

THE ASSESSMENT OF FOOD CONSUMPTION PATTERNS OF FEMALE STUDENTS OF A SELECTED CATERING SCHOOL

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Abstract. This paper attempts to find out if the education of female students of a secondary school of catering has had any effect on the improvement of their diets. The research shows that the diets of first-grade students provides the recommended dietary allowance for energy and nutrients to a greater, yet still insufficient extent than the diets of higher grade students. The results of the statistical analysis showed, that among 23, only in a few causes of nutrients, differences between percentage of recommended intake were significant. The consumption of energy, water-soluble vitamins and minerals, mainly calcium, copper and magnesium has been insufficient to satisfy the recommended dietary allowances. The intake of fat-soluble vitamins (A and E) has been sufficient or even higher than the recommended dietary allowance while that of sodium several times exceeded the low normal range in the case of all female students under study.

Key words: food diets, 24-h dietary records, nutrients, daily intake, meeting of recommended dietary allowances, female students

INTRODUCTION

Despite some favourable changes which have occurred in the structure of food consumption, the common nutritional errors identified by Polish research centres are still present. Children and adolescents are most vulnerable to the results of improper nutrition. The nutritional errors made at this stage of their lives may have adverse effect not only on their height, physical aptitude and psychophysical development, but also increase the risk of certain diseases (including cardiovascular diseases) and even mortality in adult life [Tomkins 2001, Ness et al. 2005]. Among many factors which have impact on the food consumption patterns of young people is the school environment in which students spend most of their time, and a school which provides education in the field of

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catering and nutrition should be able to better shape the nutritional behaviour and views of its students. Additionally, the school cafeteria can also have positive influence on the students' behaviour in this respect by means of promoting proper nutritional standards [Chwojnowska et al. 2003, Jeżewska-Zychowicz 2003, Flaczyk et al. 2003].

This study has been undertaken in order to find out if the diets of the female students of a selected catering school, evaluated in terms of quantity and quality, undergo any visible changes during their school education.

MATERIAL AND METHODS

The subjects of the study were 72 female students of Technikum Gastronomiczne in Gliwice, including:

- 42% – 15-year-olds, average height 162.2 ± 6.4 cm, average body weight 54.7 ± 10.2 kg,
- 33% – 18-year-olds, height 166.3 ± 6.0 cm, body weight 61.6 ± 11.8 kg,
- 25% – 19-year-olds, height 161.7 ± 4.9 , body weight 57.7 ± 9.2 kg.

The assessment of food consumption patterns was carried out in winter (when the risk of vitamin and mineral deficiencies is the highest) on the basis of 496 weekly 24-hour dietary recalls. The quantitative evaluation was performed on the basis of photographs in the Album of Foodstuffs and Dishes of Various Portion Sizes [Szczygłowa et al. 1991] and the household measurements. For the purposes of the qualitative evaluation a scoring method based on the Bielińska test [Żywnienie... 2000] was used, the scores being given those elements of the dietary recalls which contributed to proper nutrition. The overall score was then compared with the scoring scale in order to assess the quality of the diet.

The contents of nutrients in daily diets was calculated using FOOD-2 computer software, developed on the basis of the "Food Nutritional Value Tables" of 1998 [Kunachowicz et al. 1998]. The unavoidable losses due to technological and culinary processing were calculated on the basis of coefficients derived from List No. 10 in FOOD-2. These amounted to: for vitamin C – 55%, for vitamin B₁ – 20%, for vitamin B₂ – 15%, for vitamin PP – 15%, for vitamin B₆ – 10%, for vitamin A – 25%, for vitamin E – 10%, for the remaining nutrients – 10%.

The findings related to the intake of each nutrient were cross-referenced to the recommended dietary allowances. The intake of nutrients (except for those itemised below) was compared to the safe level of recommended dietary allowances. The intake of copper was compared to the lower limit of the safe intake range, that of sodium and potassium – to the lowest recommended intake [Normy żywienia... 2001], and that of manganese – with the lower limit of the appropriate safe intake range [Recommended... 1989]. The intake of cholesterol was compared with the acceptable value of 300 mg/person/24 h, and that of fibre – with the recommended value of 30 g/person/24 h [Normy żywienia... 2001].

Personal questionnaires covered, among other things, the participant's age and sex, job and physiological condition. The collected data were used to establish the RDAs and to calculate the BMI values.

The results of the study were analysed using one-way analysis of variance. The a priori hypothesis that there are not differences in average values between the three dif-

ferent age group of female students was verified using the F-Snedecor test at a significance level of $p \leq 0.05$. The least significant differences were calculated using the Student's t-test. To validate the obtained results, the standard deviation (SD) and the coefficient of variation (CV) were also determined. The SPSS software package (SPSS Sp. z o.o.) was used for statistical analysis.

RESULTS AND DISCUSSION

Quantitative assessment of food consumption patterns

The results of the statistical analysis showed, that among 23, only in a few causes of nutrients, differences between percentage of recommended intake were significant. High values of variation coefficient (CV from 17 to 63%) for intake of nutrients could in consequence cause (among other factors) that the majority of differences found appeared insignificant (Table 1).

