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Assessment of iron intake and the state of knowledge about its disturbances and food sources among students of Poznan universities

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ABSTRACT

Introduction. Iron is one of many essential mineral components necessary for normal functioning of organisms. This microelement takes part in transport of oxygen from the lungs to the tissues, DNA synthesis, and is essential for normal activity of numerous enzymes.
Aim. The aim of the work was the assessment of iron consumption among students of Poznan universities with consideration of the need for this mineral component.
Material and methods. The study was conducted between the months of February and October 2012. Based on the randomly chosen study group, 100 people were analyzed – 66 females and 34 males. In total 25 people from each of the four Poznan universities: Poznan University of Medical Sciences, August Cieszkowski University of Life Sciences, Poznan University of Technology, as well as Eugeniusz Piasecki Academy of Physical Education were included into the studied population. In this study a questionnaire was a tool used in the analysis. Statistical analysis was conducted with the use of computer programs: STATISTICA version 10 and Microsoft Office Excel 2007. Determination of average values of iron, vitamin C, calcium and fiber intake, was performed with the use of DIETETYK 2011.
Results. Satisfaction of the need for iron differs depending on the university and gender. The low iron intake was observed at Poznan University of Medical Sciences, while the high one at the University of Natural Science. Men (25) more often delivered with food adequate amount of iron in comparison to women (3). Increase in iron intake was observed together with the increase in the amount of calories in the diet as well as higher BMI. The study also showed that chronically ill people as well as women heavily bleeding during menses more frequently suffered from anemia. The main source of heme iron for the students was poultry meat, while the source of non-heme iron were mainly whole-wheat products.

Keywords: diet, iron, anemia, demand.

Introduction

Iron is an essential microelement required for normal functioning of living organisms. Iron bound to hemoglobin and myoglobin, takes part in the transport of oxygen. It is also essential on the particular stages of the respiratory chain, regulates the cell cycle, DNA synthesis as well as functioning of enzymes, eg. catalases [1].

The need for iron differs depending on the gender, age as well as the state of the human body. It increases during pregnancy, lactation, during the course of a neoplastic process, in chronic diseases or when vegetarian diet is observed.

Deficiency of iron is the most commonly occurring alimentary deficiency, which results in anemia, causing

among others inhibition of physical and psychological development in children or disturbances in immunological functions. Excessive supply and absorption of iron, on the other hand, can lead to dysfunction of organs as well as an increased risk of developing a neoplasm [2].

Iron in food occurs in the heme form, absorbable in 20%, it's source are for ex. meat, giblets, fish, seafood as well as in the non-heme form, present in green and string vegetables, absorbable only in 5% by the body [3]. Bioavailability of iron is conditioned by the type of food being consumed, among others by the presence of phytates, oxalates, tannins and some macroelements for example calcium [2].

In Poland average consumption of iron amounts to 12.4 mg per day. Men consume on average 15.0 mg of iron per day, women however 10.2 mg per day, which is too low in reference to the consumption norm for women [3].

Familiarity with the symptoms and causes of iron deficiency as well as food sources of this microelement allows for the use of diet with the appropriate iron content and if need be early diagnosis of the disease and implementation of an appropriate treatment.

Aim

The aim of the study was the assessment of iron consumption among students of Poznan universities. This was done with the consideration of the need for this mineral component, as well as the assessment of the state of knowledge on the subject of iron disturbances and their treatment in the studied group.

Material and methods

Selection of the study material

The study was conducted between February and October 2012. Based on the randomly chosen study group, 100 people were analyzed – 66 females and 34 males aged from 19 to 23 years, students of various academic years and departments. Twenty five people from each of the four Poznan universities: Poznan University of Medical Sciences, August Cieszkowski University of Life Sciences, Poznan University of Technology, as well as Eugeniusz Piasecki Academy of Physical Education were included into the studied population.

Methods of survey study

Questionnaire survey composed of 22 closed and open-ended questions was a work tool used in the analysis.

