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Original article

Evaluation of students' dietary behaviours depending on gender

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Summary. It is believed that university students commit many nutritional errors due to changes in lifestyle such as moving away from the family home, irregular meals, long hours spent studying, and frequently taking part-time jobs. Thus, we aimed to a) describe the baseline dietary intake of university students, b) identify differences in healthy eating between genders, and c) explore the relationship between lipoproteins and anthropometric data. In total, 500 students, 339 females and 161 males from Lithuanian universities and colleges participated in the study. The Food Frequency Questionnaire was used to evaluate dietary habits. The body composition values and blood analysis were estimated. Most participants (74.3%) reported regularly eating breakfast on weekdays, but of those, less than half ate breakfast 1-2 days a week. Females were more likely to consume cooked vegetables, salad/raw vegetables, fresh fruits, and curd-/cream cheese/yoghurt (p<0.001). By comparison, consumption of red meat, poultry, sausages, fish, and hard/soft cheeses (p<0.001) was common among males. In addition, males ate fast food (p<0.001) more often than females. Females consumed chocolate more often than males did (p<0.001). In males, total cholesterol, triglycerides, and low density lipoprotein (LDL) cholesterol were correlated with body weight and body mass index (BMI) (p <0.01). In females, high density lipoprotein (HDL) cholesterol was negatively correlated with body weight and BMI (p<0.01). The main barriers to healthy eating were identified as skipping breakfast and deficiencies in the consumption of specific food groups such as fruits and vegetables as recommended by the World Health Organisation (WHO). With respect to gender, differences in healthy eating were found in the consumption of meat and regular meals. The degree of obesity, triglycerides, and LDL cholesterol were higher in males, suggesting possible association with chronic disease incidence such as hyperlipidaemia and hypertension.

Key words: health behavior, students, dietary habits, lipoproteins, body composition

Introduction

According to the World Health Organisation (WHO) (2016), a healthy diet should include a high consumption of fruits, vegetables, and whole grains, in addition to low consumption of saturated fats, salt, and refined carbohydrates. Research suggests young adults engage in poor eating behaviours, such as low fruit and vegetable consumption and high consumption of energy-dense snack foods (1). In addition, they frequently fail to consume meals regularly (2). The regular omission of meals, particularly the breakfast meal, has been associated with poorer diet quality (3); lower intakes of total energy, vitamins, and minerals (4); increased risk of central adiposity (5); markers of insulin resistance (6); and cardio metabolic risk factors (7). It is believed that university students commit many nutritional errors due to changes in lifestyle. This may include moving away from the family home, irregular meals, long hours spent studying, and frequently taking part-time jobs. Therefore, students are more likely to pay less attention to the amounts and quality of food they consume (8).

Recent studies provide evidence linking the habit of not healthy eating with a lower risk of weight gain,

obesity, and metabolic syndrome (9). Increased body fat mass in turn increases total body mass and lipid concentration in the blood. High total cholesterol (Tchol), low density lipoprotein cholesterol (LDL-chol), and low high density lipoprotein cholesterol (HDL-chol) are associated with vascular death. In addition, high levels of triglyceride (TG) is an important and independent predictor of cardiovascular disease (10). Therefore, healthy levels of blood lipids and blood glucose are crucial to preventing cardiovascular disease. That is one of the reason to pay attention to the quality of food students consume. Surveys from Western countries show gender differences in food consumption, nutrient intake, and attitudes towards food. Females are more concerned about healthy diet and more often classify foods according to the assumed nutrient content than males (11). Research (12) has shown that males of all ages consume more saturated fat and dietary cholesterol than females do. Cholesterol intake of males was substantially higher that recommended levels, while dietary cholesterol of most females of all ages fell within the recommended range for classes of age (12). The combination of food categories characterizing the diet according to gender therefore plays a central role in determining the amount of energy consumed. Males have a higher energy intake, and a higher percentage of the energy in males' diets is derived from animal products, whereas the share of products of vegetable origin is higher in females' diets (13). Thus, it can be inferred that differences in food consumption, nutrient intake, and attitudes towards food are less healthy in males' diets than in females' diets.

