007. Continuous variables were expressed as mean and standard deviation (SD). The Student *t* test was used to compare the means of continuous variables across groups. A *P* value of less than 0.05 was considered statistically significant.

Factor analysis was employed in order to reduce the number of 15 food items included within the food frequency questionnaire (13). The main factors were identified using principal component analysis and varimax rotation. The factor analysis extracted 4 main factors that were different for men and women (Table 1). Food items with factor loadings having absolute values of >0.4 were considered as significantly contributing to the main factor. Factor scores for each main factor were calculated summing up the observed frequencies of the component food items weighted by a factor loading. These scores were used for linear regression analysis of association between nutrition and serum lipid levels. Age and body mass index (BMI) were included as covariates. The users of lipid-lowering medications (26 men and 59 women) were excluded from regression analysis.

Results

In 2007, the mean daily energy intake was higher in men than women: 10493.1 kJ (SD, 3416.6) vs. 7618.4 kJ (SD, 2632.9) (Table 2). The proportion of fat and SFA in total energy intake was very high both in men and women. The content of cholesterol in the diet was higher in men than women. The

Table 1. Description of the Main Factors in Men and Women

Gender	Factor	Description	% of Variance Explained
Men	Vegetables and fruits	Fresh vegetables, fruits, boiled vegetables	21.3
	Heavy food	Meat and meat products, potatoes	11.4
	Light food	Poultry, fish, porridges and cereals	9.2
	Snacks	Cheese, confectionery, white cheese	8.1
			Total: 49.9
Women	Vegetables and fruits	Fresh vegetables, fruits.	18.9
	Heavy and sweet food	Meat and meat products, potatoes, confectionery	12.5
	Protein food	Fish, poultry, cheese	9.6
	Light food	Porridges and cereals, boiled vegetables, white cheese	8.0
			Total: 49.0

Table 2. Intake of Energy (kJ), Macronutrients (E%), Cholesterol (mg), and Dietary Fiber (g) According to Gender

Energy, Nutrient	Men					Women					<i>P</i>
	Mean	SD	Median	5th Percentile	95th Percentile	Mean	SD	Median	5th Percentile	95th Percentile	
Energy	10493.1	3416.6	10190.2	5238.4	16514.9	7618.4	2632.9	7241.5	3759.2	12271.0	<0.001
Proteins	14.7	4.1	14.5	8.4	21.5	14.1	4.2	13.5	8.3	22.1	0.005
Fat	44.8	11.6	45.1	24.9	63.2	42.3	11.3	41.9	23.8	61.0	<0.001
SFA	15.1	4.8	14.8	7.6	23.6	14.8	4.9	14.6	7.1	22.8	0.120
MUFA	17.3	6.0	16.8	8.5	27.7	15.7	5.6	15.2	7.3	25.7	<0.001
PUFA	7.1	3.3	6.3	3.1	14.3	7.3	4.0	6.4	2.8	15.2	0.525
Carbohydrates	38.9	11.5	38.2	21.5	59.4	43.2	11.9	43.4	24.0	63.5	<0.001
Starch	23.1	8.9	22.3	10.2	39.4	22.1	9.0	21.7	8.8	38.3	0.017
Monosaccharides and disaccharides	13.3	7.4	11.8	3.6	26.6	18.0	8.8	16.7	6.3	34.0	<0.001
Alcohol	1.6	4.9	0	0	10.5	0.4	2.4	0	0	0	<0.001
Dietary fiber	22.2	12.5	20.4	7.4	42.4	18.3	10.9	16.0	5.0	39.4	<0.001
Cholesterol	423.1	240.2	371.4	126.7	937.1	276.4	163.3	243.4	82.0	559.1	<0.001

Estimates are age-adjusted to the 2007 Lithuanian population.