Energy and basic nutrients. The diets of all three groups of female students of Technikum Gastronomiczne in Gliwice were highly varied in terms of energy value (CV; 21-42%). The average energy value of their diets was unsatisfactory as it respectively provided only 87, 74 and 76% of the recommended dietary allowance for 15-, 18- and 19-year-olds. Only the maximum threshold values fully met the recommended allowance in the case of the two older age groups, and exceeded it by 59% in the case of 15-year-olds. On the other hand the minimum threshold values provided barely 44-49% of the recommended dietary allowance (Table 1). The energy structure also varied from the recommendation. The diets of the older girls were characterised by an excessive percentage of energy derived from fats, amounting to 39% and at the same time an insufficient intake of energy derived from carbohydrates, ~49% of the overall energy value. In the diets of 15-year-old females the percentage of energy derived from fats was also too high (34%), while that of energy derived from carbohydrates was close to the recommended allowance (54%) The percentage of energy derived protein met the recommendations (12%) only in the diets of the oldest, i.e. 19-year-old females. In the diets of the remaining two groups of females it accounted for 11% of their total energy value.

The simultaneously calculated BMI values indicating too low body mass in 56% of 15-year-old females and 17 and 33% of 18- and 19-year old females suggest that the intake of energy may have remained low for a prolonged period of time (Fig. 2).

The primary reason for incomplete provision of the recommended dietary allowance for energy was the insufficient consumption of carbohydrate products and dishes. The highest average provision of the recommended dietary allowance was found among 15-year-old females and it amounted to 78%. This age group was also the only one in which the upper threshold value fully met the recommended dietary allowance and the lower one amounted to just 45% of the recommended norm. The intake of carbohydrates by older girls was similar and ranged from ~35 to ~89% of the norm. The average intake of this nutrient amounted to 67 and 58% of the recommended dietary allowance (Table 1).

Table 1. Energy and nutrient intake in daily diets
Tabela 1. Spożycie energii i składników odżywczych z racjami pokarmowymi

Component Składnik	Female students – Uczennice											
	15-year-olds – 15-latki				18-year-olds – 18-latki				19-year-olds – 19-latki			
	X ± SD*	CV** %	percentage of recommended intake procent normy		X ± SD	CV %	percentage of recommended intake procent normy		X ± SD	CV %	percentage of recommended intake procent normy	
			range zakres	X			range zakres	X			range zakres	X
1	2	3	4	5	6	7	8	9	10	11	12	13
Energy, kcal Energia, kcal	2 041 ±853	42	47.33-159.2	86.9	1 838 ±383	21	43.9-107.8	74.3	1 653 ±528	32	48.7-115.3	75.7
Total protein, g Białko ogółem, g	59.8 ±24.3	40	49.6-205.6	114.6	54.1 ±9.2	17	64.7-132.6	102.1	52.8 ±13.3	25	69.1-177.7	124.1
Fat, g Tłuszcze, g	82.0 ±38.4	47	54.8-189.0	101.2	81.0 ±18.8	23	55.4-141.8	89.2	74.5 ±26.0	35	64.0-155.3	104.2
Total carbohydrate, g Węglowodany ogółem, g	283.0 ±108.8	38	45.2-141.0	77.5	236.1 ±50.9	22	34.6-90.0	66.5	207.5 ±66.2	32	36.5-86.5	58.4
Fibre, g Błonnik pokarmowy, g	18.9 ±5.8	30	40.0-94.3	63.1	14.0 ±2.4	17	33.7-66.7	46.8	15.6 ±3.9	25	30.3-66.7	51.9
Cholesterol, mg Cholesterol, mg	331.4 ±187.9	57	33.7-268.3	110.5	285.0 ±75.7	26	41.7-141.3	95.0	265.9 ±64.9	24	40.3-108.3	88.6
Equivalent of retinol, µg Ekwiwalent retinolu, µg	904.3 ±510.7	56	76.7-370.2	150.7 ^b	765.6 ±218.9	28	62.8-171.4	109.4 ^a	775.5 ±237.0	30	60.3-172.3	129.3 ^{a,b}
Witamin E, mg Witamina E, mg	12.9 ±7.9	61	61.6-416.5	161.6 ^b	11.1 ±3.3	30	76.8-175.8	111.2 ^a	12.4 ±6.5	50	67.1-287.6	154.6 ^b
Thiamine, mg Tiamina, mg	1.0 ±0.3	34	49.0-134.5	77.7 ^b	0.78 ±0.1	19	34.7-75.7	55.6 ^a	0.8 ±0.2	25	30.9-64.1	49.1 ^a
Riboflavin, mg Ryboflawina, mg	1.3 ±0.6	45	39.2-144.2	73.1	1.0 ±0.26	25	26.2-73.5	52.8	1.1 ±0.3	26	33.4-89.3	67.8

