

Prevalence of dyslipidemias among Lithuanian rural population (CINDI program)

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Summary. The aim of this study is to describe trends in serum total, low and high density lipoprotein cholesterol, triglycerides and nutrition habits in Lithuanian rural population between 1987 and 1999. The article presents the data of three screenings of random samples of the population aged 25–64 of five Lithuanian rural regions. Since 1987 the prevalence of hypercholesterolemia has decreased. The greatest decrease was observed in the proportion of persons with elevated level of low-density lipoprotein cholesterol. The prevalence of low level of high-density lipoprotein cholesterol decreased more significantly among women compared to men. The most remarkable changes in the prevalence of dyslipidemias were observed between 1993 and 1999. The increasing age was strongly correlated with higher prevalence of hypercholesterolemia in both genders. The prevalence of hypercholesterolemia was higher among men with higher education, overweight, hypertension and smokers than among those with low education, normal weight, normal level of blood pressure and nonsmokers. In women hypercholesterolemia was associated only with hypertension. The nutrition habits of Lithuanian rural population have changed, especially over the last five years. The consumption of animal fat has decreased and the usage of vegetable oil and margarine has increased. Women increased consumption of vegetables and fruits. The strengthening of favorable trends in nutrition habits in Lithuanian population should be one of the most important strategies in the implementation of cardiovascular disease prevention programs.

Introduction

Cardiovascular disease (CVD) is the most important cause of death in many countries of the world population (1). Epidemiological research has clearly demonstrated the relationship between dyslipidemias and CVD (2, 3). The plasma cholesterol (CHOL) was examined in Kaunas male population aged 45–59 as part of WHO coordinated Kaunas–Rotterdam Intervention Study (KRIS), the first international epidemiological project on coronary heart disease (CHD) in Lithuania (4). According to the longitudinal follow-up data the hypercholesterolemia was the most important risk factor of CHD for Kaunas males (5, 6). The CHD risk in males of the upper quartile of CHOL distribution was 5.7 times higher as compared to the first quartile (7). The follow-up of Kaunas population

cohort aged 35–64, which initially was examined within the WHO, coordinated MONICA project had demonstrated that hypercholesterolemia substantially contributed to the increase of CHD death risk in both genders (8). It is well established that measurement of total CHOL is helpful only in approximate assessment of CHD risk. The predictive power of CHD development substantially increases when low density lipoprotein cholesterol (LDLchol) and high density lipoprotein cholesterol (HDLchol) values are employed in the equation (2).

Lipid levels are closely related to nutritional habits. The intake of saturated and trans fatty acids, dietary cholesterol, fruit and vegetables consumption greatly influence low and high density lipoprotein cholesterol and subsequently the risk of CHD (9).

Changes in dietary habits in Western and Nordic European, USA, Canadian populations within past thirty years led to the decline in CHOL levels as well as decline in CHD mortality (10–12). These positive changes to a great extent occurred as a result of large preventive programs successfully implemented in these countries.

Since 1983 Lithuania is active participant of WHO coordinated Countrywide Integrated Noncommunicable Disease Intervention Program (CINDI) aimed at reducing morbidity and mortality caused by major noncommunicable diseases (13). The improvement of dietary habits of the entire population as part of risk lowering activities, and first of all lowering the prevalence of dyslipidemias, is one of major tasks of this program. The aim of this study is to assess the trends in serum CHOL, LDLchol and HDLchol in Lithuanian rural population aged 25–64 as well as some nutritional habits within the period 1987–1999.

Material and methods

The population under study was inhabitants of five rural administrative regions of Lithuania (Kaišiadorys, Kretinga, Kupiškis, Joniškis and Varėna). The stratified by age and gender random samples taken from patients lists at the centers of primary health care were invited for examination in 1987, 1993 and 1999. In each region 200 subjects (100 males and 100 females) in four age groups (25–34, 35–44, 45–54, 55–64) constituted independent samples for screening examinations. The lipid values were obtained in 2054 subjects in 1987, 1461 – in 1993 and 1758 – in 1999.

The cubital venous blood for biochemical lipid investigation was taken by vacutainers. The subjects were asked to abstain from food intake at least 12 hours. The coagulated blood after 20–30 min. was centrifuged at 1500 t/min during 20–30 minutes. Before biochemical analysis the serum was kept 3–4 days in special glasses at the temperature of 4–8°C. For more prolonged storage the samples were frozen up to –25°C.

