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ORIGINAL ARTICLE

# Health, Alcohol and Psychosocial factors In Eastern Europe study: dietary patterns and their association with socio-demographic factors in the Lithuanian urban population of Kaunas city

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**Abstract**
*Objectives* The purpose of this study was to identify the main dietary patterns in the Lithuanian urban population and to determine their association with socio-demographic factors.
*Methods* Data from the survey performed in the framework of the HAPIEE (Health, Alcohol, Psychosocial factors In Eastern Europe) study were presented. A random sample of 7,087 individuals aged 45–72 years was screened in 2006–2008.
*Results* Factor analysis of the main dietary patterns revealed a five-factor solution, which accounted for 47.8% of the variance: "fresh vegetables and fruit"; "sweets"; "porridge and cereals"; "potatoes, meat, boiled vegetables and eggs"; "chicken and fish". "Fresh vegetables and fruits" factor and "sweets" factor were inversely associated with age both in men and women: older people consumed less frequent than average of the particular food groups. Dietary patterns of people with good self-rated health and university education were healthier than among people with lower education and poorer health.
*Conclusion* Nutrition education efforts should focus on improving food diversity, with particular targeting of lower educated, single and older people.

**Keywords** Dietary patterns · Socio-demographic factors · Education · Self-rated health

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## Introduction

Research studies have revealed that there is a consistent relationship between unhealthy diet and the emergence of a range of chronic non-infectious diseases, including coronary heart disease, cerebrovascular disease, various cancers and diabetes mellitus (Kant 2004; Heidemann et al. 2008; Brunner et al. 2008; Panagiotakos et al. 2009; Nettleton et al. 2009; Isharwal et al. 2009). Traditionally nutritional research in Lithuania, as in other countries, has focused primarily on single nutrients or single food item, and different dietary components have been suggested as important modifiable risk factors for chronic disease (Pomerleau et al. 2001a, b; Luksiene et al. 2002; Vaicaitiene et al. 2003; Grabauskas et al. 2004). In the past decade, nutrition epidemiology has experienced a shift in focus from investigations at the level of individual nutrients to investigation at the level of foods and dietary patterns (Hu 2002; Kant 2004; Nettleton et al. 2008). Interest is growing in dietary patterns that consider the complexity of the overall diet, because they might have a greater effect on health than a single food item. Also, identification of dietary patterns is very important for interventions aimed at promoting healthy nutrition.

Factor analysis may be considered a pattern detection method that reduces the number of dietary variables by finding factors that are composed of correlated dietary variables (Kant 2004). Using a semi-quantitative food frequency questionnaire, it is important to reduce a data set to a more manageable size while retaining as much of the original information as possible. Multicollinearity can be a problem in multiple regression, and factor analysis can be used to solve this problem by combining variables that are collinear. Principal component analysis and principal factor analysis are the preferred methods and usually result in

similar solutions. When these methods are used, conclusions are restricted to the sample collected and generalization of the results can be achieved only if analysis using different samples reveals the same factor structure (Field 2005). Only factor analysis can estimate the underlying factors and it relies on various assumptions for these estimates to be accurate. Principal component analysis is concerned only with establishing which linear components exist within the data and how a particular variable might contribute to that component.

Not only unhealthy diet, but also socio-demographic factors and socioeconomic situation of individuals have an influence on the non-communicable disease risk estimation (Barcelo et al. 2009). A systematic review of the literature on dietary patterns in relation to lifestyle and demographic factors shows the strong association of age, income and education level with the dietary patterns (Kant 2004; Akbaraly and Brunner 2008; Riediger and Moghadasian 2008).

The purpose of this study was to identify the main dietary patterns in the Lithuanian urban population and to determine their association with socio-demographic factors.