In addition, little is known about the preventative measures that can be taken for university students to follow a healthy diet. Thus, we aimed to a) describe the baseline dietary intake of university students, b) identify differences to healthy eating between the gender, and c) explore the relationship between lipoproteins and anthropometric data.

Subjects and Methods

The analyses are based on the online survey data from the Food Frequency Questionnaire (FFQ) conducted across Lithuania among university students from February 2015 to July 2015. University students were recruited via fliers, mailing lists, social networks, and advertising the study during classes and lectures. Participants provided informed consent by selecting the "agree" button during the online survey, which then directed them to the first question of the survey. We put the exclusion criteria in the informed consent. These were: pregnancy; breastfeeding; genetic factors such cystic fibrosis and sickle cell anaemia; non-communicable chronic conditions, such as diabetes, hyperlipidaemia, inflammatory bowel disease, and multiple sclerosis; medical conditions; and regular consumption of recreational drugs and excessive alcohol. If a respondent identified with any of these exclusion criteria, they were not allowed to continue with the online survey. After completing the questionnaire, the participants were asked to evaluate their blood by using biochemical blood analysis and to assess their body composition values.

In total, 500 students from Lithuanian universities and colleges participated in the study. There were 339 females and 161 males and their mean age was 23 years old. The subjects were moderately physically active (<2 hours per week) but did not participate in any formal physical exercise or sport programme. Each subject volunteered to participate after being informed of the purpose and experimental procedures. A large proportion of respondents lived in the country (36%), in towns with 20,000 -100,000 inhabitants (30%), and with their families (68%). Generally, they defined their financial situation as average (69%).

Questionnaire

The Food Frequency Questionnaire (FFQ) was used to evaluate dietary habits in terms of dietary rate. The FFQ consisted of 22 questions regarding food items, and the rate of consumption was assessed by the following response categories: never, less than once a week, one to three times a week, four to seven times a week, or several times a day. Based on a food pyramid developed by the German state-funded Agency for Consumer Information (14), the 22 food items were grouped into six food groups: 1. vegetables, salad; 2. fruits; 3. bread, grains, side dishes; 4. dairy products; 5. meat, sausages, fish, eggs; 6. sweets and snacks.

Estimation of Biochemical Blood Analysis

Upon arrival, subjects were requested to rest in a seated position for approximately 20 minutes before blood collection. The hand used for the blood collection was placed into warm water (37–38 °C) for 5 minutes to encourage blood flow to the capillary sites. The hand was dried and an alcohol swab was used. The capillary blood from the fingertip was collected using a disposable 2 mm contact-activated sterile lancet (BD Biosciences, Australia) to the lateral portion of the distal phalanx of the third or fourth metacarpal into a 300 μL heparinised capillary tube (Kabe Labortechnik, Germany). The first blood drop for the fingertip was discarded to minimize excess tissue fluid. The blood sample from finger was taken to establish total cholesterol (Tchol), high (HDL-ch) and low (LDL-ch) density lipoprotein cholesterol and triglyceride (TG) concentration by an enzymatic method using a standard Cardio Check biochemical analyser (USA). The device operated on the principle of dry chemical reagent using test strips. LDL-ch was calculated by formula: LDL-ch = Tchol – HDL-ch - TG/5.0 (15).

Estimation of Body Composition Values

Weight (kg), body mass index (BMI), body fat mass (%) and lean body mass (%) were estimated by a body composition analyser, "Tanita body composition analyzer TBF – 300a" (USA), where we set subject's height, age, and physical capacity (Table 1). We used BMI categorization as underweight (BMI < 20), normal weight (BMI - < 24.9), overweight (BMI - < 30), and obesity (BMI ≥ 30) (16).

