Impact of socio-economic factors and nutritional education on the composition of daily diet of university students

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Summary
The purpose of this study was to analyse whether socio-economic factors would influence the composition of daily diet (DD), as well as to answer the question if nutritional education ran for a few months could have a beneficial effect on a change in diet. Food consumption patterns were estimated in a group of 504 students from Poland, aged 22–25, by interview on food intake during the last 24 h. The amount of 30 nutrients was calculated using a computer program „Dietetyk 2" (National Food and Nutrition Institute, Warsaw, Poland). In the group of women, the content of nutrients in DD was more favourable among the women whose parents had higher education, but the most vulnerable to diseases of affluence were considered to be those whose parents had a high school education. Among the most significant negative socio-economic impacts was the place of residence during the period of study. The most health threatening was living in a dorm. Family economic self-evaluation made by students was subjective and this prevented the observation of differences. Education on rational diet was more effective in the group of women than in the group of men.

Keywords:
nutrition; educating parents; place of residence; economic self-evaluation; nutritional education

Eating habits of young people are affected by many factors related to the socio-economic conditions – dietary habits acquired in the family home, education of caregivers and the state of knowledge on proper nutrition. Effects of many of these factors have a synergistic or antagonistic effect, so that their joint correlations are difficult to estimate. Factors such as gender, type of school, consumption of drugs, physical activity, living in the family home for the duration of education and, in particular, the economic situation of the family and the education of parents can significantly influence the diet of young people [1–3]. The literature reports on the positive impact of mother's education on the quality of the diet of children [4]. However, the impact of education of fathers does not always affect the outcome. Different studies were published by FARAJIAN [5] who showed that, in Greece, education of fathers is a predictor of childhood obesity.

The political situation in Poland creates relatively equal working conditions for women and men, which makes both of them involved to a similar extent in food shopping and preparing meals. Therefore, in the current research the impact of both parents' education on daily diet of students was taken into account.

An interesting observation has been made concerning the impact of the economic situation of the family on the quality of food consumption. However, the authors of the study were interested in whether the assessment of the economic situation, made otherwise than on the basis of family income, will substantially affect the diet. In this case a family economic self-esteem has been chosen as a differentiating factor.

Universities in the province of Szczecin, West Pomerania Province in Poland, differ from universities in other countries. Universities in Szczecin do not have a typical campus and students are not guaranteed a place in a dorm. Most students have to take care of accommodation on their own

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mainly in the western part of Szczecin. The University accommodation facilities are mostly spread in eastern part of Szczecin, beyond a river. For this reason, a comparison between residence of people living at homes, rented halls and lodgings was interesting. Study on the adverse changes in the diet of students during a change of residence from Greece to Glasgow in Scotland was conducted by PAPADAKI and SCOTT [6].

The impact of nutrition education on improving eating habits, conducted in different groups of recipients was repeatedly proven [7, 8]. However, the group of respondents in our study was a fairly specific population, because a large number of students were graduates of gastronomy secondary schools. Thus, certain eating habits, lack of time and the way of life in the environment shaped by relatively recent academic tradition was an interesting field to conduct extensive research.

The purpose of this study was to analyse whether socio-economic factors would influence the composition of daily food ration (DFR), as well as to answer the question if nutritional education ran for a few months could have a beneficial effect on a change in diet and whether it would be worth bearing the costs associated with nutrition education.

MATERIALS AND METHODS

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Bioethical Committee of the Pomeranian Medical University in Szczecin [9]. Written and verbal informed consent was obtained from all students. In total, 504 people participated in this study (including 436 women and 68 men), at the age of 22–25. The study of the diets of fourth-year students of the Food Technology and Human Nutrition in West Pomeranian University of Technology in Szczecin was based on the method of double 24-hour dietary interview. The questionnaire contained questions about parental education, residence during the period of study and economic self-evaluation. The anthropometric parameters were measured to the nearest 0.5 cm and 0.1 kg. The valid values of body mass index (BMI) and waist to hip ratio (WHR) are assumed to be 18.5–24.9 $kg \cdot m^{-2}$ and 0.8 for women, and 1.0 for men [10].

To perform a double interview about food ingestion during the last 24 h, "Album of photographs of food products and dishes" [11] was used. The content of selected nutrients in daily diet such as: energy, proteins, lipids, saccharides, vitamins A, D, E, C, B1, B2, B6, B12, niacin, folate, and Na, K, Ca, P, Mg, Fe, Cu, Zn, Mn, fibre and cholesterol was calculated using the computer program „Dietetyk 2" (National Food and Nutrition Institute, Warsaw, Poland) taking nutrient loss into account.

Socio-economic factors

According to the first factor concerned (parents' education), the respondents were divided into three groups based on gender. The first group included the students whose parents had primary education or vocational training, the second group were persons, of which at least one parent had completed secondary education, while the third group included those whose at least one parent had a university degree.

In the case of the second socio-economic factor, surveyed students were divided into three groups taking gender into consideration. The first group consisted of students living in the dorm, the second group were the people renting apartments. The last group included the students living at family home during the period of study.

Because of the reluctance of students to disclose the economic status of the family (the average monthly income of the family), we decided to investigate the effect of the economic situation of the family on the way they are eating on the basis of respondents' self-evaluation. In this regard, five ordinal scale was provided (rating: very good, good, satisfactory, poor, very poor). Because of the small number of responses suggesting a very good, bad and very bad economic situation of families, two groups of respondents were created taking gender into consideration. The first group included those who described the family economic situation as very good or good. The second group consisted of those who described it as sufficient.