## Methods

Data from the survey performed in the framework of the international HAPIEE study are presented. A random sample of Kaunas men and women aged 45–72 years, stratified by gender and age were randomly selected from the Lithuanian population register. A total of 7,087 individuals (3,218 men and 3,869 women) were screened in 2006–2008. The response rate was 64.8%. Data from 7,057 subjects (3,202 men and 3,855 women) were approved for statistical analysis. The study was approved by the ethics committee at the University College London, UK and by the regional ethics committee at Kaunas University of Medicine (Lithuania).

Education was measured by six education levels: primary, incomplete secondary, secondary, vocational, college and university. The responders with primary, incomplete secondary, secondary and vocational education were considered as having secondary and lower education.

Marital status was dichotomized as married (married, cohabiting) and single (single, divorced, separated, widowed). The responders were categorized into three groups according to their self-related health: very good and good; average; poor and very poor.

Nutrition habits were evaluated using food frequency questionnaire. Twenty food groups were included into the food frequency questionnaire: potatoes, porridges and cereals, cheese, curd cheese, chicken, fish, meat, sausage, eggs, fresh carrots (in summer and autumn; in winter and spring), other fresh vegetables (in summer and autumn; in winter and spring), boiled vegetables, fresh fruit (in summer and autumn; in winter and spring), natural juice (in summer and autumn; in winter and spring), candies, chocolate and cakes. Possible responses for all food groups were: 1, rarely or never; 2, 2–3 times a month; 3, 2–3 times a week; 4, once a week; 5, 4–6 times a week; 6, daily. Higher values denoted more frequent use of the current food. Mean values of use of fresh carrots, other fresh vegetables, fresh fruit and natural juice in summer and autumn and in winter and spring were calculated and 16 food groups in the final analysis were included.

*Statistical analysis* Proportions were compared using $z$ tests. The difference was considered to be statistically significant when $p < 0.05$.

Factor analysis was employed to reduce the number of food items. Exploratory factor analysis with orthogonal varimax rotation was conducted to explore the factor structure of food intake data. Eigenvalues and directions of factor loadings explaining variance were analyzed. The Kaiser–Meyer–Olkin (KMO) test was used to measure sample adequacy. The Kaiser rule (eigenvalue greater than one) was used to determine the number of factors to be indicated (Fabrigar et al. 1999). We used the varimax method to obtain orthogonal factors. A five-factor solution was indicated using this method. Using varimax rotation method, each factor tends to have either large or small loadings of any particular variable. A varimax solution yields results, which make it as easy as possible to identify each variable with a single factor (Fabrigar et al. 1999). Direct oblimin rotation is a non-orthogonal solution method, in which factors are allowed to be correlated. This can result in higher eigenvalues, but diminished interpretability of the factors (Fabrigar et al. 1999). In our case, the purpose of the factor analysis was to explore the factor structure of the nutrition habits without any prior suggestion on the number of factors or whether they are correlated. To ensure no meaningful solution was overlooked, four-, five- and six-factor solutions were also rotated using the orthogonal varimax method and examined. The five-factor solution, which accounted 47.8% of the total variance, had a good structure and, compared to the other solutions, could be most meaningfully interpreted. Factor scores were calculated using regression method: factor loadings were adjusted to take account of the initial correlations between foods.

Logistic regression analysis was performed to identify the effect of socio-demographic variables and self-rated health on the explored food factors' scores. The Hosmer–Lemeshow goodness of fit test was conducted for all models analyzed with logistic regression (Hosmer and Lemeshow 1989). A dichotomous dependent variable was

constructed by dividing food factors' scores into two groups of negative and positive values (0, negative; 1, positive values). Positive values of each factor scores indicated more frequent than average consumption of a particular food group. Independent variables in the logistic regression models were categorical variables: marital status, education, self-rated health and continuous variable age. The first category of the each variable was set as the reference category. Models were fitted for each of the five explored food intake factors separately in men and women. Statistical package SPSS version 11.5 was used.