E%, percentage of total energy intake; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids.

share of polyunsaturated fatty acids (PUFA) in total energy intake was similar in both the genders. The proportion of energy derived from carbohydrate was higher in women than men. On the contrary, the proportion of monosaccharides and disaccharides was higher in women. The intake of dietary fiber was insufficient: 22.2 g (SD, 12.5) in men and 18.3 g (SD, 10.9) in women. The proportion of proteins in total energy intake was adequate.

The main source of energy was meat and meat products. One-third (30.3%) of daily energy in men and 23.5% in women was derived from this food category. Cereal products were other important source of energy, from which a quarter of energy (24.5% in men and 24.3% in women) was derived.

Meat and its products, milk and dairy products, and animal and vegetable fats contributed most to the dietary fat and SFA intake (Fig. 1). Half of total fat in men and one-fifth in women were derived from meat and meat products. Milk and dairy products provided 13.1% of fat in men and 9.4% in women. Men received significantly more SFA from meat and its products than women did (45.2% and 35.6%, respectively). Meanwhile, women derived more SFA from milk and its products than men (22.1% and 16.3%, respectively).

Meat and cereal products were the main sources of proteins (Fig. 2). Meat and meat products supplied 46.1% and 37.5% of proteins in the diet of men and women, respectively. One-fifth of proteins were derived from cereal products. Milk and dairy products were other important source of proteins (14.1% and 9.5% of proteins in men and women, respectively).

Cereals contributed most to the intake of carbohydrates (Fig. 3). This food category provided more than two-fifths of all carbohydrates in men and one-third of all carbohydrates in women. From fruits, women received even 1.8 times more carbohydrates than men did. About one-tenth of carbohydrates were derived from potatoes in both the genders. Monosaccharides and disaccharides were mainly received from sugar and sugar products. Fruits were other source of monosaccharides and disaccharides (20.5% in men and 28.3% in women). Cereals and cereal products as well as fruits were the main sources of dietary fiber.

The factor analysis defined the 4 major factors, which are described in Table 1. These factors accounted for 49.9% and 49.0% of the total variance in food intake in men and women, respectively. The “vegetables and fruits” factor explained 21.3% and 18.9% of the total variance in men and women, respectively.

The mean age-adjusted serum lipid levels of men and women are presented in Table 3. The mean LDL-C levels were higher in men, whereas women had a higher mean HDL-C level.

The linear regression analysis was used to estimate the associations between lipid levels and scores of food factors. The “vegetables and fruits” factor was inversely associated with the TC level in men, suggesting that men consuming vegetables and fruits frequently had a lower TC level (Table 4). A negative association between the “light food” factor (i.e., poultry, fish, porridges, and cereals) and the TC as well as LDL-C levels was found in men. A higher consumption of cheese, confectionery, and

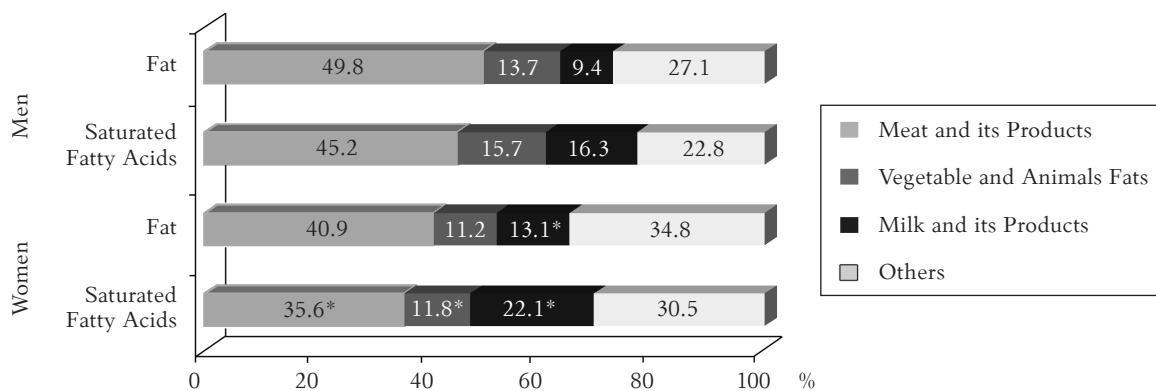


Fig. 1. The proportions of fat and saturated fatty acids derived from different food groups