Nutritional education

Nutritional education was conducted during the winter semester in the form of a course named "Fundamentals of human nutrition". It consisted of 30 hours of lectures and 30 hours of practice, during which all the essential issues related to the rational nutrition, nutrition pyramid and the assessment of nutritional status were presented. The range of topics included following issues:

- nutrient content in food products based on food composition and nutrition tables;
- evaluation of DD including an interview about food ingestion from the last 24 h, as well as quantitative and qualitative tests;
- human energy requirements;

– division of products into 12 groups;
– principles of rational nutrition values with an overview of the Mediterranean diet;
– nutritional value of proteins;
– standards of nutrition and alimentation;
– energy density, fortified food and antinutrients;
– assessment of nutritional status by using anthropometric methods;
– principles of planning a diet for populations at different age;
– risks resulting from the use of radical forms of vegetarianism and weight loss diets.

Respondents were informed about the purpose of the study. Diet surveys were carried out twice: before and after the nutritional education course.

Statistical analysis

The results were statistically analysed using the software package Statistica 8.0 (Statsoft, Tulsa, Oklahoma, USA). The arithmetical mean, standard deviation and the significance of differences with ANOVA were calculated. Because most of the distributions differed from the normal distribution (Shapiro–Wilk test), further analysis involved non-parametric tests. To assess the differences between the studied groups, the non-parametric Tukey's test was used. The level of significance was $p \leq 0.05$.

RESULTS

Average BMI for women was 21.4 kg·m^{-2} ± 3.01 kg·m^{-2} and for men was 23.6 kg·m^{-2} ± 5.04 kg·m^{-2}. WHR of women and men was 0.79 and 0.91, respectively. The majority of students (91.5%) were characterized by normal BMI within the 18.5–24.9 kg·m^{-2} range [11]. A portion of 82.9% of students were considered to be properly fed (BMI). WHR allowed to qualify subcutaneous fat distribution in most subjects to the desired gynoidal type of body.

Impact of parental education on nutrition

The scope of the research included the issue of the impact of parental education on students' nutrition. A comparison of calculations of energy content and nutrients in the diets of women showed that those whose parents had university education, nourished more rationally than their counterparts whose parents had vocational education (Tab. 1). It was expressed by significantly higher intake of some nutrients by women whose parents had university education. This applied in particular to: protein (on average by 8.8 g), calcium (on average by 64.8 mg), phosphorus (on average by 155 mg), zinc (on average by 1.57 mg), riboflavin (by 0.26 mg on average), pyridoxine (on average by 0.24 mg) and cobalamin (on average by 1.22 mg). Intake of women, whose parents had a secondary education, contained significantly greater amounts of total lipids (by 8.6 g on average) and saturated fatty acids (on average by 4 g) than the group of women with the parents with vocational education.

Looking at the results for women from families in which parents had vocational education, it is noticeable that this group consumed the least diverse food (the smallest amount of 29 nutrients out of the thirty analysed). The exception was saccharose, which was consumed at the highest level in this group. For men, the correlations were less visible (Tab. 2). Intake of students, whose parents had completed a vocational education, contained on average significantly more minerals: magnesium (59 mg) and manganese (1.25 mg) than men whose parents had a high school education. The intake of the latter group contained, on the other hand, on average significantly more energy (1168 kJ), lipids (23.1 g), monounsaturated fatty acids (13 g), polyunsaturated fatty acids (3 g), saturated fatty acids (5.5 g), cholesterol (95 mg), saccharose (14.1 g), vitamin A (101 mg), vitamin D (0.28 mg) and cobalamin (1.85 mg) than the first group (vocational education). In case of men, the diet characterized by an excess supply of protein, cholesterol, saccharose, phosphorus, vitamin A, and low supply of vitamin D, was significant for those whose parents had university education.

Considering the variability of the percentage distribution of energy from protein, lipids and saccharides, it was found that the group in which the percentage of energy derived from saccharides was significantly higher than in the others, was the group of women whose parents had the vocational education. On the other hand, a significantly higher percentage of energy from lipids was identified in women and men whose parents had completed secondary education. The largest differences related to the proportion of energy from protein. In the group of women, the proportion of energy from proteins was the highest among women whose parents had university education, and the lowest in the group whose parents had vocational education. Among men, no significant differences were found.

Effect of place of residence during the period of study on the diet

Analysis of the effect of place of residence during the period of study on the composition of

Tab. 1. Contents of nutrients in daily food rations in women depending on the parents' education.