## Results

Table 1 presents characteristics of the study population. Women were higher educated than men, whereas the proportion of living with partner was higher among men than among women ($p < 0.001$). Average, poor and very poor self-rated health was more prevalent in women as compared to men ($p < 0.001$).

The KMO resulted in a measure of sampling adequacy of 0.68 and indicated the moderate appropriateness to proceed with factor analysis ($p < 0.001$). A five-factor solution, which accounted for 47.8% of the total variance, was indicated (Table 2).

**Table 1** Characteristics of the HAPIEE study on the middle and older age Lithuanian population of Kaunas City screened in 2006–2008

| Characteristics | Men $N = 3,202$ (%) | Women $N = 3,855$ (%) |
|---|---|---|
| Age groups (years) | | |
| 45–54 | 24.2 | 26.0 |
| 55–64 | 39.8 | 39.6 |
| ≥65 | 36.0 | 34.4 |
| Level of education[a] | | |
| Secondary and lower[b] | 47.0 | 37.6* |
| College | 19.2 | 28.3* |
| University | 33.8 | 34.1 |
| Marital status[a] | | |
| Married/cohabiting | 85.4 | 59.8* |
| Single/divorced/ separated/widowed | 14.6 | 40.2* |
| Self-rated health[a] | | |
| Very good and good | 35.9 | 23.9* |
| Average | 53.4 | 60.2* |
| Poor and very poor | 10.7 | 15.9* |

*HAPIEE* Health, Alcohol and Psychosocial factors In Eastern Europe, *N* number of cases

* $p < 0.001$ as compared to men (proportions were compared using *z* tests)

[a] Data adjusted for age

[b] Secondary, vocational, primary, incomplete secondary education

**Table 2** Food intake factor structure and percentage of variance explained by the HAPIEE study in the middle and older age Lithuanian population of Kaunas City screened in 2006–2008

| Factor | Description | Percentage of the variance explained |
|---|---|---|
| 1st | Fresh vegetables, fruits, natural juice, cheese | 11.4 |
| 2nd | Sweet pastries (cookies, cakes), sweets (candies, chocolates) | 10.1 |
| 3rd | Porridge, cereals, curd cheese | 10.1 |
| 4th | Potatoes, meat and meat products, boiled vegetables, eggs | 8.9 |
| 5th | Chicken, fish | 7.3 |
| All factors | | 47.8 |

*HAPIEE* Health, Alcohol and Psychosocial factors In Eastern Europe

The first factor explained 11.4% of the variance and included fresh fruit and vegetables and natural juice. Also, cheese was attributed to the first factor. The second factor explained 10.1% of the variance and was defined by sweets and sweet pastries. The third factor explained 10.1% of the variance and encompassed porridge, cereals and curd cheese. The fourth factor comprised potatoes, meat and meat products, boiled vegetables and eggs with 8.9% of the variance. The fifth factor explained 7.3% of the variance and encompassed chicken and fish. Table 3 presents the food factor loadings. For the simplicity of data interpretation, only factors' loadings ≥0.4 are presented in the table with the exception for the variable "cheese". For this variable, the highest factor loading of 0.34 was indicated in the first factor "fresh vegetables and fruit". Consumption of meat and meat products was conversely correlated with the consumption of porridge, cereals and curd cheese.

Logistic regression analysis revealed that dietary patterns were differently associated with age, level of education, marital status and self-rated health. The first "fresh vegetables and fruits" factor and the second "sweets" factor were inversely associated with age both in men and women: older people's consumption of particular food groups was less frequent than average (Tables 4, 5). Conversely, the third factor "porridge, cereals" was directly associated with age: older men and women favored the "porridge, cereals and curd cheese" diet. The fourth factor "potatoes, meat, boiled vegetables, eggs" was associated with age only in the women group. The level of education and marital status had a significant effect on dietary patterns. Men and women with university education were more likely to follow the "fresh vegetables and fruits" and "porridge, cereals and curd cheese" patterns and less likely "potatoes, meat, boiled vegetables and