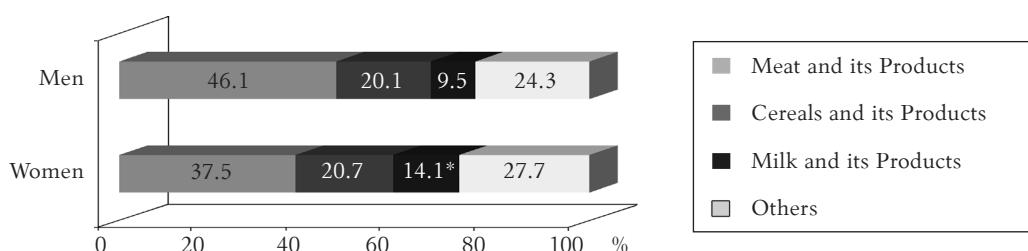
 $*P < 0.05$, compared with the corresponding proportion in men.

Fig. 2. The proportions of proteins derived from different food groups

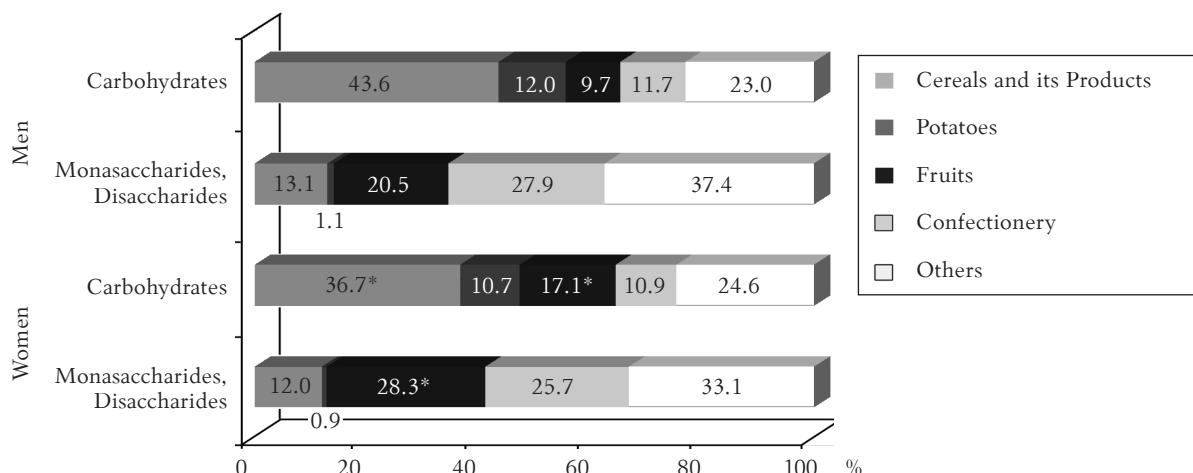
 $*P < 0.05$, compared with the corresponding proportion in men.

Fig. 3. The proportions of carbohydrates, monosaccharides, and disaccharides derived from different food groups

 $*P < 0.05$, compared with the corresponding proportion in men.

Table 3. Serum Lipid Levels According to Gender

Serum Lipid	Men	Women	<i>P</i>
TC, mmol/L	5.6 (1.16)	5.51 (1.14)	NS
LDL-C, mmol/L	3.57 (1.03)	3.39 (1.00)	<0.05
HDL-C, mmol/L	1.30 (0.43)	1.45 (0.37)	<0.05
Tg, mmol/L	1.63 (0.87)	1.45 (0.60)	NS

Values are mean (standard deviation).

Estimates are age-adjusted to the 2007 Lithuanian population.

TC, total cholesterol; LDL-C, low-density lipoprotein

cholesterol; HDL-C, high-density lipoprotein cholesterol;

Tg, triglyceride; NS, not significant.

white cheese ("snacks" factor) was associated with a lower level of HDL-C. The "heavy food" factor (i.e., meat, its products, and potatoes) was positively related to the Tg level.