Questions were concerning among others; university name, gender, weight, height, knowledge of the subject of microcytic anemia as well as food sources of iron. Questions about the use of additional supplements/medications, concomitant diseases, volume of menstruation in women, consumption frequency of particular food product groups rich in iron, vitamin C and fiber were included in the survey. Anemia was diagnosed by declaration. Diet diary, which included menu from last three days, comprised second part of the survey.

Methods of statistical calculations and form of result presentation

Statistical analysis was conducted with the use of computer programs: STATISTICA version 10 and Microsoft Office Excel 2007. Determination of average values of iron, vitamin C, calcium and fiber intake, was carried out, with the use of DIETETYK 2011 computer program. Methods used in statistical analysis were: multifactorial analysis of variance (ANOVA), Kruskal-Wallis nonparametric test, correlation analysis and test of significance for Spearman's rank-order correlation coefficient. Statistical *significance was set at* the 0.05 probability *level*.

Results

Excessive consumption of iron appearing in the results below, is defined as a difference between daily consumption and the normal demand for this microelement. For women excessive iron consumption is therefore equal to the iron consumption reduced by 18 mg, however for men – 10 mg was deducted from the iron consumption (according to the norms from 2008). In this way the defined variable allowed for coherent analysis of satisfaction of the demand for iron in both genders. In each case, positive value of this variable signifies meeting of the demand for this microelement, whereas negative value signifies, by what amount the demand for the element was not met.

All figures and tables include university abbreviations, which represent accordingly:

- MU – Poznan University of Medical Sciences,
- ULS – University of Life Sciences,
- PUT – Poznan University of Technology,
- APE – Academy of Physical Education,
- F – female,
- M – male,
- BMI – body mass index.

Survey questionnaire allowed for organization of the studied group according to the BMI. Alltogether

83% of the people examined, possessed normal body mass (59 women, 24 men). Overweight people comprised 9% (1 woman, 8 men) and those with first degree obesity 2% (2 men) of the respondents. In total 6% of people were underweight (6 women).

Amongst the surveyed persons 10 women admitted to have anemia. Additionally among the people studied there were individual people suffering from hypothyroidism, allergies, asthma, epilepsy and irritable bowel syndrome.

Iron consumption dependence on gender and university

The conducted analysis showed that in the studied group, women consumed on average less iron then their demand, while men consumed adequate amount of iron for their demand. Among the women studied, average excessive iron consumption was -8.47 mg, while among men 3.15 mg – **Table 1**.

The lowest excessive iron consumption was observed among the students of MU (average -6.78), the highest one – at ULS (average -0.80) – **Table 2**.

Influence of the diet caloric value on iron consumption

A strong positive correlation was determined between the amount of calories in the diet and the degree of meeting demand for iron. People with larger energy consumption supplied more iron to the body then people who consumed less calories. Rise in diet calories by 1 kcal increased iron consumption on average by 0.0078 mg.

In order to check the gender influence on the dependence between the amount of calories in the diet and iron consumption, correlation coefficients were set for those two variables for women (0.6513) and men (0.7585), separately. In both cases statistical tests showed that the correlation coefficient was significant when the level of significance was 0.05.

Influence of Body Mass Index (BMI) on iron consumption

Analysis of results showed that a positive dependence existed between BMI and adequately met demand for iron. People with higher Body Mass Index, generally consumed more iron than people with lower BMI. The rise in BMI by one unit translated to an increase in average iron consumption by 1.2406 mg.

In order to check the effect of gender on the dependence between BMI and iron consumption, correlation coefficients were set for those two variables, separately for women (-0.2178) and men (0.4580). In both cases the correlation coefficient was statistically different from zero, with significance level of 0.05. In case of men higher BMI, linked in general with a greater iron consumption, in the case of women this was inversely proportional – higher BMI in general translated to a lower iron consumption (**Figure 1**).

Iron consumption in heavily menstruating women

Women were divided into two groups – women with heavy menstruations and those with scant menses. Women who declared that they have heavy menstruations that last longer than 4 days were included to the group of women heavily menstruating.