**Table 3** Factors and factor loadings for the dietary variables of the HAPIEE study in the middle and older age Lithuanian population of Kaunas City screened in 2006–2008

| Type of food | Factor 1 Fresh vegetables, fruit | Factor 2 Sweets | Factor 3 Cereals, curd cheese | Factor 4 Potatoes, meat, eggs | Factor 5 Chicken, fish |
|---|---|---|---|---|---|
| Fresh carrots | 0.48 | | | | |
| Other fresh vegetables | 0.73 | | | | |
| Fresh fruit | 0.68 | | | | |
| Natural juice | 0.50 | | | | |
| Cheese | 0.34 | | | | |
| Sweets | | 0.85 | | | |
| Sweet pastries | | 0.85 | | | |
| Cereals, porridge | | | 0.68 | | |
| Curd cheese | | | 0.44 | | |
| Potatoes | | | | 0.73 | |
| Meat | | | −0.48[a] | 0.45 | |
| Meat products (sausage) | | | −0.53[a] | 0.43 | |
| Boiled vegetables | | | | 0.51 | |
| Eggs | | | | 0.47 | |
| Chicken | | | | | 0.79 |
| Fish | | | | | 0.56 |

Factor loadings of <0.4 were excluded from the table for simplicity (with the exception of cheese; the highest value of 0.34 was indicated in the first factor)

*HAPIEE* Health, Alcohol and Psychosocial factors In Eastern Europe

[a] Negative values of factor loadings indicate low consumption of meat and meat products

**Table 4** Adjusted odds ratios for the likelihood of positive values of food factors in men in relation to age, education level, marital status and self-rated health (the HAPIEE study, middle and older age Lithuanian population of Kaunas City, 2006–2008)

| Variables | Fresh vegetables, fruits | | Sweets | | Porridge, cereals, curd cheese | | Potatoes, meat, boiled vegetables, eggs | | Chicken, fish | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Age (years) | 0.98 | 0.97–0.99* | 0.97 | 0.96–0.98* | 1.06 | 1.05–1.07* | 1.01 | 0.99–1.02 | 0.99 | 0.99–1.01 |
| Level of education | | | | | | | | | | |
| Secondary[a] | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| College | 1.20 | 0.99–1.46 | 1.13 | 0.93–1.37 | 1.20 | 0.98–1.47 | 0.78 | 0.64–0.96* | 0.89 | 0.73–1.08 |
| University | 1.51 | 1.29–1.77* | 1.14 | 0.97–1.33 | 1.33 | 1.13–1.57* | 0.74 | 0.63–0.87* | 0.79 | 0.68–0.93* |
| Marital status | | | | | | | | | | |
| Married | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| Single[b] | 0.58 | 0.47–0.71* | 0.87 | 0.71–1.06 | 0.87 | 0.71–1.08 | 0.64 | 0.52–0.78* | 0.99 | 0.82–1.21 |
| Self-rated health | | | | | | | | | | |
| Good[c] | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| Average | 0.89 | 0.76–1.04 | 0.85 | 0.73–0.99* | 0.97 | 0.82–1.15 | 0.87 | 0.74–1.03 | 0.97 | 0.83–1.13 |
| Poor[d] | 0.62 | 0.48–0.79* | 0.73 | 0.57–0.93* | 1.38 | 1.07–1.77* | 0.89 | 0.69–1.14 | 1.25 | 0.98–1.61 |

Odds ratios are adjusted for all variables included in the logistic regression analysis

*OR* odds ratio, *CI* confidence interval, *HAPIEE* Health, Alcohol and Psychosocial factors In Eastern Europe

* $p < 0.05$

[a] Secondary, vocational, primary, incomplete secondary

[b] Single, divorced, separated, widowed

[c] Very good and good

[d] Very poor and poor

eggs" pattern than people with secondary education. Only women with university education were more likely to follow the "sweets" pattern than women with secondary education. Married men and women were more likely to follow "fresh vegetables and fruits" and "potatoes, meat, boiled vegetables and eggs" patterns than single people;