Discriminant	Vocational education	Secondary education	University education
Energy [kJ]	7323 ± 1700 [a]	7821 ± 1549 [a]	7704 ± 2340 [a]
Proteins [g]	61.79 ± 17.51 [a]	68.26 ± 20.17 [ab]	70.58 ± 21.62 [b]
Lipids [g]	59.37 ± 19.71 [a]	68.01 ± 21.33 [b]	64.31 ± 31.89 [ab]
Saturated fatty acids [g]	21.61 ± 8.14 [a]	25.62 ± 10.14 [b]	24.26 ± 11.41 [ab]
Monounsaturated fatty acids [g]	22.58 ± 7.31 [a]	25.51 ± 9.08 [a]	25.27 ± 15.18 [a]
Polyunsaturated fatty acids [g]	10.34 ± 8.67 [a]	11.08 ± 6.66 [a]	9.56 ± 5.5 [a]
Cholesterol [mg]	206.4 ± 100.51 [a]	220.5 ± 119.9 [a]	213.4 ± 223.9 [a]
Saccharides [g]	257.5 ± 62.86 [a]	263.0 ± 58.54 [a]	261.2 ± 80.57 [a]
Saccharose [g]	76.79 ± 34.8 [b]	61.36 ± 26.02 [a]	62.47 ± 41.72 [a]
Lactose [g]	9.19 ± 7.36 [a]	9.66 ± 7.12 [a]	12.29 ± 12.46 [a]
Dietary fibre [g]	17.39 ± 5.6 [a]	18.93 ± 7.5 [a]	18.2 ± 6.2 [a]
Na [mg]	1845 ± 894.0 [a]	1918 ± 791.0 [a]	1856 ± 724.5 [a]
K [mg]	2673 ± 907.3 [a]	2847 ± 954.4 [a]	2875 ± 1022 [a]
Ca [mg]	579.7 ± 282.8 [a]	644.5 ± 325.2 [ab]	707.0 ± 529.9 [b]
P [mg]	1073 ± 335.2 [a]	1159 ± 352.0 [ab]	1228 ± 531,8 [b]
Mg [mg]	267.2 ± 110.1 [a]	268.1 ± 96.38 [a]	295.7 ± 151.4 [a]
Fe [mg]	9.27 ± 2.49 [a]	10.38 ± 3.34 [a]	10.03 ± 4.51 [a]
Zn [mg]	8.06 ± 2.33 [a]	9.01 ± 2.6 [ab]	9.63 ± 3.94 [b]
Cu [mg]	1.08 ± 0.53 [a]	1.1 ± 0.46 [a]	1.11 ± 0.45 [a]
Mn [mg]	4.8 ± 1.63 [a]	4.91 ± 2.18 [a]	4.45 ± 1.92 [a]
Vitamin A [μg]	810.6 ± 844.5 [a]	710.4 ± 481.2 [a]	867.5 ± 1309 [a]
Vitamin D [μg]	2.38 ± 1.93 [a]	2.66 ± 3.24 [a]	3.34 ± 1,66 [a]
Vitamin E [mg]	7.28 ± 6.43 [a]	8.06 ± 4.38 [a]	6.54 ± 2.94 [a]
Vitamin B1 [mg]	0.9 ± 0.39 [a]	1.01 ± 0.4 [a]	1.02 ± 0.43 [a]
Vitamin B2 [mg]	1.22 ± 0.34 [a]	1.4 ± 0.48 [ab]	1.48 ± 0.78 [b]
Niacin [mg]	12.78 ± 5.13 [a]	13.6 ± 6.41 [a]	13.54 ± 4.8 [a]
Vitamin B6 [mg]	1.61 ± 0.63 [a]	1.74 ± 0.69 [ab]	1.85 ± 0.7 [b]
Folacin [μg]	155.9 ± 54.0 [a]	162.9 ± 54.12 [a]	160.1 ± 48.47 [a]
Vitamin B12 [μg]	3.21 ± 3.16 [a]	3.12 ± 2.45 [a]	4.43 ± 5.02 [b]
Vitamin C [mg]	49.67 ± 44.68 [a]	49.31 ± 32.61 [a]	50.46 ± 27.81 [a]
Energy of proteins [%]	13.9 ± 2.5 [a]	14.4 ± 2.8 [ab]	15.1 ± 2.5 [b]
Energy of lipids [%]	31.1 ± 6.5 [a]	33.4 ± 7.2 [b]	32.0 ± 5.5 [ab]
Energy of saccharides [%]	55.0 ± 6.6 [b]	52.2 ± 8.0 [a]	52.9 ± 5.6 [ab]

Values represent arithmetical mean ± standard deviation. a, b – homogeneous groups according to the Tukey's test.

the diet of students from Szczecin showed that the least energy was consumed by women living at that time in the family home (Tab. 3). These women were also characterized by a lower intake of lipids (13.2 g), saturated fatty acids (4.5 g), polyunsaturated fatty acids (4.1 g), dietary fibre (2.6 g), potassium (159 mg), phosphorus (159 mg), magnesium (54.7 mg), copper (0.25 mg), vitamin E (2.63 mg) niacin (1.8 mg) and pyridoxine (0.33 mg) than women living in the academician. Similar intake of nutrients was observed in a group of women living in rented apartments (roommates). Statistical calculation showed no significant differences in the intake of 30 nutrients analysed.

A comparison of average nutrient content in mens' group showed that students living in the family home consumed significantly less energy, lipids, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, cholesterol, carbohydrates, sodium, iron and vitamin E than those living in the dorm (Tab. 4). At the same time, the intake of most of these components was implemented at a standard level of a regular daily allowance. Similarly to women, a group of men living in rented apartments (roommates) during their studies ate in a way that did not differ significantly from the diet of men living in the family home. However, it should be noted that, de-

Tab. 2. Contents of nutrients in daily food rations in men depending on the parents' education.