The serum CHOL was analyzed by enzymatic (CHOD–PAP) method (14). Same method was used for analysis HDLchol by sedimenting very low and low density lipoproteins with the phosphowolfram acid and magnesium chloride mixture. The serum triglyceride (Tg) was analyzed by enzymatic (GOD–PAP) method (15). The LDLchol was calculated by the following formula: $LDLchol = CHOL - HDLchol - (Tg \times 0.45)$. The lipid analysis was done by the Laboratory of Clinical Biochemistry, Institute of Cardiology, Kaunas University of Medicine.

The following criteria were applied for classification of dyslipidemias: hypercholesterolemia – $CHOL \geq 5.0$ mmol/l; hyper LDLchol ≥ 3.0 mmol/l; hypo HDLchol ≤ 1.0 mmol/l; hyper Tg ≥ 2.0 mmol/l.

Nutritional habits were assessed using a standardized questionnaire that included questions about the frequency of consumption of certain foods within last year.

The differences between lipid means by age groups were assessed by ANOVA method. The direct standardization by age was employed when analyzing changes in the prevalence of dyslipidemias. The age structure of Lithuanian population aged 25–64 in 1987 was taken as a standard. The differences between prevalences of examined variables were assessed using *z* criterion. They were considered as significant when $p \leq 0.05$.

The relationship between the prevalence of hypercholesterolemia and age, education, marital status and other CHD risk factors was estimated by fitting logistic regression model. The data of all three screenings were analyzed altogether. Logistic regression models were fit separately to males and females. The odds ratios and 95% confidence interval were used presenting results of the analysis performed.

Results

The mean values of serum lipids in 1999 are presented in Table 1. The level of CHOL and Tg in females was increasing with age. The same values for males were increasing up to the age 35–44, however with no changes afterwards. With aging the level of LDLchol was increasing, while HDLchol – decreasing in both genders. The levels of CHOL and LDLchol in females under 45 were lower, while in older – higher than those in males. The level of HDLchol in females of all age groups was higher than in males.

The proportion of males and females with normal CHOL level has increased twice within the study period (Fig. 1). In 1999 36.6% of females and 38.3% of males had CHOL level less than 5.0 mmol/l. The proportion of people with considerably high level of CHOL (≥ 6.5 mmol/l) has declined by 11.5% in females and 15.3% in males. Most remarkable changes have occurred between the years 1983 and 1999.

The proportion of males who had high LDLchol level decreased from 88.4% in 1987 up to 56.6% in 1999, while in females – from 85.9% to 56.8% accordingly (Fig.2). The prevalence of hyper LDLchol in the youngest groups of males and females dropped down by twofold. Within the study period the proportion of subjects having low levels of HDLchol had

Table 1. Mean and standard deviation (SD) of lipid levels in Lithuanian rural population aged 25–64 in 1999

Age groups	Cholesterol mean (SD)	HDL cholesterol mean (SD)	LDL cholesterol mean (SD)	Triglycerides mean (SD)
Males				
25–34 years	5.12 (0.11)	1.47 (0.04)*	3.06 (0.11)*	1.40 (0.07)
35–44 – ” –	5.68 (0.10)	1.45 (0.04)	3.45 (0.09)	1.67 (0.08)
45–54 – ” –	5.66 (0.08)	1.42 (0.03)	3.44 (0.08)	1.69 (0.07)
55–64 – ” –	5.66 (0.08)	1.35 (0.03)	3.61 (0.08)	1.64 (0.06)
25–64 – “ –	5.60 (0.04)	1.41 (0.01)	3.44 (0.04)	1.62 (0.04)
Females				
25–34 years	5.00 (0.11)*	1.65 (0.04)*	2.90 (0.11)*	1.24 (0.06)*
35–44 – ” –	5.53 (0.08)	1.55 (0.03)	3.32 (0.08)	1.35 (0.04)
45–54 – ” –	5.81 (0.08)	1.51 (0.02)	3.56 (0.09)	1.59 (0.05)
55–64 – ” –	6.14 (0.08)	1.50 (0.02)	3.89 (0.07)	1.67 (0.04)
25–64 – ” –	5.70 (0.04)	1.53 (0.01)	3.52 (0.04)	1.51 (0.03)

HDL – high density lipoproteins.

LDL – low density lipoproteins.