Table 1 – cont.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Niciane, mg		10.2	34	34.8-90.3	56.9	9.4	16	34.9-67.0	52.1	9.9	22	32.4-64.8	52.5
Niacyna, mg		±3.4				±1.5				±2.2			
Piridoxine, mg		1.3	32	53.3-147.3	90.2 ^a	1.1	20	30.6-93.1	65.7 ^b	1.2	27	38.3-93.9	64.1 ^b
Pirydoksyna, mg		±0.4				±0.25				±0.3			
Witamin C, mg		39.3	63	26.3-160.8	65.5	26.0	35	10.8-65.2	43.3	25.7	34	29.8-75.0	42.9
Witamina C, mg		±24.9				±9.2				±8.8			
Sodium, mg***		2 508.4	37	268.2-839.4	501.7	2 382.8	15	297.2-522.9	414.4	2 620.2	17	336.8-564.7	455.7
Sód, mg***		± 918.3				±371.3				±443.1			
Potassium, mg		2 292.1	41	46.9-167.3	91.7 ^a	1 837.5	16	58.2-101.9	73.5 ^{ab}	1 929.5	19	34.4-68.2	55.1 ^b
Potas, mg		±943.1				±298.2				±369.1			
Calcium, mg		598.6	55	26.0-104.5	54.4	466.8	37	12.1-67.1	42.4	484.9	36	26.7-74.8	44.1
Wapń, mg		±331.6				±175.6				±175.1			
Phosphorus, mg		1 007.7	40	72.5-236.9	125.9	878.8	22	66.0-142.2	109.8	869.0	25	66.4-141.0	108.6
Fosfor, mg		±404.1				±192.6				±216.1			
Magnesium, mg		237.6	40	41.1-145.0	84.8	191.7	24	42.8-89.4	59.9	212.9	22	45.0-98.9	76.1
Magnez, mg		±95.0				±46.2				±47.4			
Iron, mg		9.5	36	40.7-110.0	63.1	8.3	18	40.0-74.0	55.2	9.2	23	35.7-79.3	65.8
Żelazo, mg		±3.4				±1.5				±2.2			
Zinc, mg		8.1	39	36.2-152.0	80.8	7.6	17	49.5-94.3	73.1	7.6	24	45.8-97.5	76.2
Cynk, mg		±3.2				±1.3				±1.8			
Copper, mg		1.1	41	34.7-130.7	70.0 ^a	0.8	28	35.3-98.7	56.9 ^{ab}	0.9	21	27.0-63.5	45.9 ^b
Miedź, mg		±0.4				±0.3				±0.2			
Manganese, mg		3.5	38	94.5-324.0	176.0	3.2	27	88.0-235.0	157.1	3.3	34	99.5-280.0	166.9
Mangan, mg		±1.4				±0.9				±1.1			

*Standard deviation, **coefficient of variation, ***only sodium inherent to food; sodium chloride added during meal preparation was not considered.

Differences between values (percentage of recommended intake) signed this same letters or nonsignet are nonsignificant.

*Odchylenie standardowe, **współczynnik zmienności, ***tylko chlorek, sól naturalnie występujący w żywności; nie uwzględniano chlorku sodu dodawanego w czasie przygotowywania potraw.

Różnice pomiędzy wartościami (procentowego pokrycia normy) oznaczone tymi samymi literami lub nieoznaczone są nieistotne.

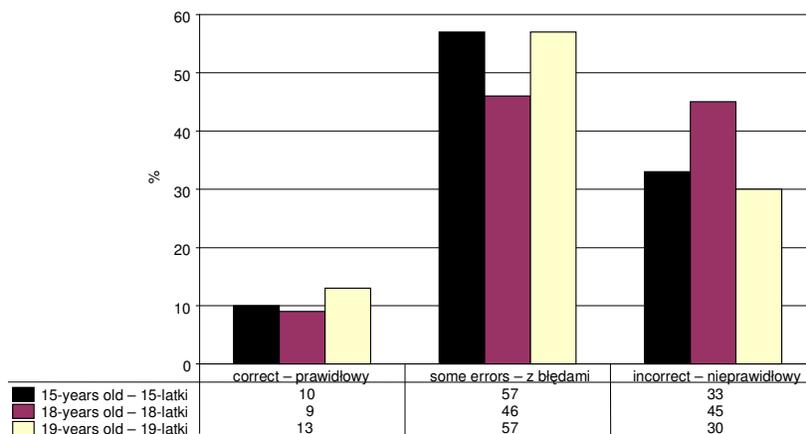


Fig. 1. Qualitative evaluation of female students' diets in percentage terms
Rys. 1. Ocena jakościowa jadłospisów w ujęciu procentowym

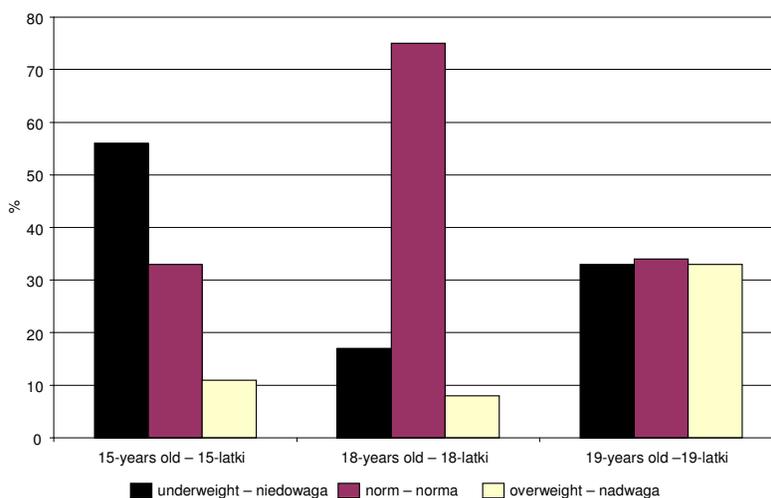


Fig. 2. Body Mass Index of female students
Rys. 2. Wskaźnik masy ciała uczennic

The low content of carbohydrates in general resulted in a deficiency of fibre in the diets under study. An average intake closest to the recommended one (30 g/person/24 hrs) was found in the group of 15 year-old females, but it amounted only to 63% of the above-mentioned value with the range running from 40 to 94%. In the diets of both older age groups fibre was present in similar amounts ranging from ~32 to ~67%, while the average intake accounted for ~50% of the recommended amount. The insufficient

amount of fibre in the girls' diets was the consequence of a small percentage of vegetables and fruit, wholemeal grain products and legumes, as proven in the qualitative assessment (Table 2). On the other hand the increased intake of sugar and sweets resulted in a higher percentage of saccharose in the overall amount of the energy provided by the diet, accounting for 13, 12, and 11% in the respective age groups. According to the recommendations, this percentage should not exceed 10% [Normy żywienia... 2001].