Discriminant	Vocational education	Secondary education	University education
Energy [kJ]	9726 ± 2257^{a}	10894 ± 2684^{b}	10768 ± 2490^{b}
Proteins [g]	85.75 ± 18.37^{a}	91.35 ± 29.92^{ab}	94.89 ± 21.62^{b}
Lipids [g]	94.39 ± 32.10^{a}	117.5 ± 48.96^{b}	105.4 ± 31.89^{ab}
Saturated fatty acids [g]	35.85 ± 14.17^{a}	41.35 ± 17.19^{b}	39.57 ± 11.41^{ab}
Monounsaturated fatty acids [g]	37.16 ± 14.40^{a}	50.12 ± 23.28^{b}	42.95 ± 15.18^{a}
Polyunsaturated fatty acids [g]	14.02 ± 3.23^{a}	17.00 ± 6.93^{b}	14.55 ± 5.5^{a}
Cholesterol [mg]	259.8 ± 83.4^{a}	354.7 ± 171.7^{b}	458.8 ± 223.9^{c}
Saccharides [g]	305.6 ± 71.04^{a}	317.0 ± 64.99^{ab}	334.2 ± 80.57^{b}
Saccharose [g]	61.76 ± 28.74^{a}	75.88 ± 28.85^{b}	85.44 ± 41.72^{b}
Lactose [g]	15.46 ± 10.89^{a}	8.25 ± 6.66^{a}	15.37 ± 12.46^{b}
Dietary fibre [g]	24.36 ± 6.11^{a}	22.76 ± 6.09^{a}	24.94 ± 10.4^{a}
Na [mg]	2693 ± 1238.4^{a}	2995 ± 1471.3^{a}	2722 ± 973.7^{a}
K [mg]	3362 ± 994.8^{ab}	3255 ± 1062^{a}	3699 ± 1161.1^{b}
Ca [mg]	770.3 ± 296.6^{a}	779.9 ± 536.1^{a}	902.6 ± 303.6^{a}
P [mg]	1471 ± 362.8^{a}	1434 ± 465.81^{a}	1618 ± 375.7^{b}
Mg [mg]	349.8 ± 96.92^{b}	290.6 ± 81.11^{a}	375.2 ± 148.2^{b}
Fe [mg]	12.31 ± 3.08^{a}	11.9 ± 3.87^{a}	14.42 ± 5.38^{a}
Zn [mg]	11.8 ± 2.66^{a}	12.31 ± 5.09^{a}	13.12 ± 3.59^{a}
Cu [mg]	1.30 ± 0.39^{a}	1.19 ± 0.32^{a}	1.48 ± 0.51^{b}
Mn [mg]	6.56 ± 2.01^{b}	5.31 ± 2.6^{a}	6.62 ± 3.33^{b}
Vitamin A [μg]	724.1 ± 220.45^{a}	924.9 ± 615.1^{b}	1320 ± 1450^{c}
Vitamin D [μg]	2.42 ± 1.39^{a}	5.14 ± 6.31^{b}	3.59 ± 6.31^{a}
Vitamin E [mg]	9.94 ± 2.51^{a}	11.51 ± 4.58^{a}	10.22 ± 4.07^{a}
Vitamin B1 [mg]	1.43 ± 0.32^{a}	1.49 ± 0.53^{a}	1.56 ± 0.53^{a}
Vitamin B2 [mg]	1.67 ± 0.46^{a}	1.60 ± 0.48^{a}	2.15 ± 0.84^{b}
Niacin [mg]	20.7 ± 8.48^{a}	18.6 ± 8.18^{a}	20.00 ± 10.58^{a}
Vitamin B6 [mg]	2.24 ± 0.88^{ab}	2.14 ± 0.84^{a}	2.48 ± 0.91^{b}
Folacin [μg]	185.0 ± 70.94^{a}	177.8 ± 41.71^{a}	227.2 ± 88.74^{b}
Vitamin B12 [μg]	3.05 ± 0.8^{a}	4.9 ± 4.28^{b}	4.34 ± 1.82^{b}
Vitamin C [mg]	50.37 ± 39.07^{a}	48.47 ± 50.57^{a}	55.19 ± 45.15^{a}
Energy of proteins [%]	14.6 ± 3.0^{a}	13.8 ± 2.9^{a}	14.5 ± 2.5^{a}
Energy of lipids [%]	37.3 ± 4.8^{a}	41.3 ± 9.8^{b}	37.5 ± 4.2^{a}
Energy of saccharides [%]	48.1 ± 5.0^{a}	44.9 ± 8.8^{a}	48.0 ± 4.6^{a}

Values represent arithmetical mean ± standard deviation. a, b, c – homogeneous groups according to the Tukey's test.

spite the lack of significant differences, the intake of 16 nutrients was higher in the group of people living in roommates.

The analysis of the energy structure showed that in the diets of women living in dorms (academician), the percentage of energy from lipids was significantly higher, and the percentage of energy from saccharides significantly lower than in other groups. Among men, a significantly higher percentage of energy from lipids was typical for both groups of people living in academician and roommates. In rations of people living in dorms (academician), too low percentage of energy from protein was observed.

Impact of economic situation on nutrition

When comparing the nutrition of female and male students with respect to self-evaluated family economic situation, no significant differences were observed with reference to the average intake of 30 analysed nutrients in DD. No significant differences were also noted in DD energy structure.

Effect of nutrition education on a diet

The effect of nutrition education run within the course 'Fundamentals of human nutrition' was different in female and male groups (Tab. 5, 6). Women, after finishing the education, consumed on average significantly more protein

(6.5 g), saccharides (27 g), dietary fibre (2.4 g), potassium (339 mg), phosphorus (156 mg), magnesium (39.4 mg), manganese (1.36 mg), vitamin D (0.87 μg), pyridoxine (0.28 mg), folacin (22 μg), cobalamin (1 μg) and vitamin C (9.1 mg). Also was observed a significant reduction in the intake of total lipids (9.5 g) and monounsaturated fatty acids (5.2 mg). The effect of diet modification was a significant change in energy structure coming from lipids in favour of saccharides and protein.

To summarize, as it resulted from statistical assessment of nutrients in DD of students from Szczecin, women, after finishing nutrition education during the course 'Fundamentals of human nutrition', consumed significantly more of 12 from 30 analysed nutrients. It should be noted that the increase in the amount of protein, pyridoxine, cobalamin, phosphorus and manganese in womens' diets caused a further increase in already high intake. On the other hand, the increase in the intake of saccharides, dietary fibre, potassium, magnesium, vitamin D, folacin and vitamin C lead to more favourable daily intake of these nutrients.

No similar tendencies were observed in male group. Significant differences in intake related only to manganese. However, the effect of the

Tab. 3. Contents of nutrients in daily food rations in women depending on the place of residence at the time of study.