In the group of 31 heavily menstruating women, average iron consumption totaled 9.79 mg, with stan-

Table 1. The values of excessive iron intake, depending on the university and gender

	The number of cases	Average (mg)	Min (mg)	Max (mg)	Standard deviation
MU	25	-6.78	-12.78	3.84	4.46
ULS	25	-0.80	-11.65	24.42	8.13
PUT	25	-4.21	-12.18	11.79	7.76
APE	25	-6.27	-15.94	4.83	5.63
F	66	-8.47	-15.94	3.84	3.50
M	34	3.15	-4.03	24.42	5.49

Table 2. The impact of chronic use of drugs on the occurrence of anemia

	Anemia	No anemia	Total
People chronically using medications	4 (25%)	12 (75%)	16 (100%)
People not using any medications chronically	6 (7%)	78 (93%)	84 (100%)
Total	10 (10%)	90 (90%)	100 (100%)

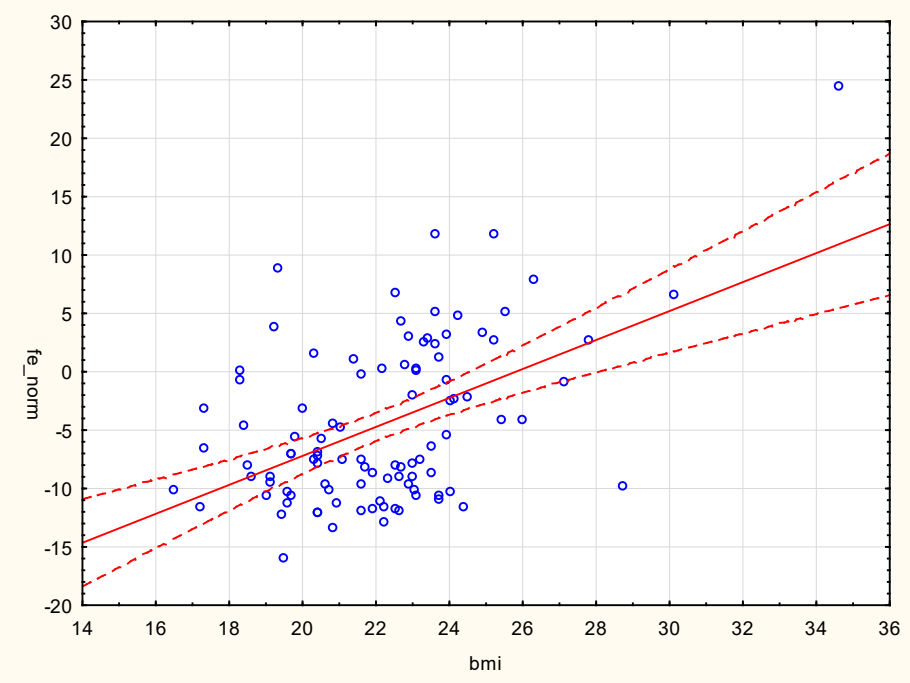

Figure 1. Correlation between iron consumption and BMI

dard deviation of 3.79 mg, while in the group of 35 women with normal menstruations, average iron consumption totaled 9.30 mg, with standard deviation of 3.26 mg.

In the group with heavily menstruating women, iron consumption was consequently slightly higher than in the group of women with normal menses, however this still was an unsatisfactory amount of daily demand.

Chronic diseases and iron deficiency anemia

Among surveyed persons, 16% declared medication use for chronic disease (anti-asthma, anti-allergy, anti-epileptic medications, as well as thyroid hormone replacement drugs).

Among 16 people using medications – 4 individuals (25%) had anemia, whereas among people not taking any medications chronically, 6 individuals suffered from anemia (7.14%) – **Table 3**.

At the significance level of 0.05 it can be stated, that people taking medications because of a chronic illness, statistically speaking suffered from anemia significantly more often.

Correlation between adequate iron consumption and consumption of vitamin C, fiber and calcium

Statistically significant correlation was found between vitamin C as well as fiber consumption and excessive iron consumption. In both cases correlation coefficients were positive, which means, that similarly to higher consumption of vitamin C, higher consumption of fiber was linked to a higher consumption of iron – **Table 4**.