**Table 5** Adjusted odds ratios for the likelihood of positive values of food factors in women in relation to age, education level, marital status and self-rated health (the HAPIEE study, middle and older age Lithuanian population of Kaunas City, 2006–2008)

| Variables | Fresh vegetables, fruits | | Sweets | | Porridge, cereals, curd cheese | | Potatoes, meat, boiled vegetables, eggs | | Chicken, fish | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Age (years) | 0.97 | 0.96–0.98* | 0.98 | 0.97–0.98* | 1.05 | 1.04–1.06* | 1.01 | 1.00–1.02* | 1.01 | 0.99–1.02 |
| Level of education | | | | | | | | | | |
| Secondary[a] | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| College | 1.37 | 1.16–1.61* | 1.00 | 0.85–1.18 | 1.16 | 0.99–1.37 | 0.87 | 0.74–1.03 | 1.01 | 0.86–1.18 |
| University | 1.72 | 1.46–2.02* | 1.28 | 1.09–1.49* | 1.42 | 1.20–1.67* | 0.69 | 0.59–0.81* | 0.88 | 0.76–1.03 |
| Marital status | | | | | | | | | | |
| Married | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| Single[b] | 0.58 | 0.51–0.66* | 1.03 | 0.91–1.18 | 1.02 | 0.89–1.17 | 0.64 | 0.56–0.73* | 0.86 | 0.76–0.98* |
| Self-rated health | | | | | | | | | | |
| Good[c] | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| Average | 0.70 | 0.58–0.83* | 0.88 | 0.74–1.04 | 1.09 | 0.92–1.29 | 1.09 | 0.92–1.28 | 1.08 | 0.92–1.27 |
| Poor[d] | 0.55 | 0.44–0.70* | 0.79 | 0.64–0.98* | 1.16 | 0.93–1.45 | 0.95 | 0.77–1.18 | 1.07 | 0.86–1.32 |

Odds ratios are adjusted for all variables included in the logistic regression analysis

*OR* odds ratio, *CI* confidence interval, *HAPIEE* Health, Alcohol and Psychosocial factors In Eastern Europe

* $p < 0.05$

[a] Secondary, vocational, primary, incomplete secondary

[b] Single, divorced, separated, widowed

[c] Very good and good

[d] Very poor and poor

also married women favored the "chicken and fish" diet than single women. Self-rated health was differently associated with dietary patterns: men and women with poor health were less likely to follow the "frequent fresh vegetables and fruits" and "sweets" patterns than people with good health; men with poor health favored the "porridge, cereals, curd cheese" diet than men with good health.

## Discussion

The majority of previous studies followed the approach of assessing single nutrients or food items instead of assessing dietary patterns. It is accepted that people do not eat isolated nutrients, but consume meals consisting of a variety of foods with complex combinations of micro and macro nutrients. Recently, interest is growing in dietary patterns that consider the complexity of the overall diet. In the present study, factor analysis was used to identify dietary patterns of the Lithuanian urban population aged 45–72 years. Factor analysis defined five major factors. Three factors ("fresh vegetables, fruits", "porridge, cereals" and "chicken, fish") might be assigned to healthy patterns, and the other two factors ("sweets" and "potatoes, meat, boiled vegetables, eggs") might be assigned to unhealthy patterns, because, as shown in previous studies, they might increase the risk of noncommunicable diseases (Kant 2004; Heidemann et al. 2008; Panagiotakos et al. 2009). Plant-based dietary patterns that are rich in fruits, vegetables, whole grains and cereals, but low in meat and refined grains, appear to be useful in preventing coronary heart disease and stroke (Kant 2004; Schulze and Hoffmann 2006). The identified dietary patterns are partly similar to those found in a previous study, which was carried out in Lithuania within the Finbalth Health Monitor Project in 1998–2004 years (Kriaucioniene et al. 2008). The previous study identified only four main dietary factors: "light food", "sweets", "heavy food" and "cereals". One of the reasons for the inadequacy is that dietary patterns defined in the previous study represented the nutrition habits of urban and rural population aged 20–64 years, while the dietary patterns defined in the present study represent the nutrition habits of the urban population aged 45–72 years. So in the previous study, responders were younger and some of them lived in the rural areas, compared to responders from our study. It is important that the dietary patterns of the Lithuanian population are associated with the place of residence: men and women living in the rural areas favored less healthy diet than people living in urban areas (Kriaucioniene et al. 2008). Regardless of these differences, some factors such as "sweets" and "cereals" in the previous study were similar to factors defined in our