Discriminant	Academician	Family home	Roommates
Energy [kJ]	8131 ± 2492^{b}	7486 ± 1753^{a}	7557 ± 1424^{ab}
Proteins [g]	72.95 ± 24.08^{b}	66.61 ± 20.03^{ab}	64.55 ± 17.51^{a}
Lipids [g]	74.61 ± 32.84^{b}	61.43 ± 16.78^{a}	62.69 ± 18.01^{ab}
Saturated fatty acids [g]	27.85 ± 16.45^{b}	23.33 ± 7.55^{a}	23.05 ± 8.68^{a}
Monounsaturated fatty acids [g]	27.19 ± 12.41^{b}	24.23 ± 8.15^{ab}	23.73 ± 7.16^{a}
Polyunsaturated fatty acids [g]	14.05 ± 11.63^{b}	9.98 ± 4.39^{a}	9.56 ± 4.19^{a}
Cholesterol [mg]	200.1 ± 82.49^{a}	230.48 ± 128.4^{a}	208.83 ± 111.3^{a}
Saccharides [g]	262.4 ± 81.9^{a}	254.4 ± 61.96^{a}	265.94 ± 55.81^{a}
Saccharose [g]	68.34 ± 30.34^{a}	65.35 ± 33.50^{a}	64.92 ± 29.11^{a}
Lactose [g]	10.77 ± 10.15^{a}	9.22 ± 7.00^{a}	10.75 ± 8.96^{a}
Dietary fibre [g]	19.3 ± 6.48^{b}	16.7 ± 5.65^{a}	19.2 ± 7.41^{b}
Na [mg]	1970 ± 891.4^{a}	1878 ± 918.5^{a}	1841 ± 636.0^{a}
K [mg]	3029 ± 1097.0^{b}	2686 ± 864.5^{a}	2797 ± 951.2^{ab}
Ca [mg]	698.7 ± 544.72^{a}	609.7 ± 344.6^{a}	642.8 ± 300.4^{a}
P [mg]	1270 ± 540.39^{b}	1111 ± 342.39^{a}	1130 ± 362.7^{a}
Mg [mg]	311.3 ± 160.41^{b}	256.6 ± 85.72^{a}	271.98 ± 109.5^{a}
Fe [mg]	9.8 ± 2.87^{a}	9.49 ± 2.89^{a}	10.51 ± 4.17^{a}
Zn [mg]	9.35 ± 3.36^{a}	8.73 ± 2.75^{a}	8.84 ± 2.97^{a}
Cu [mg]	1.28 ± 0.73^{b}	1.03 ± 0.32^{a}	1.06 ± 0.39^{a}
Mn [mg]	4.86 ± 1.93^{a}	4.66 ± 1.95^{a}	4.8 ± 2.04^{a}
Vitamin A [μg]	837.2 ± 575.1^{a}	645.8 ± 414.9^{a}	858.7 ± 1186^{a}
Vitamin D [μg]	2.84 ± 3.07^{a}	2.45 ± 2.18^{a}	2.98 ± 5.09^{a}
Vitamin E [mg]	9.67 ± 8.26^{b}	7.04 ± 3.21^{a}	6.68 ± 2.72^{a}
Vitamin B1 [mg]	1.04 ± 0.44^{a}	0.9 ± 0.38^{a}	1.02 ± 0.42^{a}
Vitamin B2 [mg]	1.44 ± 0.56^{a}	1.27 ± 0.39^{a}	1.42 ± 0.64^{a}
Niacin [mg]	14.51 ± 6.35^{b}	12.71 ± 5.74^{a}	13.32 ± 5.24^{ab}
Vitamin B6 [mg]	1.92 ± 0.73^{b}	1.59 ± 0.57^{a}	1.77 ± 0.72^{ab}
Folacin [μg]	158.1 ± 40.03^{a}	153.8 ± 54.68^{a}	167.3 ± 55.83^{a}
Vitamin B12 [μg]	3.13 ± 1.83^{a}	3.41 ± 3.18^{a}	3.72 ± 4.3^{a}
Vitamin C [mg]	49.67 ± 25.19^{a}	46.6 ± 35.22^{a}	52.34 ± 39.09^{a}
Energy of proteins [%]	14.8 ± 3.0^{a}	14.7 ± 2.5^{a}	14.1 ± 3.0^{a}
Energy of lipids [%]	35.2 ± 8.2^{b}	31.6 ± 4.0^{a}	31.6 ± 7.5^{a}
Energy of saccharides [%]	50.0 ± 9.3^{a}	53.7 ± 4.4^{b}	54.3 ± 8.5^{b}

Values represent arithmetical mean ± standard deviation. a, b – homogeneous groups according to the Tukey's test.

lack of diet modification in male group resulted in the lack of significant changes in energy structure from macronutrients.

DISCUSSION

Socio-economic factors and diet

Among the many socio-economic factors discussed in various studies four were chosen, significance of which seemed crucial regarding nutrition and nutritional status. These were parents' education, economic situation of the family, place of residence and the effect of nutrition education [12]. This was confirmed, among others, by a study of NOJOMI et al. [13], performed among the students from Teheran (University of Medical Sciences). In the study, a significant difference between BMI, gender, living place, age, smoking and nutrition was observed. An interesting report on the effect of the first three factors and, additionally, the type of parental care during early childhood was presented in the study of WRONKA et al. [14], which stated that children that were in care of their mothers in early childhood were taller and better developed physically and mentally than

Tab. 4. Contents of nutrients in daily food rations in men depending on the place of residence at the time of study.