In women, the "light food" factor (i.e., porridges and cereals, boiled vegetables, white cheese) was inversely associated with the LDL-C level (Table 5). No statistically significant associations between other food factors and lipid levels in women were found.

Table 4. Associations Between Food Factors and Lipid Levels in Men

Dependent Variable	Independent Variable	$\beta \pm SE$	95% Confidence Interval	P
TC, mmol/L	Vegetables and fruits	-0.192±0.080	-0.349; -0.035	0.017
	Heavy food	0.075±0.081	-0.084; 0.235	0.355
	Light food	-0.151±0.080	-0.309; 0.007	0.049
	Snacks	0.043±0.080	-0.115; 0.201	0.590
LDL-C, mmol/L	Vegetables and fruits	-0.023±0.077	-0.174; 0.128	0.764
	Heavy food	0.104±0.078	-0.048; 0.257	0.181
	Light food	-0.156±0.077	-0.307; -0.004	0.044
	Snacks	0.069±0.077	-0.082; 0.220	0.370
HDL-C, mmol/L	Vegetables and fruits	-0.053±0.031	-0.113; 0.007	0.086
	Heavy food	-0.002±0.031	-0.063; 0.058	0.939
	Light food	-0.002±0.031	-0.063; 0.058	0.938
	Snacks	-0.092±0.031	-0.153; -0.032	0.003
Tg, mmol/L	Vegetables and fruits	0.003±0.073	-0.140; 0.146	0.969
	Heavy food	0.147±0.074	0.003; 0.292	0.046
	Light food	0.031±0.073	-0.112; 0.175	0.667
	Snacks	-0.029±0.073	-0.172; 0.114	0.691

Estimates are adjusted by age and body mass index. The users of lipid-lowering medications were excluded.

TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; Tg, triglyceride.

Table 5. Associations Between Food Factors and Lipid Levels in Women

Dependent Variable	Independent Variable	$\beta \pm SE$	95% Confidence Interval	P
TC, mmol/L	Vegetables and fruits	-0.012±0.070	-0.149; 0.125	0.864
	Heavy and sweet food	0.018±0.069	-0.118; 0.155	0.790
	Protein food	0.008±0.069	-0.127; 0.143	0.906
	Light food	-0.090±0.070	-0.228; 0.049	0.203
LDL-C, mmol/L	Vegetables and fruits	0.007±0.063	-0.116; 0.129	0.917
	Heavy and sweet food	0.042±0.062	-0.080; 0.164	0.502
	Protein food	0.039±0.062	-0.082; 0.160	0.528
	Light food	-0.129±0.063	-0.253; -0.005	0.042
HDL-C, mmol/L	Vegetables and fruits	0.002±0.024	-0.044; 0.048	0.928
	Heavy and sweet food	-0.030±0.023	-0.076; 0.016	0.204
	Protein food	-0.037±0.023	-0.083; 0.008	0.108
	Light food	0.005±0.024	-0.042; 0.052	0.833
Tg, mmol/L	Vegetables and fruits	-0.008±0.054	-0.113; 0.098	0.886
	Heavy and sweet food	0.013±0.053	-0.092; 0.118	0.812
	Protein food	0.008±0.053	-0.096; 0.111	0.887
	Light food	-0.086±0.054	-0.192; 0.021	0.115

Estimates are adjusted by age and body mass index. The users of lipid-lowering medications were excluded.

TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; Tg, triglyceride.