study. Hu in his review paper underlines that it is not clear whether different sources of dietary data would produce the same clusters or the same components in a given population, and whether there is reproducibility and stability of the derived clusters over time (Hu 2002). In our study, the identified first "fresh vegetables, fruits" factor was to some extent similar to that found in the Nurses Health Study and was labeled the "Prudent" pattern, which was characterized by a high intake of fruits and vegetables (Fung et al. 2005; Heidemann et al. 2008). The second dietary pattern with a high intake of meat and named "Western" in the Nurses Health Study was similar to the fourth factor "potatoes, meat, boiled vegetables, eggs" identified in our study. On the other hand, some differences between the studies and countries are evident. For example, the results of nationally representative surveys undertaken in ten European countries show that the differences in the fruit and vegetable consumption previously identified between Mediterranean and northern European countries seem to be levelling out, particularly in relation to fruit consumption. Straying from their traditional food choices, Mediterranean's recorded high availability of unprocessed red meat, while central and northern Europeans preferably consumed meat products (Naska et al. 2006). The results from our study detected that consumption of porridge, cereals and curd cheese was conversely correlated with the consumption of meat and meat products (the third factor "porridge, cereals").

Our study shows that dietary patterns were differently related to socio-demographic factors. The first "fresh vegetables, fruits" factor and the second "sweets" factor were inversely associated with age: older people consumed less frequently than average of particular food groups. Conversely, the third factor "porridge, cereals" was directly associated with age: older people favored this diet. These findings are similar to previous reports in research literature that middle-aged and older people prefer high-fiber diet, while younger people do not (Pomerleau et al. 2001b; Park et al. 2005; Kriaucioniene et al. 2008). Many studies reported that higher education level was a general predictor of better dietary patterns (Kant 2004; Naska et al. 2006). The results of our study corroborated these findings that irrespective of age, people with a higher level of education followed healthier dietary patterns compared to people with a lower education level: men and women with university education were more likely to follow the "fresh vegetables, fruits" and "porridge, cereals" patterns and less likely "potatoes, meat, boiled vegetables, eggs" pattern than people with secondary education. Only women with university education were more likely to follow the "sweets" pattern than women with secondary education. Some studies determined that educational status was a strong predictor of self-rated health (Bobak et al. 2000; Kelleher et al. 2003). Results from a prospective observational study in Denmark showed that poor self-rated health and a low prudent food score were associated with increased mortality in men and women aged 30–70 years (Osler et al. 2001). Our findings indicated that men and women with poor self-rated health were less likely to follow the "fresh vegetables, fruits" and "sweets" patterns than people with good health; on the contrary, men with poor health favored the "porridge, cereals, curd cheese" diet than men with good health. Some investigators have shown that poor self-rated health was related to a low score on the prudent food intake pattern (prudent food was characterized by a frequent intake of whole meal bread, fruits and vegetables) (Osler et al. 2001). Recent data demonstrated that marital status has been recognized as a significant health-influencing factor and being single may have implications for health behaviors (Yannakoulia et al. 2008; Elfhag and Rasmussen 2008). The findings of the other surveys on the association between marital status and dietary patterns are inconsistent: some investigators have shown that dietary patterns of married people are healthier (Fraser et al. 2000; Riediger and Moghadasian 2008); other investigators have shown that dietary patterns were associated with marital status in men and women differently (Kriaucioniene et al. 2008). Our findings indicated that married men and women were more likely to follow "fresh vegetables, fruits" and "potatoes, meat, boiled vegetables, eggs" patterns than single people; also married women favored the "chicken, fish" diet than single women. On the one part, the dietary patterns of married men and women were healthier because they more frequently consumed fresh vegetables and fruits, but on the other hand they more often preferred to eat frequent potatoes, meat and eggs compared to single people. The results from the ATTICA study showed that marital status was a significant predictive factor of fruits and vegetables consumption: being married was significantly associated with the adoption of this healthy eating behavior and single/never married or divorced/separated individuals were less likely to be high fruit and vegetable consumers (Yannakoulia et al. 2008). Socio-demographic differences in dietary patterns might suggest the same explanations. People with a higher level of education are more concerned about their health; they are more knowledgeable about healthy nutrition and also able to buy healthier, ecological food, the price of which is higher compared to common food. Whereas lower educated as well as older people restrict themselves to a healthy diet, one of the main reasons being lack of money, because price is an important factor influencing food choice in the Lithuanian population (Kadziauskiene et al. 1999). The recent data from TRUEFOOD pan-European consumer survey also show the importance of price, which was significantly related to general attitude and traditional food consumption (Pieniak et al. 2009). Nutrition and health claims may influence