Statistical Analysis

Statistical analysis was performed by using *SPSS 20.0* software for *Windows*. Descriptive statistics were applied. The nutrition habits were conducted by Chi^2 tests to explore if eating behaviour differs between male and female university students. The correlation among variables was evaluated by Chi^2 tests. Links among nutrition habits and food additives were determined using Chi^2 tests applying to discrete variables and a Kruskal-Wallis H test. For all tests $p<0.05$ was considered significant.

Results

Table 1 presents the anthropometric data. The males had higher weight, height, and skeletal muscle ($p<0.001$) values than the females. Body fat values were higher in females ($p<0.001$) than males. There were no differences in BMI between the two groups ($p>0.05$).

The subjects (74.3%) reported regularly eating breakfast on weekdays (3-5 times), while 9.33% stated they rarely or never ate breakfast on weekdays. But 31.86% females and 36.02% males ate breakfast only 1-2 days a week. During the week, 63% of students ate 3-4 times a day (Table 2).

Subjects reported eating cooked vegetables (3.2%) as well as raw vegetables and salad (3.6%) several times a day (Table 3). Fresh fruits were consumed by 26.9% of students several times a day. Brown bread was eaten by 10.3% less than once a week. While 18% of the students reported they never ate red meat, 12.6% stated that they consumed it 4-7 times a week. More than half of the students (55.4%) ate poultry 1-3 times a week, and 43.1% consumed fish 1-3 times a week. More than half (52.5%) of the students reported consuming fast food less than once a week, and 1.9% reported eating fast food frequently (4-7 times a week) (Table 3). Females were more likely to consume cooked vegetables ($p<0.01$), salad/raw vegetables, fresh fruits, and curd-/cream cheese/yoghurt (all: $p<0.001$) compared to males. Consumption of red meat, poultry, sausages, fish (all: $p<0.001$), and hard/soft cheeses ($p<0.001$) was more common among male students. Males ate fast food ($p<0.001$) and side dishes like pasta/rice ($p<0.001$) and fried potatoes/chips ($p<0.001$) more frequently than females did. Females consumed chocolate more often than males ($p<0.001$). Chocolate was eaten by 4.5% several times a day.

Table 1. Subjects' characteristics

	Female	**Male**
Height, m	1.61 ± 1.1	1.72 ± 1.7*
Weight, kg	67.71 ± 5.1	81.37 ± 5.8*
Body mass index, kg/m^2	24.74 ± 0.03	27.21 ± 0.01
Lean body mass %	29.68 ± 2.9	41.82 ± 4.1*
Body fat, %	28.67 ± 3.1	16.61 ± 3.9**

Statistically significant difference; significance level p<0.05

Table 2. Baseline dietary for breakfast consumption and eating times per day

	Female % (n)	Male % (n)	Age 19 - 25 % (n)
Breakfast consumption a week			
6 – 7 days	23.01 (78) *	14.28 (23)	22.2 (111)
3 – 5 days	35.10 (119) *	74.30 (65)	74.3 (173)
1 – 2 days	31.86 (108)	36.02 (58)	33.4 (167)
Rarely or never	10.03 (34)	9.33 (15)	9.33 (49)
χ^2 P*	0.442		0.001
Eating times a day			
1 – 2 times	24.19 (82)	25.47 (41)	24.8 (124)
3 – 4 times	63.12 (214)	63.35(102)	63 (315)
5 and more	12.68 (43)	11.18 (18)	12.2 (61)
χ2 P *	0.079		0.001*

Statistically significant difference; significance level p<0.05; χ^2 – Chi square

Table 3. Baseline dietary intake

	Never (%)	< 1 times/week (%)	1-3 times/week (%)	4-7 times/week (%)	Several times a day (%)
Cooked vegetable	0	20	40	60	5
Salad and raw vegetables	5	10	40	40	5
Fresh fruits	0	10	20	40	25
Canned fruits and compote	30	30	20	5	0
Pasta and rice	2	5	60	60	5
Boiled potatoes	0	20	70	30	0
Brown bread	0	15	20	60	0
White bread	0	15	20	60	0
Breakfast cereals	5	10	25	35	5
Curd, cream, yogurt	5	10	25	35	10
Eggs	0	5	20	60	0
Poultry	0	20	10	30	20
Red meat	0	19	21	45	15
Fish	0	20	35	40	5
Sausage and ham	0	23	15	40	45
Chocolate	10	20	40	30	10
Cake and pastries	0	15	55	55	10
Ice cream	0	20	65	40	3
Fast food	0	15	55	30	5
Chips and fried potatoes	0	12	50	30	5