Discriminant	Academician	Family home	Roommates
Energy [kJ]	12711 ± 1778^{b}	9571 ± 1420^{a}	10379 ± 2836^{a}
Proteins [g]	99.63 ± 20.99^{a}	88.15 ± 20.75^{a}	89.66 ± 28.22^{a}
Lipids [g]	134.5 ± 22.33^{b}	91.50 ± 18.01^{a}	108.3 ± 50.32^{a}
Saturated fatty acids [g]	49.46 ± 8.48^{b}	35.77 ± 8.78^{a}	37.94 ± 17.79^{a}
Monounsaturated fatty acids [g]	56.25 ± 10.80^{b}	36.14 ± 7.91^{a}	45.60 ± 24.18^{a}
Polyunsaturated fatty acids [g]	18.79 ± 4.37^{b}	12.48 ± 2.71^{a}	16.13 ± 6.85^{a}
Cholesterol [mg]	517.9 ± 274.09^{b}	328.2 ± 84.98^{a}	327.6 ± 172.09^{a}
Saccharides [g]	384.0 ± 60.08^{b}	298.2 ± 59.29^{a}	308.6 ± 68.97^{a}
Saccharose [g]	103.2 ± 42.84^{b}	72.14 ± 26.24^{ab}	66.89 ± 29.99^{a}
Lactose [g]	13.73 ± 14,48^{a}	14.24 ± 11,59^{a}	10.50 ± 7,52^{a}
Dietary fibre [g]	28.34 ± 10.99^{a}	22.21 ± 6.34^{a}	23.18 ± 6.46^{a}
Na [mg]	3619 ± 1004.4^{b}	2430 ± 650.74^{a}	2793 ± 1502.2^{a}
K [mg]	3749 ± 1391.1^{a}	3385 ± 961.96^{a}	3320 ± 1035.4^{a}
Ca [mg]	720.6 ± 283.5^{a}	830.11 ± 375.54^{a}	842.7 ± 486.6^{a}
P [mg]	1586 ± 283.5^{a}	1532 ± 436.64^{a}	1449 ± 435.1^{a}
Mg [mg]	362.1 ± 127.26^{a}	364.6 ± 138.23^{a}	300.0 ± 85.14^{a}
Fe [mg]	16.74 ± 5.34^{b}	11.78 ± 3.39^{a}	11.94 ± 3.65^{a}
Zn [mg]	13.24 ± 3.42^{a}	12.35 ± 3.45^{a}	12.18 ± 4.76^{a}
Cu [mg]	1.58 ± 0.62^{a}	1.31 ± 0.38^{a}	1.20 ± 0.30^{a}
Mn [mg]	6.38 ± 2.62^{a}	6.80 ± 3.07^{a}	5.42 ± 2.55^{a}
Vitamin A [μg]	1523 ± 1846.5^{a}	847.4 ± 491.5^{a}	895.9 ± 554.73^{a}
Vitamin D [μg]	3.75 ± 1.36^{a}	5.14 ± 7.57^{a}	3.33 ± 1.82^{a}
Vitamin E [mg]	12.86 ± 3.12^{b}	8.76 ± 2.47^{a}	11.13 ± 4.54^{a}
Vitamin B1 [mg]	1.67 ± 0.55^{a}	1.48 ± 0.45^{a}	1.44 ± 0.47^{a}
Vitamin B2 [mg]	2.28 ± 1.03^{a}	1.67 ± 0.59^{a}	1.68 ± 0.40^{a}
Niacin [mg]	22.10 ± 8.83^{a}	19.72 ± 11.02^{a}	18.51 ± 7.60^{a}
Vitamin B6 [mg]	2.56 ± 1.15^{a}	2.24 ± 0.72^{a}	2.18 ± 0.84^{a}
Folacin [μg]	225.7 ± 97.89^{a}	178.9 ± 68.12^{a}	193.6 ± 55.41^{a}
Vitamin B12 [μg]	4.04 ± 1.82^{a}	4.99 ± 4.52^{a}	3.89 ± 2.33^{a}
Vitamin C [mg]	39.62 ± 21.64^{a}	48.48 ± 36.26^{a}	56.93 ± 55.95^{a}
Energy of proteins [%]	12.9 ± 3.0^{a}	15.2 ± 3.9^{b}	14.3 ± 3.3^{b}
Energy of lipids [%]	40.6 ± 4.1^{b}	36.6 ± 6.3^{a}	39.9 ± 10.5^{b}
Energy of saccharides [%]	46.5 ± 3.0^{a}	48.2 ± 6.4^{a}	45.8 ± 8.5^{a}

Values represent arithmetical mean ± standard deviation. a, b – homogeneous groups according to the Tukey's test.

Tab. 5. Contents of nutrients in daily food rations in women before and after the nutrition education.