* – p<0.05 assessing differences between age groups by ANOVA method.

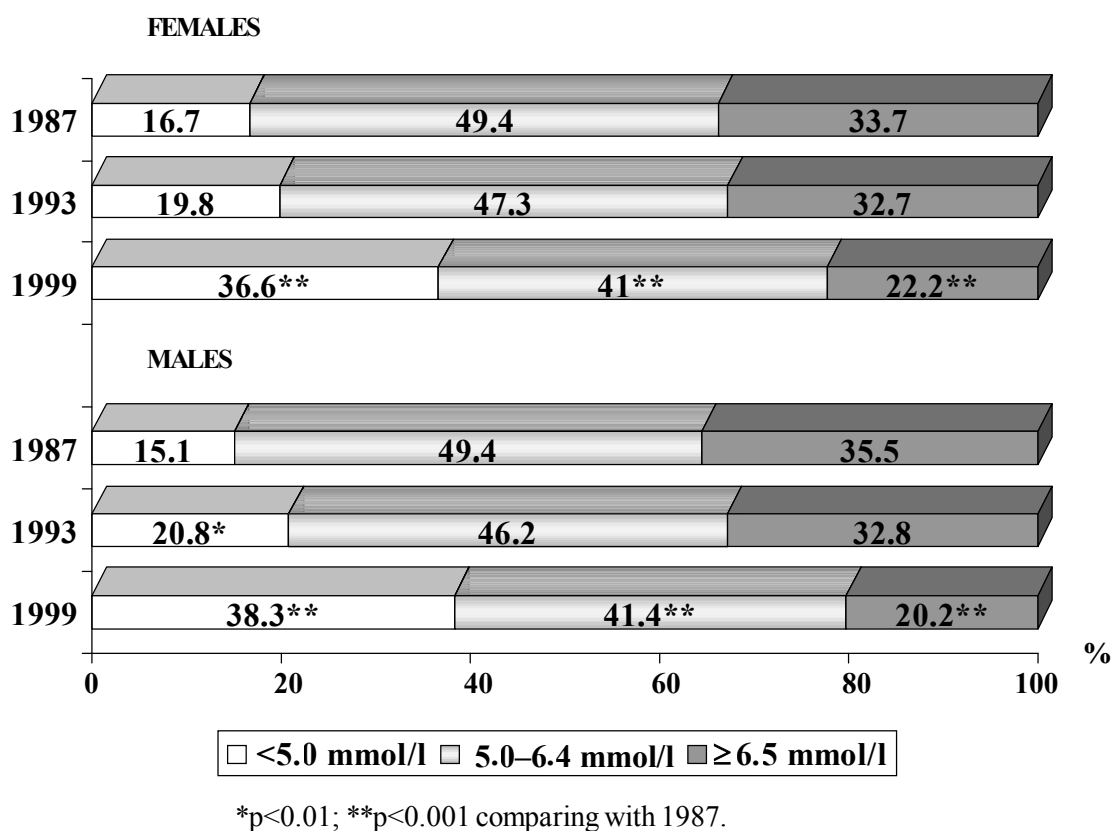


Fig. 1. Distribution of Lithuanian rural population according to serum cholesterol level in 1987, 1993 and 1999