The average supply of fats in the diets of 15-, 18- and 19-year-old females corresponded to the recommendations amounting to 101, 89 and 104% of the recommended norm. The diets of the above-mentioned groups were also characterised by a high variability of the content of this nutrient (CV: 47, 23 and 35%), and the wide intake range resulted in the lower values providing only half of the recommended dietary allowance and the upper values being too high and amounting to 189, 142 and 155% of the recommendation (Table 1).

The content ratio of saturated:monounsaturated:polyunsaturated fatty acids was 1.0:1.0:0.5 in the diets of the 18-year-old females and 0.9:1.0:0.6 in the diets of the other two age groups. The overall percentage of energy derived from fat amounted to 15, 15, and 7%, 12, 13, 7%, and 14, 15, 8% respectively. The maximum caloric value of saturated fatty acids should not exceed 10% of the overall energy derived fats. For monounsaturated fatty acids (MUFA), it should not exceed 13% and for polyunsaturated fatty acids (PUFA) – 6% (but it can be as high as 9%) [Normy żywienia... 2001]. It can then be stated that in the diets of all three groups of females the percentage of energy from fatty acids was too high. Considering the fact that the calculations referred to the content of fatty acids in unprocessed products, their amount could have been even higher as in products subjected to culinary processing the content of saturated fatty acids increases while that of unsaturated acids decreases.

The highest average intake of cholesterol, amounting to 331 mg/person/day was found in the diets of 15-year-old females, while in the other two groups the cholesterol intake was lower than the acceptable value of 300 mg/person/day, amounting to 285 and 266 mg/person/day.

The average protein consumption in the diets of all three groups of adolescent females fully met the recommended safe intake levels. The average protein content in the diets of the groups of adolescent females under investigation fully met the safe intake level. Consumption of this nutrient varied most among 15-year-olds (CV = 40%) ranging between 50 and 206% of the recommended allowance with the average value amounting to 115% of the norm. In the other two age groups the average protein intake amounted to 102 and 124% of the recommended amount within the ranges of 65-133% and 69-178% of the recommendation. The percentage of animal protein in the overall protein intake was ~60%. The remaining percentage of protein intake derived from plant sources was the result of insufficient consumption of cereals, certain vegetables and legumes (Table 1).

The percentage of adolescent females who met the recommended dietary allowances at the level of less than 66.7% was: for energy – 29%, for protein – 9%, for carbohydrates – 52%, and for fats – 20%.

In general adolescent females meet the recommended dietary allowances to a lesser degree than adolescent males. Intakes in excess of the recommended dietary allowances are also more frequently found in the food consumption patterns of adolescent males [Ilow et al. 1999 a, b].

Table 2. Daily diet score according to Bielińska
Tabela 2. Ocena punktowa jadłospisu według Bielińskiej

Scoring criteria Kryteria oceny	Score Liczba punktów	Female students – Uczennice		
		15-year-olds 15-latki %	18-year-olds 18-latki %	19-year-olds 19-latki %
How many meals does the daily diet consist of? Ile posiłków zawiera jadłospis?				
4-5 meals – 4-5 posiłków	5	80	82	79
3 meals – 3 posiłki	2	13	16	18
less than 3 meals – mniej niż 3 posiłki	0	7	2	3
Do the intervals between meals exceed 5 hours? Czy przerwy między posiłkami przekraczają 5 godzin?				
no – nie	5	93	81	87
yes – tak	0	7	19	13
How many meals contain animal protein products? W ilu posiłkach występują produkty dostarczające białko zwierzęce?				
3-4 meals – w 3-4 posiłkach	5	27	25	38
2 meals – w 2 posiłkach	2	34	47	33
1 meal or none – w 1 posiłku lub żadnym	0	39	28	29
How many meals contain milk or dairy products? W ilu posiłkach występuje mleko i jego przetwory?				
2-3 meals – w 2-3 posiłkach	5	51	35	48
1 meal – w 1 posiłku	2	32	35	30
none – w żadnym	0	17	30	22
How many meals contain fruit and vegetables rich in vitamin C and β -carotene? W ilu posiłkach występują warzywa i owoce obfitujące w witaminę C i β -karoten?				
3 meals – w 3 posiłkach	5	10	18	29
2 meals – w 2 posiłkach	2	51	45	48
no such meals – w żadnym	0	39	37	23
How many meals are served with salads? W ilu posiłkach podano surówkę?				
2 meals – w 2 posiłkach	5	3	1	8
1 meal – w 1 posiłku	2	39	36	43
no salads at all – nie podano wcale	0	58	63	49
How many meals contain fruit and vegetables? W ilu posiłkach występują owoce i warzywa?				
3-4 meals – w 3-4 posiłkach	5	39	42	49
2 meals – w 2 posiłkach	2	36	34	34
1 meal or none – w 1 lub wcale nie występują	0	25	24	17
How many meals contain wholemeal bread or cereals? W ilu posiłkach występuje ciemne pieczywo lub grube kasze?				
2 meals – w 2 posiłkach	5	5	8	16
1 meal – w 1 posiłku	2	29	21	18
none – nie występują wcale	0	66	71	66

Similarly to the results of this study, certain researchers of the diets of female secondary school students found energy intakes to be lower than the recommended amount [Ostrowska et al. 2003 a, Ilow et al. 1999 a]. The above-mentioned as well as other studies also showed that the diets of adolescent males and females met [Ilow et al. 1999 a, Krechniak and Zaborski 1999, Ostrowska et al. 2003 a] or in the case of male diets even exceeded the demand for energy [Ilow et al. 1999 b]. In young people's diets the energy structure differed from the dietary recommendations. Similarly to the findings of this study, some researchers reported excessive intakes of energy from fat and too low intakes of energy from carbohydrates while intakes of energy from protein were generally appropriate in the diets under study [Krechniak and Zaborski 1999, Ostrowska et al. 2003 a, Ilow et al. 1999 a, b].