TG and LDL-chol (p<0.05) values were higher, and HDL-chol was lower (p<0.001), in males than females. There was no difference in triglyceride and Tchol level between the two genders (p>0.05) (Table 4). In males, Tchol, LDL-chol and TG were correlated with body weight and BMI (p<0.01). In females, HDL-chol was correlated with body weight and BMI (p<0.01) (Table 5).

Discussion

The main barriers to healthy eating were identified as skipping breakfast and the deficiencies in the consumption of specific food groups such as fruits and vegetables compared to WHO recommendations. With respect to gender, differences in healthy eating were found in the consumption of meat and regular meals. The degree of being overweight ~~obesity~~, triglycerides, and LDL cholesterol were higher in males, suggesting possible associations with chronic disease incidence such as hyperlipidaemia and hypertension. Such knowledge is necessary to inform health promotion strategies in the university setting.

Table 4. Blood lipid profile levels of subjects by gender

	Female	Male
Tchol (mmol/l)	4.65 + 0.88	4.67 + 1.27
HDL-ch (mmol/l)	1.83 + 0.43	1.41 + 0.34*
LDL-ch (mmol/l)	2.62 + 0.74	3.99 + 1.05*
TG (mmol/l)	1.03 + 0.39	2.07 + 0.69**

Statistically significant difference; significance level p<0.05; Tchol – total cholesterol, HDL-ch – high density lipoprotein cholesterol, LDL-ch – low density lipoprotein cholesterol, TG – triglyceride.

Table 5. Correlation coefficient between anthropometric and blood clinical indices for gender

	Female		Male	
	Age	**BMI**	**Age**	**BMI**
Tchol (mmol/l)	0.139	0.350	0.145*	0.097*
HDL-ch (mmol/l)	0.011*	0.123*	0.058	0.337
LDL-ch (mmol/l)	0.147	0.452	0.177*	0.111*
TG (mmol/l)	0.112	0.282	0.060*	0.134*
Glucose (mmol/l)	0.239	0.460	0.163	0.134*

Statistically significant difference; significance level p<0.05; Tchol – total cholesterol, HDL-ch – high density lipoprotein cholesterol, LDL-ch – low density lipoprotein cholesterol, TG – triglyceride, BMI – body mass index.

The students' life at university has a variety of components affecting their diet: irregular lifestyle; a change in residence; a lack of student cafeterias; stress; a hectic lifestyle; jobs taken during non-class time; inappropriate habits and eating behaviors adopted from their family homes; meeting energy requirements by consuming energy-packed snacks, or the use of stimulants (8). Kowalska (8) observed that a frequent problem among students relates to irregular consumption of meals, particularly breakfast. In our study, we found that 74.3% of participants reported regularly eating breakfast on weekdays (3-5 days), but 31.86% of females and 36.02% of males ate breakfast only 1-2 days per week.

Our literature review identified that young adults skipped breakfast more frequently than other main meals. A sample of American elderly participants reported the prevalence of breakfast skipping was highest (10.7%) when compared to lunch skipping (8.6%) and dinner skipping (5.8%) (17), with similar results seen in children and adolescent populations (18). Nine of the ten studies reported time as the biggest perceived influence on meal skipping when ranked against other important correlates of young adult meal skipping (19). Smith et al. (5) reported that skipping breakfast over an extended period time may be associated with cardio-metabolic health.