Student knowledge on the subject of iron deficiency anemia

While student knowledge on the subject of iron deficiency anemia was checked, people surveyed were

Table 3. Daily iron, vitamin C, fiber and calcium intake, and correlations between them

	Mean	Standard deviation	r*			
			Fe_norm	Vit C	Fiber	Ca
Excessive iron intake (mg)	3.15	5.49	1.0000	**0.5386** P < 0.05	**0.6078** P < 0.05	0.2371
Vit C (mg)	104.37	90.88	–	1.0000	0.1759	0.2464
Fiber (g)	19.02	7.52	–	–	1.0000	0.1645
Ca (mg)	807.04	336.18	–	–	–	1.0000

** – correlation coefficient*

Table 4. Answers of the surveyed students on the question on a different name of iron deficiency anemia, relative to the university and gender

	MU	ULS	PUT	APE	Females	Males
Microcytic	92%	4%	36%	24%	53%	12%
Megaloblastic	4%	4%	4%	8%	5%	6%
Don't know	4%	92%	60%	68%	42%	82%

asked to pick the correct answer, concerning different name of the same disease entity, from three possibilities: 1) microcytic, 2) megaloblastic, 3) don't know.

The most correct answers (92% – 23 people) were given by questioned students from MU, next from PUT (36% – 9 people) as well as students from APE (24% – 6 people). From ULS as many as 92% (23 people) picked the answer – "don't know." More correct answers were given by women (53% of them) than by men (11.76%).

The next question verifying student's knowledge was to pick five signs/symptoms of anemia, from among nine given choices: brittle nails, constipation, painful tongue, vertebral column pain, hair loss, weakness, vomiting, hand tremor, paleness. To the typical signs/symptoms that can occur with existing anemia, belong: brittle nails, painful tongue, hair loss, weakness, and paleness.

The highest number of correct answers was given by MU students, 64% of them were able to give 4 out of 5 correct signs/symptoms. From APE and ULS majority questioned students were able to give 3 of 5 correct symptoms (52% and 36% respectively). Students from PUT indicated comparably 2 out of 5 and 4 out of 5 correct symptoms (32%, 36%). Not many people questioned were able to indicate all 5 signs/symptoms; respectively MU and PUT (12%), ULS (4%), APE (0%). Women showed higher familiarity of signs/symptoms, because as much as 42% of them were able to give 4 out of 5 signs/symptoms and 9% of them gave all occurring symptoms. Men however mainly were able to indicate 2 out of 5 or 3 out of 5 typical signs/symptoms (41% and 35% respectively). The most frequently chosen signs/symptoms were paleness and weakness.

Summarizing questions concerning student knowledge on the subject of microcytic anemia, we can conclude that students from MU had the greatest knowledge on the subject. It can be also concluded that women possessed the greatest knowledge about anemia. The results are shown in **Table 5**.

Student knowledge on the subject of food sources of heme and non-heme iron

Students were asked to write down at least three products, containing heme iron as well as at least three products, containing non-heme iron. All kinds of meat and meat products for example: beef, pork, poultry, veal, pate, liver, giblets, fish and egg yolk among others, were included as correct answers considering products rich in heme iron, whereas to correct answers considering non-heme iron product sources belonged such products as: grains, whole-wheat goods, oatmeal, bran, as well as beets, green vegetables, string vegetables and cacao.

While working out the results two options were considered; 1) correct answer – when students were able to give 3 correct answers and 2) incorrect answer – when students were unable to give any correct products, or gave only one or two correct food sources.

Correct answer on the subject of sources of heme iron were given by 36% of people surveyed. Among them the most correct answers were given by students from MU (96%), next by students from PUT (36%). As many as 96% of ULS students and 92% of APE students were unable to give correct responses, or gave less than 3 products containing heme iron. Among women the correct answer was given by 48%, whereas among men only 12% gave correct responses.