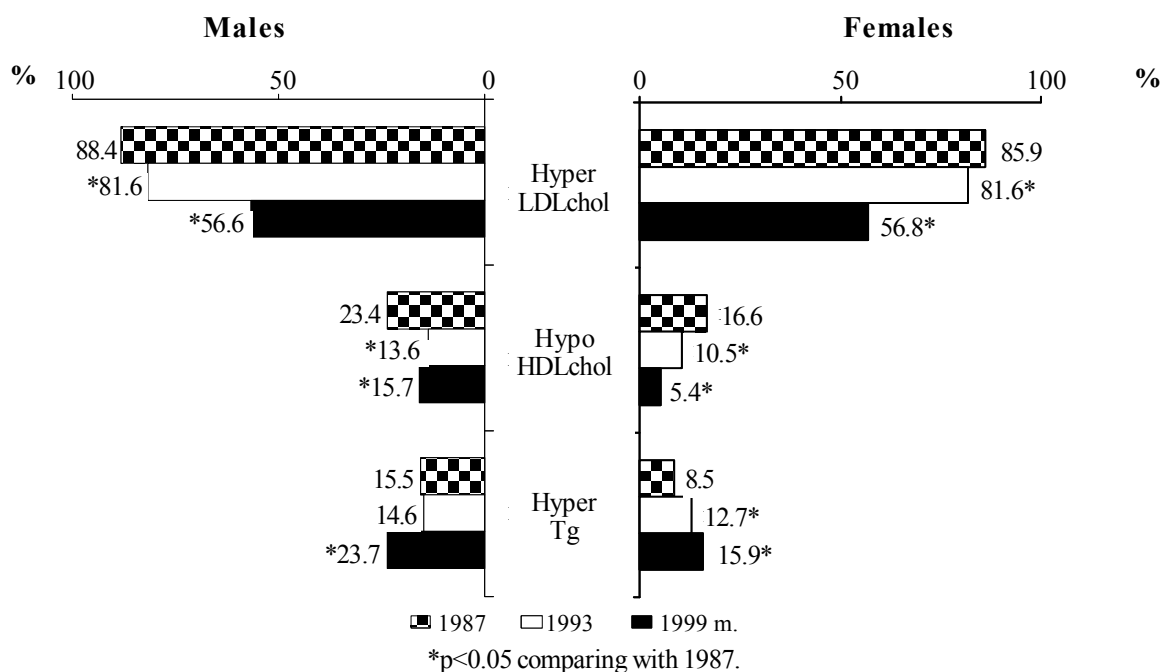


Fig. 2. Changes in the prevalence of dyslipidemias in Lithuanian rural population between 1987 and 1999

substantially decreased: 1.5 fold in males and 3 fold in females accordingly. At the same time the prevalence of hypo HDLchol in 1999 in males remained three-fold higher than in females – 15.7% and 5.4% accordingly. In 1999 the elevated level of Tg was found in 23.7% of males and 15.9% of females, i.e. hyper Tg prevalence was higher than in preceding years.

The prevalence of hypercholesterolemia was related to some social variables and other CVD risk factors (Table 2). The hypercholesterolemia increased with age. The educational level had no influence for the level of hypercholesterolemia in females while it was different in males: the prevalence of hypercholesterolemia in subjects of secondary and high education was higher than in those with low education. The odds of having hypercholesterolemia were higher in overweight males. Both, hypertensive males and females had higher prevalence of hypercholesterolemia than normotensive. It was also more prevalent among regular smoking males compared to non-smokers.

The analysis of nutritional habits in Lithuanian rural population demonstrated that more substantially they changed after 1993 reflecting significant decrease in consumption of animal fat and increase in fruit and vegetables (Table 3). The proportion of animal fat users in male population declined from 78.3% to 16.9%, and in female – from 69.1% to 7.5% ($p < 0.05$). In 1999 Lithuanian population was most frequently using vegetable oil for their food preparation (81.3% of males

and 91.0% females accordingly). In 1993 91.3% of males and 94.5% of females used the butter on bread, while in 1999 – by 46.8% of males and 42.5% of females. Although within the study period there were no changes in fresh vegetables consumption in males, the consumption in females increased from 69.1% to 80.1% ($p < 0.05$) in summer season with no changes in winter. At the last screening females indicated more frequent use of fresh fruits in both seasons.

Discussion

The repeated surveys of Lithuanian rural population in five selected regions demonstrated substantial changes in lipid profile. Within past twelve years the proportion of males and females with high levels of total CHOL and LDLchol as well as low level of HDLchol significantly decreased. At the same time, the proportion of those with high Tg level has increased. Similarly, significant changes in nutritional habits have been observed: the intake of animal fat decreased, while intake of vegetable oil increased. Female population shifted to more frequent consumption of fruits and vegetables. Most significant changes in lipid profile were observed between 1993 and 1999.