The average content of protein (in contrast to the findings of this study) and carbohydrates in the diets of other groups under study was not sufficient to provide the recommended dietary allowance. The percentage of vegetable protein in the total amount of protein was found to be too low. An insufficient intake of fibre in the diets of both adolescent females and males was identified [Ilow et al. 1999 a, b, Krechniak and Zaborski 1999, Ostrowska et al. 2003 a]. Similarly to the findings of this study, the percentage of saccharose in the overall intake of energy was found to be too high [Ilow et al. 1999 a].

The average fat intake met the recommended dietary allowance [Ilow et al. 1999 a], or was lower in the case of adolescent females [Ostrowska et al. 2003 a], and in the case of adolescent males exceeded it by 10-46% [Ilow et al. 1999 b, Ostrowska et al. 2003 a]. On the other hand the cholesterol intake did not exceed the acceptable level [Ilow et al. 1999 a, Krechniak and Zaborski 1999] or the identified intake, especially in the diets of boys was too high [Ostrowska et al. 2003 a, Ilow et al. 1999 b].

A comparative analysis of the results of this study and the findings of the authors cited above confirms unfavourable correlations associated with the intake of basic nutrients. In spite of the increased consumption of carbohydrates in recent years and the resulting higher percentage of energy derived from them, the overall supply of these nutrients in diets is still too low and the energy derived from carbohydrates does not meet the demand. A marked decrease in the consumption of fats in the 1990s, when compared with the 1980s, did not result in decreasing their intake to the level of the recommended dietary allowance. The findings of this study, when compared with the results published by other researchers, lead to the statement that certain tendencies associated with the improper structure of energy derived from various still hold true. Although over the past decades the level of knowledge and education in the field of healthy nutrition has increased considerably, the intake of fibre is still too low and the consumption of saccharose is rising. Positive changes include an increase in the percentage of polyunsaturated fatty acids in people's diets [Augustyniak and Brzozowska 2002].

Minerals. The diets of the 15-year-old adolescent females under study were generally characterised by a higher content of minerals when compared with the diets of the older girls and the coefficient of variation (CV) for all minerals under analysis ranged from 15 (in the case of sodium) to 55% (in the case of calcium).

The average content of calcium and copper in the diets of all groups under study did not provide the recommended dietary allowances. The greatest deficiency was identified in the case of calcium, the intake of which in all age groups provided ~40% of the rec-

ommendation. The lower values of calcium intake provided only ~20% of the recommended dietary allowance with the lowest threshold values being found in the group of 18-year-olds. The upper threshold values provided 67% of the recommended norm in the case of 18- and 19-year-old females and 105% in the case of 15-year-olds (Table 1). Calcium deficiencies were the consequence of insufficient consumption of milk and dairy products which are the major, valuable and relatively cheap source of this mineral (Table 2).

The diets of 19-year-old females was characterised by the lowest consumption of copper amounting to barely 46% of the lower level of the safe intake range. In the other two groups the mean intake levels for copper corresponded to 50% of the recommended dietary allowance for 18-year-old females and 70% (sufficient difference in compare to 46%) for 15-year-old females. The lowest threshold levels of copper intake amounting to 27% of the recommendation, were found among the 19-year-old girls, while the highest levels amounting to 131% of the norm were identified among the 15-year-olds. In the diets under study the primary sources of copper were grain products, potatoes as well as meat and its products.

Low intakes of potassium and magnesium were found particularly among older age groups. The highest mean intake of potassium by 15-year olds met the recommended dietary allowance – 92% (taking into account a 10% tolerance) while that of magnesium provided 85% of the recommended amount. Among 19- and 18-year-olds the intakes of the above-mentioned minerals provided just 55 (sufficient difference in compare to 92%) and 76% as well as 74 and 60% of the recommended dietary allowance. The lower threshold values of potassium intake amounted to 34% of the recommendation for 19-year-old females, while the upper threshold values amounted to 167% of the recommendation for 15-year-olds. The respective values for magnesium amounted to 40% of the recommendation for all females under study and 145% of the norm for 15-year-olds (Table 1). The main source of potassium were potatoes, cereals, dairy products, meat and vegetables while the primary source of magnesium were cereals, potatoes, fruit and vegetables.

Iron and zinc were present in the diets of the female students in insufficient amounts. As in the case of other microelements, the average zinc intake was the highest among 15-year-olds amounting to 81% of the recommended dietary allowance. In the other two groups it amounted to ~75%. The lower intake levels amounted to ~40% of the recommendation, while the upper ones provided ~100% of the recommendation. Only among 15-year-olds they amounted to 152% of the recommended allowance. The mean values for iron intake amounted to 55% of the recommended allowance for 18-year-olds and ~64% in the case of the other two groups. The minimum daily intake also amounted to 40% of the recommended norm for all adolescent females, reaching the maximum level only among 15-year-olds (Table 1).

Phosphorus and manganese were consumed by the adolescent females in the amounts which fully met or exceeded the recommended dietary allowance. The highest mean intakes amounting to 126 and 176% were found among the 15-year-olds, while the lowest ones amounting to 109 and ~160% were identified in the other two groups. The primary sources of manganese were grain products, potatoes and vegetables, and the main sources of phosphorus were grain products as well as dairy products and meat.