Table 5. Indication of correct answers on the foods rich in heme and non-heme iron, relative to the university and gender

Heme iron sources	MU	ULS	PUT	APE	Females	Males
The correct answer	96%	4%	36%	8%	48%	12%
Incorrect answer	4%	96%	64%	92%	52%	88%
Non-heme iron sources	MU	ULS	PUT	APE	Females	Males
The correct answer	96%	0%	28%	4%	44%	9%
Incorrect answer	4%	100%	72%	96%	56%	91%

Taking into consideration correct responses about products rich in non-heme iron, MU came out with the best result, because 96% of students were able to give correct answers to this question. 28% of students from PUT and only 4% from APE were able to give at least 3 sources of non-heme iron. No one questioned from ULS was able to give a correct response. The study showed that more questioned women (43%), than men (9%) were able to list at least three products containing non-heme iron fraction of this microelement.

Summarizing the knowledge on the subject of sources of iron, it can be stated that the greatest knowledge of products rich in particular fractions of iron among universities was demonstrated by students from MU whereas with gender consideration, women showed the greatest source of knowledge (**Table 6**).

Iron supplementation formulations

Students were asked about the use of dietary supplements. In the case of a positive answer, they were asked to give the name of the pharmaceutical agent, which gave the possibility of checking if iron was part of the particular preparation.

Majority of students did not use any supplements. The greatest percentage of people that used iron preparations were students from MU (20%) (**Table 7**).

Considering gender, women more frequently than men reached for supplements. Additionally from the conducted studies, the results show that among the 10% of people suffering from anemia – 50% declared the use of iron preparations.

Preparations containing iron in their composition, such as: Sorbifer Durules, Ascofer, Revitaben, Feroplex, Hemofer, Bodymax plus and Centrum, were those which the use of was declared by the surveyed students.

Vitamin C supplementation

In the questionnaire, students were asked about the supplementation of vitamin C, which is one of the factors increasing the absorption of iron from the digestive tract. Most of the students (66%) declared that they do not use any forms of vitamin C preparations.

Supplementation with this vitamin was used by 60% surveyed students from APE. More women, among people asked, consumed vitamin C, as compared to men (**Table 8**).

Results from the conducted studies show that among 10 people declaring consumption of iron containing preparations – 7 people additionally consumed vitamin C.

Consumption of products rich in iron and vitamin C

For the purpose of assessment of frequency of consumed products, a table was created in which students were asked to pick one answer from five choices: 1 = every day, 2 = 1–3 times per week, 3 = >4 times per week, 4 = sporadically, 5 = never, found next to appropriate food group. Taking into consideration iron deficiency anemia, the study mainly focused on the analysis of food groups rich in this mineral component.

Frequency of products consumption, which are the best sources of heme iron, was analyzed. Therefore, the consumption of different types of meats was looked at, such as: pork, beef, poultry, game meat, giblets, fish, seafood. Pork was consumed most frequently 1–3 times per week or sporadically in Poznan universities, where more frequently pork was consumed by men. Beef however was consumed only sporadically and 20% of surveyed declared that it was not part of their diet at all. On the other hand 26% of men declared

Table 6. Consumption of dietary supplements by the responders, depending on the university and gender

	MU	ULS	PUT	APE	Females	Males
Don't take any dietary supplements	68%	80%	92%	68%	73%	85%
Take dietary supplements	20%	4%	0%	16%	14%	3%
Take other supplements	12%	16%	8%	16%	13%	12%

Table 7. Declaration of students about the consumption of vitamin C, depending on the university and gender

	MU	ULS	PUT	APE	Females	Males
Supplementation with vit. C	24%	28%	24%	60%	44%	15%
No supplementation with vit. C	76%	72%	76%	40%	56%	85%

Table 8. Percentage indication of the normal symptoms of anemia, depending on gender

	1/5	2/5	3/5	4/5	5/5
Females	3%	21%	24%	42%	9%
Males	6%	41%	35 %	15%	3%

Table 9. Indication of correct answers on the foods rich in heme and non-heme iron, relative to the university

Heme iron sources	MU	ULS	PUT	APE
The correct answer	96%	4%	36%	8%
Incorrect answer	4%	96%	64%	92%
Non-heme iron sources	MU	ULS	PUT	APE
The correct answer	96%	0%	28%	4%
Incorrect answer	4%	100%	72%	96%