Discriminant	DD women in October	DD women in January
Energy [kJ]	7461 ± 2019	7641 ± 1828
Proteins [g]	60.6 ± 21.1 *	67.1 ± 19.4 *
Lipids [g]	73.90 ± 30.3 *	64.40 ± 21.2 *
Saturated fatty acids [g]	26.43 ± 11.2	24.28 ± 10.6
Monounsaturated fatty acids [g]	29.35 ± 13.6 *	24.17 ± 8.9 *
Polyunsaturated fatty acids [g]	11.46 ± 8.78	10.7 ± 7.15
Cholesterol [mg]	208.6 ± 99.8	215.54 ± 109.9
Saccharides [g]	235.2 ± 68.4 *	262.2 ± 63.1 *
Saccharose [g]	61.08 ± 36.6	64.86 ± 30.6
Lactose [g]	8.96 ± 8.94	10.46 ± 8.91
Dietary fibre [g]	15.84 ± 6.02 *	18.23 ± 6.85 *
Na [mg]	1802 ± 828.0	1883 ± 787.7
K [mg]	2482 ± 845.4	2821 ± 939.2
Ca [mg]	560.1 ± 317.4	615.9 ± 302.8
P [mg]	1006 ± 367.8 *	1162 ± 403.2 *
Mg [mg]	238.9 ± 118.8 *	278.3 ± 109.7 *
Fe [mg]	8.57 ± 2.94	9.98 ± 3.43
Zn [mg]	8.25 ± 2.72	9.02 ± 2.97
Cu [mg]	0.95 ± 0.48	1.08 ± 0.44
Mn [mg]	4.42 ± 1.97 *	5.78 ± 1.87 *
Vitamin A [μg]	742.8 ± 488.9	828.4 ± 654.6
Vitamin D [μg]	1.97 ± 1.64 *	2.84 ± 3.78 *
Vitamin E [mg]	8.62 ± 6.43	7.49 ± 5.82
Vitamin B1 [mg]	0.96 ± 0.51	0.98 ± 0.40
Vitamin B2 [mg]	1.22 ± 0.48	1.38 ± 0.52
Niacin [mg]	12.78 ± 6.54	13.62 ± 5.63
Vitamin B6 [mg]	1.46 ± 0.64 *	1.74 ± 0.69 *
Folacin [μg]	138.2 ± 46.8 *	160.1 ± 52.2 *
Vitamin B12 [μg]	2.52 ± 1.31 *	3.48 ± 3.42 *
Vitamin C [mg]	40.7 ± 30.7 *	49.8 ± 34.9 *
Energy of proteins [%]	13.5 ± 3.5	14.5 ± 3.0
Energy of lipids [%]	36.8 ± 8.1 *	32.4 ± 5.8 *
Energy of saccharides [%]	49.7 ± 8.4 *	53.1 ± 7.1 *

Values represent arithmetical mean ± standard deviation. * – significance of differences at $p < 0.05$

the children attending at this age day care centres (nurseries, kindergartens).

Parents' education

One of the major socio-economic factors influencing diets and development of young people is the level of parents' education, especially mothers. Caretakers having higher education are characterized by better knowledge of child's nutrition needs, which results in more rational diet. The level of education is usually connected with higher economic status of the family, which influences easier access to valuable food products but also contributes to the fact that young people from families with parents with higher education have the possibility to use payable recreation, hygiene and health protection facilities, which favours healthy lifestyle and proper child development. Both Wronka et al. [14] and Farajian et al. [5] in their studies determined positive effect of mothers' education level on BMI value of their grown children. It is striking that such relation was not determined in case of fathers' education [14]. In the study of Lazzeri et al. [1], cultural resources, especially fathers', and father's occupation were found to influence nutritional status of Tuscan children [5]. Wronka et al. [14] also stressed a positive effect of mother's care at home during children's early

Tab. 6. Contents of nutrients in daily food rations in men before and after the nutrition education.

Discriminant	DD men in October	DD men in January
Energy [kJ]	10668 ± 2886	10886 ± 2697
Proteins [g]	85.92 ± 24.53	92.0 ± 24.71
Lipids [g]	109.4 ± 40.41	107.6 ± 35.8
Saturated fatty acids [g]	41.47 ± 17.62	39.49 ± 13.12
Monounsaturated fatty acids [g]	43.85 ± 18.23	44.65 ± 17.21
Polyunsaturated fatty acids [g]	14.73 ± 8.84	15.75 ± 4.63
Cholesterol [mg]	366.2 ± 207.92	362.5 ± 187.6
Saccharides [g]	325.9 ± 78.22	324.2 ± 65.58
Saccharose [g]	72.71 ± 38.16	76.421 ± 33.23
Lactose [g]	13.18 ± 11.46	12.31 ± 9.98
Dietary fibre [g]	21.28 ± 6.26	24.76 ± 7.21
Na [mg]	2892 ± 1033	3052 ± 1222
K [mg]	3048 ± 1115	3454 ± 1077
Ca [mg]	812.3 ± 407.9	822.5 ± 418.9
P [mg]	1378 ± 378.8	1508 ± 402.1
Mg [mg]	314.2 ± 123.8	338.7 ± 100.2
Fe [mg]	12.21 ± 3.73	13.14 ± 3.89
Zn [mg]	11.29 ± 3.16	12.27 ± 3.62
Cu [mg]	1.16 ± 0.37	1.28 ± 0.36
Mn [mg]	5.01 ± 2.52 *	7.41 ± 2.39 *
Vitamin A [μg]	951.4 ± 626.5	1034 ± 814.2
Vitamin D [μg]	3.56 ± 2.46	4.12 ± 2.82
Vitamin E [mg]	10.22 ± 4.64	10.76 ± 3.79
Vitamin B1 [mg]	1.38 ± 0.51	1.50 ± 0.43
Vitamin B2 [mg]	1.62 ± 0.68	1.78 ± 0.61
Niacin [mg]	17.21 ± 6.22	19.21 ± 8.47
Vitamin B6 [mg]	2.03 ± 0.98	2.28 ± 0.88
Folacin [μg]	187.6 ± 57.8	198.2 ± 67.66
Vitamin B12 [μg]	4.12 ± 1.80	4.22 ± 2.89
Vitamin C [mg]	40.92 ± 29.8	50.78 ± 48.12
Energy of proteins [%]	13.4 ± 5.1	14.2 ± 3.9
Energy of lipids [%]	39.0 ± 9.8	39.2 ± 7.1
Energy of saccharides [%]	47.6 ± 6.6	46.6 ± 7.0

Values represent arithmetical mean ± standard deviation. * – significance of differences at $p < 0.05$

childhood on higher height of girls, as compared to girls who attended day care centres (nursery, kindergarten). LOTH et al. [15], however, draws the attention to the influence of parents' education (lower than secondary school), during child's upbringing, on the regulation related to food consumption such as force-feeding or consumption restrictions.