The decline of total CHOL within past decades has been observed in many populations of developed countries. The combined data from 21 countries (WHO coordinated MONICA project) demonstrated that between 1985 and 1995 the mean total CHOL level de-

Table 2. Odds ratios of hypercholesterolemia by social factors and other risk factors for noncommunicable diseases

Independent variables	Females	Males
	OR (95 % CI)	OR (95 % CI)
Year of examination		
1987 yr.	1.00	1.00
1993 yr.	0.70 (0.54–0.91)	0.62 (0.47–0.82)
1999 yr.	0.34 (0.27–0.43)	0.27 (0.21–0.35)
Age		
25–34 yr.	1.00	1.00
35–44 yr.	1.77 (1.35–2.32)	1.67 (1.21–2.31)
45–54 yr.	2.38 (1.77–3.19)	2.17 (1.55–3.04)
55–64 yr.	3.40 (2.40–4.80)	2.07 (1.46–2.94)
Education		
Incomplete secondary	1.00	1.00
Secondary	0.89 (0.68–1.17)	1.55 (1.19–2.02)
University	0.89 (0.64–1.25)	1.55 (1.09–2.21)
Marital status		
Married	1.00	1.00
Single	1.26 (0.81–1.96)	0.88 (0.58–1.33)
Divorced	1.21 (0.84–1.73)	0.73 (0.45–1.18)
Widow	1.00 (0.69–1.46)	0.54 (0.24–1.23)
Body mass		
Normal	1.00	1.00
Overweight (BMI \geq 25 kg/m ²)	1.11 (0.89–1.38)	1.63 (1.31–2.04)
Alcohol consumption		
Abstinent and moderate users	1.00	1.00
Heavy drinkers (males>56. females>28 drinks/month).	1.29 (0.48–3.32)	1.26 (0.91–1.76)
Blood pressure		
Normal	1.00	1.00
BP \geq 140/90 or on treatment	1.31 (1.06–1.61)	1.31 (1.05–1.63)
Smoking		
No smoking	1.00	1.00
Regular smoking	1.03 (0.72–1.49)	1.25 (1.001–1.55)

OR – odds ratio.

PI – confidence interval.

Drink – 10 g of ethanol.

Table 3. The prevalence of certain nutritional habits in Lithuanian rural population (%) in the years 1987, 1993 and 1999

Nutritional habits	Males			Females		
	1987	1993	1999	1987	1993	1999
Mostly vegetable oil used for cooking	13.0	10.6	81.3***	18.8	19.7	91.0***
Mostly animal fat used for cooking	70.6	78.3*	16.9***	56.5	69.1***	7.5***
Butter on bread	–	91.3	46.8***	–	94.5	42.5***
Margarine on bread	–	0.5	43.9***	–	1.1	45.3***
Fresh fruits daily in summer	–	69.8	56.6***	–	72.5	76.5*
Fresh fruits daily in winter	–	10.9	13.4	–	12.6	17.9**
Fresh vegetables daily in summer	–	65.6	62.9	–	69.1	80.1***
Fresh vegetables daily in winter	–	13.1	11.6	–	16.7	17.5

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ comparing with 1987.

clined by 0.008 mmol/l/year in males and 0.015 mmol/l/year in females (16). In Finland total CHOL level was declining since 1992 (10, 17). Within twenty year period total CHOL decreased by 0.9 mmol/l in Finnish middle aged males and by 1.2 mmol/l in females. The changes in CHOL were related to changes in dietary habits. The daily intake of saturated fatty acids and dietary CHOL decreased while intake of polyunsaturated fatty acids increased. The decrease of body mass in females was also an important determinant for decrease of CHOL level. The mean total CHOL level in middle-aged USA males and females declined by 0.2 mmol/l between 1976 and 1991 while HDLchol increased by 0.03 mmol/l (18). All these changes were explained by changes in intake of saturated, polyunsaturated fatty acids and dietary cholesterol. Between 1993 and 1997 the mean total CHOL level decreased by 4% in males and by 5% in females in the Netherlands. This decline could partially be explained by decrease in trans fatty acids, saturated fatty acids and cholesterol intake (19).

The nutritional habits in Lithuanian population were examined using the standardized food frequency questionnaire. Although the applied method lacks precision the regular use of same methodology allows evaluating the changes in nutritional habits in the population (20). The data of our study correspond to the ones collected in Lithuania since 1994 as part of FINBALT HEALTH MONITOR where similar changes in nutritional habits have been also demonstrated, i. e. decrease in consumption of animal fat, butter, whole milk and increase in intake of margarine and vegetable oil (21). As a consequence of these nutritional changes the decrease in daily intake of saturated fat and increase of polyunsaturated fatty acids is a logical re-

sult. It is well established that saturated fatty acids increase and polyunsaturated fatty acids decrease CHOL level (22). Furthermore, it was observed that prevalence of overweight in rural Lithuanian population declined by 5% in males and 11% in females (23). It is known from the literature that decline of total CHOL and LDLchol as well as increase of HDLchol is related to the decrease in body mass (24, 25).