Table 10. Indication of correct answers on the foods rich in heme and non-heme iron, relative to gender

Heme iron sources	Females	Males
The correct answer	48%	12%
Incorrect answer	52%	88%
Non-heme iron sources	Females	Males
The correct answer	44%	9%
Incorrect answer	56%	91%

Table 11. Consumption of dietary supplements by the responders, depending on the university

	MU	ULS	PUT	APE
Don't take any dietary supplements	68%	80%	92%	68%
Take dietary supplements	20%	4%	0%	16%
Take other supplements	12%	16%	8%	16%

Table 12. Consumption of dietary supplements by the responders, depending on gender

	Females	Males
Don't take any dietary supplements	73%	85%
Take dietary supplements	14%	3%
Take other supplements	13%	12%

Table 13. Declaration of students about the consumption of vitamin C, depending on the university

	MU	ULS	PUT	APE
Supplementation with vit. C	24%	28%	24%	60%
No supplementation with vit. C	76%	72%	76%	40%

Table 14. Declaration of students about the consumption of vitamin C, depending on gender

	Females	Males
Supplementation with vit. C	44%	15%
No supplementation with vit. C	56%	85%

that they consume beef even 1–3 times per week. Poultry meat was most frequently consumed from among all the meat types. From 64 to 92% of studied people consumed poultry 1–3 times per week. Game meat could be found on the opposite side of the spectrum. As a meat type it is consumed least frequently by 20–60% of surveyed students or not at all by 72–80% of students. There was an exception with ULS students, 20% of whom declared consumption of game meat 1–3 times per week. Giblets make ULS a meat product group which is consumed by students sporadically – mainly by men. The frequency of fish consumption at the universities varried. Students from MU mostly eat fish 1–3 times per week, while surveyed students from other universities declared sporadic consumption of fish. The least popular was seafood – most students (56–80%) declared that they do not eat them at all. Only women were declaring (34%) that they eat them sporadically.

Consumption frequency of food products containing non-heme iron was also analyzed. These products include: whole-wheat products, string vegetables, group of vegetables such as; spinach, sorrel, beets, rhubarb, cabbage, broccoli, dried fruits, as well as fruit groups such as; bilberry, blackberry, black currents, raspberry, bananas, black grapes. Whole-wheat products were consumed everyday (56–80% surveyed students). Among the questioned people there was no single respondent

who did not consume products from this food group. String vegetables were consumed sporadically – most surveyed women and men (70% and 62% respectively) pointed to their scarce consumption. Products from the vegetable group were most frequently consumed by students from MU – 60% marked that they eat those products 1–3 times per week, while at the other universities the same product group was consumed sporadically – 52% among surveyed students from each university. Dried fruits were also rarely consumed – mainly their consumption was declared by women. The last food group analyzed was the fruit group. People surveyed mainly claimed that they consume them 1–3 times per week, only students from ULS declared that these fruits show sporadically in their diet.

Discussion

In this study the level of consumed iron among Poznan university students was analyzed taking into consideration such factors as: type of university, gender, concomitant diseases. The knowledge on the subject of iron among the respondents was also studied.

Significant differences were observed in the consumption level of iron between universities and between genders. The correct daily iron consumption was observed only in 28% of people surveyed. Excessive iron consumption was seen at ULS (-0.80). Next in order were the following universities: PUT (-4.21), APE (-6.27) and MU (-6.78). It was also shown that excessive iron consumption was more pronounced among men (3.15) then in women (-8.47).

Positive correlation between calorific diet, and iron consumption was found in the analysis. People consuming more calories were supplying their bodies with more iron than people following low calorie diet. Positive correlation was also found between BMI values, and iron consumption. Those surveyed with higher BMI in general consumed larger amounts of iron than people with lower BMI. However, what is interesting is that men with higher BMI consumed more iron, while in women higher BMI translated to its lower consumption, which can be related to adherence to slim diets, as well as to a lower consumption of proteins by females.