consumer preference and facilitate well-informed food choices. When applied correctly, these have the potential to enhance consumer's nutritional knowledge and healthy eating patterns as well as to improve public health in general (Leathwood et al. 2007). Several misunderstood dietary concepts (myths) about salt, meat, fat and alcohol are still prevalent in Baltic countries, but people with a higher education level are more likely to be familiar with these issues (Pomerleau et al. 2001a). Food choices are based on a complex interaction among the social and environmental context, the individual and the food (Locher et al. 2009). Thus, efforts to change eating behaviors, especially community-based interventions involving self-management approaches, must carefully take into account individual's self-perceived motivations and barriers to food selection.

Finally, we conclude that dietary patterns of people with university education, good self-rated health and living with partner are healthier than among single people with lower education and poorer self-rated health. The results of investigation of dietary patterns and their relations to socio-demographic factors in the Lithuanian urban population will be useful for planning preventive programs of non-communicable diseases. Nutrition education efforts should focus on improving food diversity, with particular targeting of lower educated, single and older people.

There are some limitations to our study. In this study, only perceived health status in relation to nutrition patterns was analyzed. Objective risk factors such as blood lipids and glucose, blood pressure, overweight and obesity, verified chronic health conditions and their association with nutrition patterns will be discussed in further studies.

The method of factor analysis for identification of dietary patterns presents some limitations. The results depend on the food items included, the number of factors extracted and the method of rotation used. The dietary pattern analysis by Hu (2002) showed that it was not clear whether different sources of dietary data would produced the same clusters or the same components in a given population, and whether there was reproducibility and stability of the derived clusters over time. The number of food items included in this factor analysis was relatively low (20 variables), and also we used a food frequency questionnaire with a semi-quantitative scale. The limitation of the categorical food frequency scale is that the answers may be more affected by subjective evaluation and less accurate than quantitative methods of calculating food servings (e.g., 1 day of 24-h dietary recall; 7-day diet diary). These findings should be interpreted cautiously as the factor structure depends on the food items initially assessed. Conclusions are restricted to the sample collected and generalization of the results can be achieved only if analysis using different samples reveals the same factor structure. Also, we cannot assert that the cross-sectional study population of Kaunas City is perfectly representative of the general population of Lithuania.

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