It is also known from the epidemiological studies that decrease plasma total CHOL reduction of 1% results in a decrease of CHD mortality of 2% (26). The CHD mortality in Eastern Finland has declined by 75% within last quarter of the century. Finnish research community these positive trends are explaining by decline in smoking, hypercholesterolemia and hypertension in the entire population, emphasizing the impact of CHOL decline, which explains at least 50% of CHD mortality changes (17). Epidemiological research carried out in Lithuania demonstrates substantial decline of total and CHD mortality in both genders (age range 25–64) since 1995 (23). Among other factors the decrease of CHOL might also have a potential impact for the observed mortality trends.

Although frequency of dyslipidemias in Lithuanian rural population is declining, the mean total CHOL level remains too high. The disturbing fact is that hypercholesterolemia is found in combination with other risk factors for noncommunicable diseases. The hypercholesterolemia is more prevalent in overweight and regularly smoking males, in hypertensive males and females. This means that implementing noncommunicable disease preventive programs multifactorial intervention strategies should integrate advocacy of healthy nutrition together with control of other risk factors.

Conclusions

1. Substantial changes in the prevalence of dyslipidemias in Lithuanian rural population have been observed within the period of 1987–1999. The proportion of subjects with high levels of total CHOL, LDLchol as well as low level of HDLchol significantly declined. Prevalence of hypertriglyceridemia increased. Most significant changes in lipid profile have been observed between 1993 and 1999.

2. Levels of HDLchol were significantly higher in females as compared to males. The levels of total CHOL and LDLchol were lower in females than in males under age of 45 while in older groups – just an opposite.

3. Prevalence of hypercholesterolemia increased with age. This risk factor was more frequently found in males with higher educational level, with overweight and in regular smokers as well as in subjects of both genders who were hypertensive.

4. Nutritional habits of Lithuanian rural population most significantly changed within past five years: the consumption of animal fat decreased in both genders, the intake of fruits and vegetables increased only in females.

In implementing cardiovascular disease prevention programs and aiming at reducing the prevalence of dyslipidemias it is necessary to stimulate positive changes in nutritional habits of Lithuanian population.

Lipidų apykaitos sutrikimai tarp Lietuvos kaimiškųjų rajonų gyventojų (CINDI programa)

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Raktažodžiai: bendrasis cholesterolis, didelio ir mažo tankio lipoproteinų cholesterolis, trigliceridai, mitybos įpročiai, pokyčiai.

Santrauka. Straipsnyje pateikiami penkių Lietuvos rajonų atsitiktinai atrinktų 25–64 metų gyventojų sveikatos patikrinimų, atliktų 1987, 1993 ir 1999 metais, rezultatai. Šio darbo tikslas – nustatyti bendrojo cholesterolio, mažo ir didelio tankio lipoproteinų cholesterolio bei trigliceridų koncentracijų ir mitybos įpročių pokyčius. Per analizuojamą laikotarpį lipidų apykaitos sutrikimų dažnis tarp Lietuvos rajonų gyventojų sumažėjo. Labiausiai sumažėjo dalis žmonių, turinčių padidėjusią mažo tankio lipoproteinų koncentraciją. Per mažos didelio tankio lipoproteinų koncentracijos dažnis tarp moterų sumažėjo labiau negu tarp vyrų. Didžiausi lipidų apykaitos sutrikimų paplitimo pokyčiai užfiksuoti 1993 ir 1999 metais. Hipercholesterolemijos paplitimas didėjo su amžiumi. Šis rizikos veiksnys dažniau nustatytas aukštesnio išsimokslinimo, turintiems antsvorį ir rūkantiems vyrams, taip pat vyrams ir moterims, kurių arterinis kraujospūdis buvo padidėjęs. Nustatyta, kad Lietuvos gyventojų mityba labiausiai pakito per paskutinius penkerius metus: sumažėjo gyvulinių riebalų ir padidėjo augalinių riebalų vartojimas, moterys pradėjo valgyti daugiau daržovių ir vaisių. Vykdamt širdies ir kraujagyslių ligų profilaktiką ir mažinant lipidų apykaitos sutrikimų paplitimą tarp Lietuvos gyventojų, būtina skatinti teigiamus Lietuvos gyventojų mitybos pokyčius.

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