Discussion

Our study has demonstrated that the diet of the Lithuanian rural population does not meet the WHO recommendations on healthy nutrition (14). The proportion of fat, especially SFA, in total energy intake was too high in both men and women, indicating a high consumption of fat products of animal origin. Considering the WHO recommendations, the share of fat and SFA in total energy intake should not exceed 30% and 10%, respectively (14). The content of cholesterol in the diet of Lithuanian men was higher than recommended. Although the intake of carbohydrates was below the recommended level, the proportion of monosaccharides and disaccharides was 1.6 times higher than recommended. The intake of dietary fiber was insufficient. Many studies have confirmed that unhealthy nutrition plays a major role in the development of chronic diseases (15, 16). The high consumption of saturated as well as

total fat and sugars and the lack of unsaturated fatty acids, complex carbohydrates, and dietary fiber lead to obesity, hypertension, dyslipidemias, and diabetes. It is well known that nutrient content of the diet depends on the consumed foods. Furthermore, dietary patterns might have a greater effect on health than individual foods (17). Identification of dietary patterns is very important for interventions aimed at promoting healthy nutrition.

Four factors, in other words dietary patterns, were determined by the factor analysis using the data collected by the food frequency questionnaire. The “vegetables and fruits” and “light food” factors might be assigned to healthy dietary patterns, while the “heavy food” and “snacks” factors in men and the “heavy food and sweets” factor in women might be considered as unhealthy dietary patterns. In our study, the associations between dietary patterns and lipids levels were more evident in men than women.

The “heavy food” factor (i.e., meat and its products, potatoes) was positively related to the Tg level in Lithuanian men. Other researchers also found that the Western dietary pattern characterized by high meat consumption was associated with the greater odds of having an elevated Tg level (18). Our data indicated that meat, milk, and their products were the main sources of energy, fat, SFA, cholesterol, and proteins. Frequent consumption of such foods may lead to obesity. Many studies have confirmed that obese people have a higher level of Tg compared with people having normal BMI (19, 20). Intake of dietary fat, especially saturated fat, is associated with the increased levels of TC and LDL-C, and risk of CVD (1, 21). In the Dutch population, a high intake of meat and potatoes was related to a higher TC level (22). On the contrary, the NHANES III study, in which a Western dietary pattern was characterized by a high intake of processed meat, eggs, red meat, and high-fat dairy products, did not find any association between this dietary pattern and serum TC level (23). Inconsistent results might be explained by a cross-sectional study design, which does not allow estimating the causal relationship between dietary patterns and dyslipidemias, and possible interactions between foods and food components.

According to our findings, the “vegetables and fruits” pattern was related to a lower TC level only in men. Evidence from a prospective cohort study indicated that a high consumption of plant-based foods, such as fruits and vegetables, nuts, and whole grains, was associated with a significantly lower risk of coronary artery disease and stroke (24). Anti-oxidant nutrients and other phytochemicals, which are in vegetables and fruits, can reduce the amount of free radicals that oxidize LDL and accelerate the atherosclerotic process (25). The results of the intervention study showed that an increase in the servings of fruits and vegetables in the diet was associated with a decrease in the oxidized LDL concentration (26).

In our study, the “light food” pattern, which included porridges and cereals rich in dietary fiber, was related to a lower level of LDL-C in both men and women. It is known that dietary fiber is effective not only in lowering the TC level, but also in lowering dietary density, on this way protecting against obesity and controlling body weight (27, 28). Fish was a component of the “light food” pattern in men.

References

- Kannel WB, D'Agostino RB, Sullivan L, Wilson PW. Concept and usefulness of cardiovascular risk profiles. *Am Heart J* 2004;148:16-26.
- Sharrett AR, Ballantyne CM, Coady SA, Heiss G, Sorlie PD, Catellier D, et al. Coronary heart disease prediction from

Habitual intake of fish is a negative predictor of serum TC because of a high content of omega-3 fatty acids (29).

The “snacks” factor (i.e., sweets and cheese) was positively associated with the low HDL-C level. The study carried out in the United States also showed a significant association between the consumption of sweets and HDL-C levels (30). The results of other cross-sectional study demonstrated that the consumption of added sugars was associated with the lower HDL-C level, higher Tg level, and higher ratios of Tg to HDL-C (31).