Van der Heijden et al. (20) found the habit of eating breakfast contributed to the prevention of weight gain. A possible explanation is a higher insulin stimulus of hydroxyl methyl glutaryl Co-A (HMG-CoA) reductase. Compared with participants who ate breakfast, those who skipped breakfast had higher fasting insulin concentrations and, therefore, might have higher HMG-CoA reductase (5). Through these possible mechanisms, skipping breakfast might induce higher LDL cholesterol and, therefore, atherosclerosis. Furthermore, recent studies found that skipping breakfast clusters were associated with risk factors of hypertension such as smoking and lower levels of physical activity (21).

According to WHO (2016), a healthy diet includes the consumption of at least five portions of fruits and vegetables a day. In relation to this recommendation, the intake of fruits and vegetables in our sample was quite low with less than 30% of all students reporting to eat fruit and vegetables several times a day. This finding aligns with other studies focusing on university students from various countries: the United States (22), Spain (23), Italy (24), and Germany (25). In accordance with other studies (24), males consumed fast food, red meat, poultry, sausages, hard/soft cheeses, side dishes like pasta/rice, fried potatoes/chips and meat products more often than females did. Males also consumed fruits and vegetables less often than females did. Reasons for such gender differences could be a generally higher health awareness (24), better nutrition knowledge (26), and better knowledge about what constitutes a "healthy diet" (22) among females.

A previous study conducted among 479 Swedish university students found that female students had healthier habits than male students, despite being stressed, whereas male students showed a high level of overweight and obesity and were less interested in nutrition advice and health-enhancing activities (26). Also, the authors reported that female students were more interested in changing their dietary habits than male students were (26). It has also been shown that men give lower priority to health compared to other considerations, such as taste and convenience, in making their food choices (27) and that they feel more ambivalent about healthy dietary choices (28).

The International Health and Behaviour survey (IHBS) examined a range of health behaviours in a total of 19298 university students from 23 different countries using a study approach based on a self-report questionnaire (29). In almost all 23 countries, a higher percentage of women reported avoiding high fat-foods, eating fibre-rich foods, and eating fruit daily. In comparison, males have a higher energy intake, and a higher percentage of the energy in males' diets is derived from animal products (13). However, men reported liking fruit slightly more than women liked fruit. However, there was no significant gender difference in attitudes towards fruit and vegetables (29).

The females within our sample reported eating chocolate more frequently than the males did. Previous studies also reported that female students consumed sweet foods more frequently than their male counterparts (22). They found an association between such eating habits and higher levels of perceived stress in female students (22). Also, women are more often affected by the problem of craving (i.e., the strong desire for certain foods) than men, with the women more likely crave sweet foods. Extensive research showed that women often experience the so called "carbohydrate craving" and there is an association between the wish for sugar- and fat-rich foods (like chocolate and other sweets) and menstrual cycle (30).

Problems with eating behaviour have a strong female prevalence emerging in childhood and adolescence (31). Girls often eat less and pay attention to calories, sugar, and fat intake under the pressure of "feeling obliged" to be slim (31). Consequently, in part due to a specific social pressure, girls are more likely than boys to develop eating disorders (i.e., anorexia, bulimia, binge eating disorder) (31). Among school children, girls were found to consume much less energy than boys and have reduced micronutrient intakes (31).

In our study, males' BMI showed higher incidence of being overweight, higher triglycerides and higher LDL cholesterol than women did, and the blood lipids showed positive correlation with males' BMI. Chang et al. (10) reported similar results; part of the reasons for higher triglycerides and LDL-cholesterol levels in male students was the higher rate of obesity among males. It has been reported that higher obesity rate was related to increased blood triglycerides and total cholesterol and decreased HDL-cholesterol (17) in male college students (10).

Most researchers now agree that being overweight increases the risk of developing chronic diseases and premature death (32). In comparison with normal weight individuals, overweight individuals have 4.7 times higher probability of suffering from metabolic syndromes, which can lead to abdominal obesity, high serum triglycerides, low HDL cholesterol, and elevated plasma glucose (33). Both lipid profile and BMI have been shown to be important predictors for hypertension, diabetes, and cardiovascular diseases (33), and clinical data indicate that elevated levels of total cholesterol, triglycerides and low-density lipoprotein are risk factors for cardiovascular events (34).