The average intake of sodium, mainly in the form of table salt, exceeded the recommended dietary allowance several times in all age groups amounting to 502, 414 and

456% of the minimum recommended amount. Even the lower intake levels exceeded the norm two or three times in all groups of females.

The optimum calcium-phosphorus ratio should be 1:1 [Normy żywienia... 2001]. Low calcium intake and at the same time high phosphorus intake are responsible for the fact that in the diets of the age groups under study this ratio was 0.55, 0.53, 0.55 respectively. Such a Ca:P ratio may lead to calcium-phosphorus metabolism disturbances which are particularly undesirable in the case of children and adolescents whose skeletons haven't finished growing [Miller et al. 2001, Novotny et al. 2003].

As many as 77% of the females under study did not meet the requirements for copper in the amounts corresponding to at least 66.7 per cent of the norm. At the same time 40% of the subjects consumed potassium, calcium, magnesium and iron in amounts less than 2/3 of the recommended dietary allowance.

Similarly to the results of this study, the picture of adolescent nutrition emerging from the review of available literature on this subject [Waśkiewicz et al. 2000] and the findings of other researchers [Augustyniak and Brzozowska 2002, Dziuda et al. 2000, Iłow et al. 1999 a, Nazarewicz et al. 2000, Ostrowska et al. 2003 b, Szponar et al. 2002] is characterised by unsatisfactory, frequently only partial provision of the recommended dietary allowances for calcium and copper as well as insufficient intakes of magnesium, zinc and iron, and at the same time excessive intakes of sodium and phosphorus.

One of the threats associated with the deficiencies of iron, zinc and copper in young girls is the risk of anaemia [Iłow et al. 1999 a, Krechniak and Zaborski 1999, Olejnik et al. 1999, Chwojnowska et al. 2003, Ołtarzewski et al. 2003, Ostrowska et al. 2003 b]. Adolescent and adult males meet the recommended dietary allowances for minerals to a greater extent than adolescent and adult females [Iłow et al. 1999 a, b, Dziuda et al. 2000]. In the adolescent males' diets the average level of the majority of minerals was in accordance with the recommendations, the only exceptions being phosphorus and sodium, the levels of which exceeded the recommended amounts [Iłow et al. 1999 b, Krechniak and Zaborski 1999, Ostrowska et al. 2003 b]. Nevertheless the level of calcium intake among adolescent boys did not meet the recommended dietary allowance [Chwojnowska et al. 2003, Iłow et al. 1999 b, Olejnik et al. 1999, Ołtarzewski et al. 2003]. The magnesium intake by male adolescents was also insufficient [Olejnik et al. 1999].

Vitamins. Of all vitamins under investigation an alarmingly low intake of vitamin C was identified. The highest average intake of this vitamin and at the same time the widest intake range ($CV = 63\%$) was found among 15-year-old females whose diets provided only 66% of the recommended dietary allowance, with the highest values amounting to 161%, and the lowest ones to just 26% of the norm. In the diets of older girls the content of vitamin C allowed to meet 43% of the recommended allowance. The lowest daily intake was found among 18-year-olds and amounted to 11% of the recommendation, while the highest one was identified among 19-year-olds and amounted to 75% of the recommended value (Table 1). The research into food consumption patterns was carried out and that is the reason why the assortment of fruit and vegetables in the adolescent females' diets was poorly varied and the calculated values of Vitamin C intake were depleted by technological and culinary losses amounting to 55%.

Low intake of fruit and vegetables is one of the major nutritional errors made not only by adolescents but also adults. An average diet usually contains too little vitamin C [Ziemiański and Wartanowicz 1999].

The demand for B-group vitamins was satisfied to the greatest extent (just as in the case of vitamin C) by 15-year-old girls. The lowest average intakes provided 57% of the recommended dietary allowance (niacin), while the highest intakes provided 90% (pyridoxine). The lowest daily intake was that of niacin (35% of the recommended allowance, while that of riboflavin and pyridoxine was the highest (145% of the recommended intake). The lowest mean values of intake of such vitamins by 18-year-olds provided 50% of the recommended allowance in the case of thiamine, riboflavin and niacin, and 66% in the case of pyridoxine. Among 19-year-old females the average intake amounted to 49% for thiamine and 67% for riboflavin. The lowest intake values provided ~30% of the recommended dietary allowance while the upper ones provided from 64% (thiamine) to 94% (pyridoxine) of the recommended value.

According to some authors, the reason for a low intake of B-group vitamins is not only the insufficient consumption of cereal products, but also their deteriorating quality. Additionally, the low intake of riboflavin by adolescents is caused by an insufficient amount of milk and dairy products in their diets [Flaczyk et al. 2003].

Vitamin A and E levels in the diets under study fully provided or even exceeded the recommended dietary allowances (Table 1). The highest average intake of the above-mentioned vitamins, amounting to 151% for vitamin A and 162% for vitamin E was again found among 15-year-olds, while the lowest intakes amounting to 109 and 111% was identified among 18-year-old females. The range of vitamin A and vitamin E levels was most varied in the diets of 15-year-old females (CV = 56 and 61%), while the threshold intake values in this group ranged from 77 to 370% and 62 to 416%.