Several limitations of our study should be considered when interpreting the results. The validity of 24-hour recall used for the dietary survey may be affected by the memory and co-operation ability of respondents as well as by skills of interviewers. In order to increase the accuracy of the data, models and a food picture book were used to facilitate the estimation of portion sizes. The interviewers underwent a special training course.

The patterns of food consumption identified by the factor analysis depend on the limited number of food items included into the questionnaire. Because of this, dietary patterns can be expected to differ among populations. However, many studies revealed the similarities of food consumption patterns in various countries.

Conclusions

Our study indicated that the diet of the Lithuanian rural population did not meet the WHO recommendations on healthy nutrition, being high in fat, particularly saturated. The main sources of fat, saturated fatty acids, and cholesterol were meat, milk, and their products. Dietary patterns were related to serum lipids. Identified dietary patterns can be used for the promotion of healthy nutrition in order to decrease the prevalence of cardiovascular diseases.

Authors' Contributions

V.G., J.K., and J.P. have made substantial contributions to the conception and design of the manuscript. V.R. and V.K. have been involved in data collection and in drafting the manuscript. E.S. has carried out statistical analysis. All authors read and approved the final version of manuscript.

Statement of Conflict of Interest

The authors state no conflict of interest.

lipoprotein cholesterol levels, triglycerides, lipoprotein(a), apolipoproteins A-I and B, and HDL density subfractions: the Atherosclerosis Risk in Communities (ARIC) Study. *Circulation* 2001;104:1108-13.

- Schaefer EJ. Lipoproteins, nutrition, and heart disease. *Am J Clin Nutr* 2002;75:191-212.