Consequently, male students could possibly have higher risks for chronic disease incidence such as hyperlipidaemia and hypertension. It is well established that obesity or being overweight is often associated with increased plasma TG and decreased HDL-cholesterol concentrations. Women typically have lower plasma TG and higher HDL-cholesterol concentrations than men (35), as our results confirm. Several authors have demonstrated that oestrogen may have an agonistic effect on peroxisome proliferator-activated receptor (PPAR) activity and thus may underlie gender differences in lipid homeostasis (36). It has been reported that men may have higher insulin resistance than women, possibly due to more visceral and hepatic adipose tissue in the setting of lower oestrogen levels, which may be protective, as well as lower adiponectin levels (37).

In our study, we have found the correlation between Tchol, LDL-chol, TG and BMI in males. We also found HDL-chol was correlated with BMI in females. The researchers analysed the relationship between BMI categories and 16 commonly tested blood biochemical indicators in low-income female population (38). It is interesting to note that, along with increasing BMI, the levels of 11 bio-indicators show a trend of linear increase, including TG, LDL-cholesterol, Tchol, and glucose, but negatively with the levels of 5 bio-indicators including HDL cholesterol (38). These results help focus our data where BMI was overweight in males and correlated with Tchol, LDL-chol and TG values in comparison to women, where HDL-chol was correlated with BMI.

Importantly, the effect of obesity on the lipoprotein profile is evident in the absence of clinically significant imbalances in plasma glucose and lipid homeostasis, and is qualitatively the same in men and women; the females' and maless chronic heart disease risk advantage is largely related to the traditional lipid risk factors (e.g., plasma TG and HDL-cholesterol concentrations) because the differences between men and women in lipoprotein particle concentration is comparably minor (35).

In conclusion, this study demonstrated that the main barriers to healthy eating were identified as skipping breakfast and deficiencies in the consumption of specific food groups, such fruits and vegetables as recommended by WHO. With respect to gender, differences in healthy eating were found in the consumption of meat and regular meals. This study demonstrated, that the degree of being overweight ~~obesity~~, triglyceride levels, and LDL cholesterol levels were higher in males than in females, suggesting possible association with chronic disease incidence such as hyperlipidaemia and hypertension among males.

The findings of this study can inform health promotion strategies in the university setting. Students, faculty, staff, and administrators can work together to make meaningful changes within the university environment. Nutrition educators can partner with dining service personnel to provide guidance for students when making food choices. They can also write articles for campus newspapers addressing barriers and enablers to healthful dietary practices, including quick recipes. Educators with expertise in nutrition or physical activity can partner to develop service learning projects for students to share with their peers ways to overcome barriers and facilitate enablers to healthful dietary practices.

Researchers may want to explore the differences in barriers and enablers for maintaining a healthful diet based on whether students subscribe to meal plans and live on or off campus. Also, they can create opportunities as well as motivate students regularly to make test of lipids in the blood, not only in medical institutions, but also on campus, or even in areas where the studies may take place.

Limitations

Our study aimed to describe the baseline dietary intake in Lithuanian university and college students, identify gender-specific differences to healthy eating, and explore the relationship between lipoproteins and anthropometric data. We found that the main barrier for healthy eating was skipping breakfast. Gender-specific eating behaviors were found in the consumption of meat and the regularity of meals. Finally we concluded that the degree of being overweight and concentrations of triglycerides, and LDL cholesterol were higher in males than in females. The knowledge of this work is important to promote optimal health strategies in high education institutions.

Nevertheless, our study has some limitations. First, due to the cross-sectional design of our study,

no causal relationships can be drawn from our data. In addition, the study recruited university students from across Lithuania. Therefore, we cannot rule out the possibility of a participation bias, which may limit the generalizability of our results. Furthermore, due to the self-reported variables, reporting bias and recall bias may have occurred.

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