The high supply of antioxidant vitamins is conducive to ensuring the proper functioning of the organism and preventing the so-called civilisation-related metabolic diseases. A diet that is well-balanced in terms of basic nutrients and rich in vitamins A, C, E and selenium can be an effective exogenous antioxidative system [Tomkins 2001, Ness et al. 2005]. Considering the action of tocopherols in the human body, certain researchers point out that the current norms solely help to avoid a deficiency of this vitamin without ensuring its sufficient provision at a level optimal for the health of the individual. According to some researchers the increased demand for tocopherols in the order of 17-20 mg/day, would not only decrease the risk of certain diseases, but also reduce it to the maximum possible extent. With regard to the protective action of this vitamin in the processes of ageing of the organism and prevention of degenerative diseases, consumption of higher amounts of vitamin E seems to be justified [Normy żywienia... 2001].

The percentage of persons who met the recommended dietary allowances at the level of less than 66.7% was: for vitamin C – 83, thiamine – 71, riboflavin – 63, niacin – 87, pyridoxine – 37, Vitamin A – 6, Vitamin E – 3.

The diets of the female students of Technikum Gastronomiczne in Gliwice, which were the subject of this study, were characterised by insufficient response to the demand for vitamin C and B-group vitamins and at the same time full provision of the recommended dietary allowance for vitamins A and E. These findings are confirmed in the literature cited below. On the basis of literature review it was established that the consumption of vitamins in different population groups in Poland does not meet the recommendations [Augustyniak and Brzozowska 2002, Ziemiański and Wartanowicz 1999]. The most commonly deficient vitamins are vitamin C and B-group vitamins, although there are cases of their increased consumption beyond the recommended

amount [Dziuda et al. 2000, Iłow et al. 1999 a, b, Nazarewicz et al. 2000, Ostrowska et al. 2003 b, Stopnicka and Szarmej 2001, Szponar et al. 2002]. According to other sources, the intake of vitamin C was close to the recommended level. However, as in this study deficiencies of group B vitamins were identified [Duda et al. 1998, Iłow et al. 1999 a, Ostrowska et al. 2003 b].

The results concerning the provision of the recommended dietary allowance for vitamins A and E among female adolescents confirm the findings of other authors who identified a high supply of these vitamins in diets [Iłow et al. 1999 a, Ostrowska et al. 2003 b], often exceeding the recommended norm [Iłow et al. 1999 b, Krechniak and Zaborski 1999]. Some researchers reported that the consumption of vitamin A by children and adolescents is too low and that of vitamin E is satisfactory [Duda et al. 1998, Krechniak and Zaborski 1999]. As in the case of minerals, male populations meet the recommended dietary allowances more often than female populations. The diets of male adolescents fully satisfied the requirement for vitamins or even exceeded it. The content of vitamins in the diets of males was generally higher than in the diets of females [Iłow et al. 1999 b, Ostrowska et al. 2003 b].

The low consumption of fruit and vegetables among adolescents does not satisfy the dietary allowance for vitamin C. The reason for a decreased intake of B-group vitamins is the insufficient consumption of cereal products, especially the wholemeal varieties, and their low quality. Additionally, the low intake of riboflavin among adolescents is caused by an insufficient amount of milk and dairy products in their diets [Flaczyk et al. 2003, Jeżewska-Zychowicz 2003].

Qualitative assessment of food consumption patterns

On the basis of the obtained results it was found that more than half of the daily diets of 15- and 19-year-old females contained nutritional errors. The structure of the frequency of the occurrence of selected foodstuffs and dishes was deemed correct only in the case of approximately 10% of the diets with the largest proportion of correct diets (13%) being found in the eldest age group (Fig. 1). Approximately 80% of the diets under study in all age groups consisted of the recommended 4-5 meals. At the same time 7% of the 15-year-old females ate less than three meals. Out of the entire population under study 81-93% of girls consumed meals regularly at intervals of not more than 5 hours. The percentage of girls who ate lunch on a regular basis was higher among 15-year-olds than the elder groups. During the questionnaire period 90% of the younger females and 100% of the elder ones ate dinner at least 5 days a week. Only half of the population of 18- and 19-year-olds and 67% of 15-year-olds ate supper on a regular basis (Table 3). As regards breakfast and lunches excessive consumption of chocolate bars, crisps, buns, cookies and carbonated soft drinks was observed.

The percentage of products containing animal protein was low in the daily diets under study. Approximately 25% of the diets of 15- and 18-year old females and 38% of the diets of 19-year-old females included 3-4 meals which provided animal protein. At the same time about 1/3 of girls in each group consumed such foodstuffs only once a day or did not eat them at all. Deficient consumption of milk and dairy products was the cause of low intakes of calcium and riboflavin among adolescent females. Only half of the diets of 15- and 19-year-olds included at least 2-3 meals containing milk and dairy products. In approximately 30% of diets dairy products were present in at least one meal,

Table 3. Meal consumption frequency
Tabela 3. Częstotliwość spożywania posiłków

Female students Uczennice	Percentage of subjects eating meals for at least 5 days in week Procent populacji spożywającej posiłki przynajmniej przez 5 dni w tygodniu			
	breakfast I śniadanie	lunch II śniadanie	dinner obiad	supper kolacja
15-year-olds 15-latki	6	44	89	67
18-year-olds 18-latki	66	33	100	58
19-year-olds 19-latki	75	12	100	50

however 17% of the diets of 15-year-olds and 30% of the diets of 18-year-olds did not include any products of this kind. The most frequently consumed dairy products were fruit yoghurts, less often buttermilk and kefir. As regards cheese the hard of swiss-style cheese were the most frequent choice while milk was usually consumed together with breakfast cereals or as an addition to coffee.