Place of residence

In many nutritional studies, the place of residence was taken into consideration as it was thought to affect the diet. The study on Greek students [16] showed that people living in family home did not change their diet when they started their education at the University in Crete. Different situation was reported in case of students living far from home and, in this group, reduction in consumption of fresh fruits, cooked and fresh vegetables, fish, seafood and olive oil was observed, whereas increased consumption related to saccharides, wine, alcohol and fast food, crisps and convenience food was observed. A disturbing phenomenon observed by BIBILONI et al. [17] was the decline of Mediterranean diet among the young people, in particular men living outside their homes. LARSON et al. [18] stated that people consuming meals in family home are character-

ized by higher consumption of fruits, vegetables, both green and orange, and energy. Similar results were found in a group of Italian students [19]. In another studies [20], significant differences in boys' diets were observed between the boys from rural and urban areas of Russia. In Poland, the differences between the diets of people living in cities and in the country have been vanishing for more than a decade [21].

Economic situation

One of the factors most strongly influencing the composition of the diet is economic situation. In this work, we decided to check whether subjective students' assessments concerning their financial status had any influence on the composition of their diets. Such relation was not determined, which was caused by various students' expectations. It was probably the effect of subjective assessment of economic status of the respondents because, undoubtedly, the family economic status has a direct influence on nutritional state of its members [1, 22]. KIRSCHNER et al. [23] showed that women from families with low income were classified to, the so called, permanently anaemic group, and favourable nutrition patterns were more often realized by women from urban areas. In American studies carried out in groups with high economic status, significant differences were observed in the consumption of fruits and cereals (higher consumption was attributed to higher economic status), soya products, legumes and dietary fibre (higher consumption was connected to lower economic status). The highest differences were shown between the group of white people with higher economic status and the group of African Americans with lower status, where additionally significant differences related to the consumption of eggs and bacon (higher consumption was linked to lower economic status) [24]. MURAKAMI et al. [25], when studying the effect of diet cost among almost 4 thousands Japanese female students, observed that higher cost of energy intake was connected to higher intake of fruits, sweetened drinks, oils, fish, crustaceans and meat, the consequence of which was higher intake of lipids (in particular saturated fatty acids), cholesterol, sodium and animal protein. However, lower consumption of cereals (rice, bread and pasta) was noted, which was attributed to lower intake of saccharides. Many studies reported that economic situation of the family influences the structure and frequency of meals. An interesting observation was that family dinner was more often present in families with higher socio-economic status [26]. Moreover, as reported by NEUMARK-SZTAINER et al. [27], higher frequency of family dinners had a positive effect on diet structure, of both girls and boys, and also on higher intake of dietary fibre, calcium, iron, folacin, pyridoxine, cobalamin and vitamin C and E, and on lower intake of trans fatty acids and saturated fatty acids [28]. Consumption of family dinners has also social implications. Higher frequency of family dinners was linked to less incidents of dangerous behaviour among young people [29]. Favourable effect of family meals can be destroyed in families, where TV is on during the dinner, or when the meal is consumed outside the home [26]. In people consuming family dinners, a lower percentage of overweight people (difference 15%) was observed, as compared to people consuming this meal outside their home. Therefore, as reported in many studies, higher economic status of the family relates to changes in nutrition, which can both positively and negatively affect nutritional behaviour.

Education

In 2003, American Dietetic Association, Society for Nutrition Education and American School Food Service Association published a report in which they stated that childhood obesity reached epidemic proportions caused directly by the lack of physical activity and dietary errors [30]. Currently, school healthy schemes and education in rational nutrition are supported in many countries. Nutritional education is also advisable for pregnant women, even though, as noted by VERBEKE et al. [31], pregnant women intuitively change their nutritional behaviour to more rational and fulfilling their needs. Nutritional education ran in obstetric clinics in the United States of America, concerning the prevention of gestational diabetes, had a positive effect, which resulted in decreased insulin concentration in blood and increased infants' birth weight [32]. Positive effect of education on changes in nutrition was stressed in studies of, among others, LACEY et al. [33] (studies in West Chester University, Pennsylvania), KOLODYNSKY et al. [34] (University of Vermont, northeast part of USA), ROSSITER et al. [35] (studies in Canada) and Misra [36] (studies from Texas).

In studies of nutritional habits of students from Nebraska [37], it was observed that women more often tried diets low in lipids and saccharides than men. Moreover, women thought that their current diet contained too much saccharides, in particular simple saccharides, and too much total lipids. Women also more often tried to lose their weight, as compared to men. Significantly higher percentage of men did not try to modify their diets. Reported observations correlated with the results

presented here, where education in proper human nutrition lasting for several months led to improvement in womens' diets but had no positive effect on men. Higher intake of manganese in male group should be attributed to more frequent drinking of hot tea during winter season, thus it was an accidental artefact and not an intentional change.

It seems that young people should understand the subject of food and nutrition and be aware of the relations between diet and health in order to choose food products to maintain full health and reduce the possibility of the onset of diseases of affluence later in life. These diseases affect the length and quality of life, biological, productive and economic potential not only of an individual and his family, but also of the whole population. Therefore, it is crucial to transfer scientifically based knowledge on food and nutrition to children and young people.

CONCLUSIONS

The contents of nutrients in DD of female students was most favourable in group of females whose parents were highly educated, but the most vulnerable to the diseases of affluence were the people with secondary education due to high lipids intake. Among the analysed socio-economic factors, the highest negative impact on DD contents of students from Szczecin had their residence in a dorm during the studies, which was highly connected to the second unfavourable factor, economic situation of the family. Education in rational nutrition lasting for several months, measured by the improvement in diet contents, had a positive effect only in case of women. Thus, with limited financial resources, women will benefit more from nutrition education then men. Self-evaluation of the economic situation of the examined people was subjective and made it impossible to observe any significant differences in nutrition.

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