4. Mente A, de Koning L, Shannon HS, Anand SS. A systematic review of the evidence supporting a causal link between dietary factors and coronary heart disease. *Arch Intern Med* 2009;169:659-69.
5. Valsta LM, Tapanainen H, Sundvall J, Laatikainen T, Mäntistö S, Pietinen P, et al. Explaining the 25-year decline of serum cholesterol by dietary changes and use of lipid-lowering medication in Finland. *Public Health Nutrit* 2010; 13:932-8.
6. Ernst ND, Sempos CT, Briefel RR, Clark MB. Consistency between US dietary fat and serum total cholesterol concentrations. *Am J Clin Nutr* 1997;66(suppl 4):965S-72S.
7. Kadziauskienė K, Bartkevičiūtė R, Olechnovič M, Visiekienė V, Abaravičius A, Stukas R, et al. Suaugusių Lietuvos žmonių gyvensenos ir faktiškos mitybos tyrimas 1997–1998. (Health behaviour and nutritional status of Lithuanian population: 1997–1998.) Vilnius: UAB Solidarity; 1999.
8. Barzda A, Bartkevičiūtė R, Abaravičius JA, Stukas R, Šatkutė R. Suaugusių Lietuvos žmonių faktinės mitybos tyrimas ir vertinimas. (Food consumption survey in adult Lithuanian population.) Medicinos teorija ir praktika 2009;15:53-8.
9. WHO Regional Office for Europe. Protocol and Guidelines. Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) Programme. Copenhagen; 1996.
10. Patiekalų sudėtis, maistinė ir energetinė vertė. (Content, nutrient and energy value of dishes.) Vilnius: Respublikinis mitybos centras; 2005.
11. Willett W. Nutritional epidemiology. New York: Oxford University Press; 1990.
12. Guidance document for the use of the Concise European Food Consumption Database in exposure assessment (EFSA/DATEX/2008/01). Parma, European Food Safety Authority; 2008. Available from: URL: <http://www.efsa.europa.eu/en/datex/docs/datexfooddbguidance.pdf>
13. Čekanavicius V, Muraukas G. Statistika ir jos taikymai. (Statistics and its application.) Pt. 2. Vilnius: TEV; 2004.
14. World Health Organization. Diet, nutrition and prevention of chronic Diseases. 2003. Report No. 916.
15. Bouillon K, Singh-Manoux A, Jokela M, Shipley MJ, Batty GD, Brunner EJ, et al. Decline in low-density lipoprotein cholesterol concentration: lipid-lowering drugs, diet, or physical activity? Evidence from the Whitehall II study. *Heart* 2011;97:923-30.
16. Choi BG, Vilahur G, Yadegar D, Viles-Gonzalez JF, Badimon JJ. The role of high-density lipoprotein cholesterol in the prevention and possible treatment of cardiovascular diseases. *Curr Mol Med* 2006;6:571-87.
17. Osler M, Heitmann BL, Gerdes LU, Jorgensen LM, Schroll M. Dietary patterns and mortality in Danish men and women: a prospective observational study. *Br J Nutr* 2001; 85:219-25.
18. Amini M, Esmailzadeh A, Shafaeizadeh S, Behrooz J, Zare M. Relationship between major dietary patterns and metabolic syndrome among individuals with impaired glucose tolerance. *Nutrition* 2010;26(10):986-92.
19. Paradis AM, Godin G, Pérusse L, Vohl MC. Associations between dietary patterns and obesity phenotypes. *Int J Obes (Lond)* 2009;33(12):1419-26.
20. Rezazadeh A, Rashidkhani B. The association of general and central obesity with major dietary patterns of adult women living in Tehran, Iran. *J Nutr Sci Vitaminol (Tokyo)* 2010;56(2):132-8.
21. Siri-Tarino PW, Sun Q, Hu FB, Krauss RM. Saturated fatty acids and risk of coronary heart disease: modulation by replacement nutrients. *Curr Atheroscler Rep* 2010;12:384-90.
22. van Dam RM, Grievink L, Ocké MC, Feskens EJ. Patterns of food consumption and risk factors for cardiovascular disease in the general Dutch population. *Am J Clin Nutr* 2003; 77:1156-63.
23. Kerver JM, Yang EJ, Bianchi L, Song WO. Dietary patterns associated with risk factors for cardiovascular disease in healthy US adults. *Am J Clin Nutr* 2003;78:1103-10.
24. Hu FB. Plant-based foods and prevention of cardiovascular disease: an overview. *Am J Clin Nutr* 2003;78(Suppl 3): 544S-51S.
25. Rimm EB, Stampfer MJ. Antioxidants for vascular disease. *Med Clin North Am* 2000;84:239-49.
26. Lapointe A, Goulet J, Couillard C, Lamarche B, Lemieux S. A nutritional intervention promoting the Mediterranean food pattern is associated with a decrease in circulating oxidized LDL particles in healthy women from the Québec City metropolitan area. *J Nutr* 2005;135(3):410-5.
27. Klingberg S, Ellegard L, Johansson I, Hallmans G, Weinell L, Andersson H, et al. Inverse relation between dietary intake of naturally occurring plant sterols and serum cholesterol in northern Sweden. *Am J Clin Nutr* 2008;87:993-1001.
28. Lairon D, Arnault N, Bertrais S, Planells R, Clero E, Hercberg S, et al. Dietary fiber intake and risk factors for cardiovascular disease in French adults. *Am J Clin Nutr* 2005;82:1185-94.
29. Panagiotakos DB, Zeimbekis A, Boutziouka V, Economou M, Kourlaba G, Toutouzas P, et al. Long-term fish intake is associated with better lipid profile, arterial blood pressure, and blood glucose levels in elderly people from Mediterranean islands (MEDIS epidemiological study). *Med Sci Monit* 2007;13:CR307-12.
30. López EP, Rice C, Weddle DO, Rahill GJ. The relationship among cardiovascular risk factors, diet patterns, alcohol consumption, and ethnicity among women aged 50 years and older. *J Am Diet Assoc* 2008;108(2):248-56.
31. Welsh JA, Sharma A, Abramson JL, Vaccarino V, Gillespie C, Vos MB. Caloric sweetener consumption and dyslipidemia among US adults. *JAMA* 2010;303:1490-7.

Received 23 March 2012, accepted 30 April 2012