The assortment of fruit and vegetables in the daily diets was not sufficiently varied due to the fact that the assessment of food intake was carried out in winter. In approximately 34% of the diets of all females under study fruit and vegetables were present in 2 meals; and 3-4 meals in 40% of the diets of 15- and 18-year-olds and 49% of the diets of 19-year-olds. 23% of 19-year-old females and 38% of the females from the other two age groups did not include this important group of foodstuffs products in their diets at all. The diets in which a salad was served with one meal accounted for 36% in each group under study, those in which at least two meals included salads accounted for 1% of the diets of the 18-year-old females and 8% of the diets of 19-year-olds. More than half of all girls did not eat salads at all. Those who did most often consumed carrot, beetroot and both white and red cabbage salads. The most frequently consumed fruit were apples and bananas. Low intake of fibre was the consequence of insufficient consumption of cereals and wholemeal bread. At least 66% of the diets of females in each group did not include such foodstuffs.

The available literature suggests that the most frequent errors in nutrition of children and adolescents in Poland are the irregularity of meals, their insufficient number, omission of breakfast and lunch as well as excessively long intervals between meals. School children tend to eat too much sweets, replacing basic meals with snacks and fast foods. At the same time they consume insufficient amounts of milk, dairy products, fruit, vegetables and wholemeal bread and excessive amounts of simple carbohydrates [Gronowska-Senger 2001, Hamułka et al. 2000, 2002].

According to foreign sources there are significant differences in food consumption patterns not only between populations belonging to a given nationality [Arab et al. 2003, Perry et al. 2004], but also between populations belonging to different countries [Jahns et al. 2004], or even regions of the same country [Serra-Majem 2001]. Over 2 billion of the world's population are exposed to the risk associated with the deficiency of vitamin A, iodine and iron. Other deficient nutrients are zinc, folic acid and group B vitamins [Ramakrishnan 2002]. The highest risk populations in terms of nutritional

deficiencies, particularly the deficiencies of iron, vitamin C, vitamin E, and B-group vitamins are children and adolescents. Fortification of food, particularly cereals, in France, Ireland, Great Britain and Spain has had a major impact on the increased consumption of vitamins and minerals [Serra-Majem 2001]. Both in Europe and the United States excessive intakes of protein, fat and sugar has been observed. Young people in Central and Eastern Europe consume too few vegetables, fruit and dairy products which results in low intakes of calcium, fibre and vitamin C. This deficient consumption is less visible in Western Europe. Improper nutrition is related not only to habits and traditions, but also changes in the prices of foodstuffs being a direct result of political and economic in recent years. Common nutritional errors increase the risk of certain diseases, particularly among the populations of Ukraine, Belarus and Central Poland exposed to the consequences of the nuclear disaster in Chernobyl [Parizkova 2000].

A noticeable feature of the nutritional pattern of adolescent and adult females in the U.S. is the deficiency calcium, folic acid, vitamin B₆, vitamin B₁₂, and vitamin C [Arab et al. 2003]. According to other reports the diets of Asian (but not European) [Novotny et al. 2003] and American youths could do with an increased intake of calcium [Miller et al. 2001, Rockett et al. 2001, Arab et al. 2003].

SUMMARY

It has not been found that the education received by students of the selected school of nutrition and catering has had any effect on the improvement of their nutrition. The results of the statistical analysis showed, that among 23, only in a few causes of nutrients, differences between percentage of recommended intake were significant (but not in this same direction). The diets of first-grade female students meet the recommended dietary allowance for energy, water-soluble vitamins and the majority of nutrients to a greater, yet still insufficient extent. However both 15-year-olds and the girls from older age groups make nutritional errors associated with a too low intake of animal protein, fruit, vegetables, wholemeal bread and cereals, milk and dairy products resulting in the insufficient provision of the recommended dietary allowance for energy (74-86%), minerals, mainly calcium, copper and magnesium (~40, 46-70% and 60-85% respectively), and water-soluble vitamins (43-66% for Vitamin C), and at the same time sufficient or slightly higher intake of fat-soluble vitamins (A and E), and an excessive intake of sodium. The Body Mass Index (BMI) values indicating too low body mass in 56% of 15-year-old females and 17 and 33% of 18- and 19-year olds suggest that the above-mentioned intake of energy may have remained low for a prolonged period of time.

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OCENA SPOSOBU ŻYWIENIA UCZENNIC WYBRANEJ SZKOŁY GASTRONOMICZNEJ

Streszczenie. W pracy podjęto próbę stwierdzenia czy edukacja młodzieży żeńskiej w średniej szkole gastronomicznej wpłynęła na poprawę sposobu żywienia. Badania wykazały, że sposób żywienia dziewcząt klasy pierwszej pozwolił na pokrycie norm na energię i składniki odżywcze w stopniu lepszym, lecz najczęściej niezadowalającym, w stosunku do dziewcząt klas wyższych. Wyniki analizy statystycznej wskazują, że jedynie w wypadku kilku składników (na 23 analizowane) wystąpiły istotne różnice w pokryciu norm spożycia. Spożycie energii, witamin rozpuszczalnych w wodzie oraz składników mineralnych, głównie wapnia, miedzi i magnezu nie pozwoliły na pokrycie norm, spożycie witamin rozpuszczalnych w tłuszczach (A i E) było właściwe bądź podwyższone, a sodu kilkakrotnie przewyższało wartość minimalnej normy spożycia wśród wszystkich badanych dziewcząt.

Słowa kluczowe: racje pokarmowe, zapis żywieniowy z ostatnich 24 godzin, składniki odżywcze, dzienne spożycie, pokrycie normy, uczennice

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