Analysis showed that women with heavy menstruations consume a little more iron than women with normal menses.

Studies also showed that chronically ill people suffered more frequently from anemia. In patients with hypothyroidism, development of anemia can be caused by the deficiency of tyrosine, which hinders the synthesis of hemoglobin. Furthermore, medication use alone can be the cause of decreased absorption, not only of iron, but also of folic acid, which predisposes for the development of anemia.

During the study a statistically significant correlation was found between the consumption of vitamin C as well as fiber, and excessive iron consumption. Both alike, higher consumption of fiber as well as vitamin C were linked to a higher consumption of iron in diet. This can be due to the fact that in the student diet besides meat and fish, rich in heme iron, very frequently appeared whole-wheat products, which besides fiber, are a rich source of non-heme iron. Frequently in students' diet also appeared fruits containing this iron fraction and moreover abundant in vitamin C.

Most surveyed (77%) were not taking any dietary supplements, however some (10%) declared consumption of iron containing supplements. Women reached for supplements more frequently, which can be related to their cosmetic or medicinal needs for example, during heavy menstruations. Most students (66%) did not use any vitamin C supplementation. Amongst 10 students consuming iron preparations – 7 people consumed vitamin C.

The greatest knowledge on the subject of microcytic anemia was shown by MU students. They were able to pick the largest correct number of anemia signs/symptoms as well as iron dietary sources. Women possessed the greatest knowledge on the subject of anemia. Nevertheless they supply too little iron with diet.

Analyzing the frequency of consumption of iron rich products, it can be stated that students derive heme iron mainly from poultry meat. This fact can be conditioned by low price of this meat type, easier and faster method of its preparation and gustatory preferences. The least frequently consumed meat is game meat, which can be related to its characteristic taste as well as its scarce market availability.

Non-heme iron is most frequently supplied together with whole-wheat products. Consumption frequency of fruits and vegetables was more or less equal at the particular universities studied. These products are more often consumed by women.

In order to compare the results of this work with other studies, analyses were chosen taking into consideration people studying in secondary schools as well as those in universities.

First of them, conducted by Jeruszka-Bielak et al. included 182 women age 19–26 years old, studying at the Principal School of Rural Farming in Warsaw. The study showed that their nutritional method was inap-

propriate when taking into consideration iron consumption, which was higher in women supplementing this element (11.6 mg/d) than in women not using iron supplementation (9.0 mg/d) [4]. Considering the use of supplements, the study by Sigłowa et al., conducted among 440 students of Warsaw and Tarnów universities showed that 53.1% of student population, mainly women, used vitamin and mineral dietary supplements [5].

In the study of Szczepańska et al., looking at iron consumption among female secondary school students in the Silesia region, inadequate iron consumption (7.2 ± 1.7 mg) as well as low consumption of vitamin C (38 ± 17 mg) was shown in both girls living in cities, as well as those living in the countryside [6].

Differences were also observed in studies by Regulska-Ilow et al., conducted among 198 secondary school students from Oleśnica. Researchers also showed that there was deficient iron consumption among girls (around 10.7 mg/d), while in boys the food ration covered the daily demand for iron [7].

Analysis performed by Marzec et al., on 684 students from Lublin universities, showed a low consumption level of iron in female gender (on average: 9.04 mg at the Medical University, 7.77 mg at the University of Life Sciences and 7.73 mg at the Lublin Catholic University), whereas men consumed iron in quantities satisfying the norm, and sometimes even exceeding it (average: 10.4 mg at the Medical University, 13.1 mg at the University of Life Sciences and 8.87 mg at the Lublin Catholic University). Students taking supplements consumed approximately 3 times more iron and vitamin C in comparison to people not using supplements [8].

Discrepancies in the consumption of iron were observed in the study by Wajszczyk et al. This study included 3304 girls (11–15 years old) and 1855 women (20–23 years old) from Warsaw and vicinity. Higher consumption of iron was noticed as compared to this hereby study – 13 mg in women aged 20–23. It was also found that women living in the city consume more of this element (12.5 mg) than women living in the countryside (11.8 mg) [9].

Adequate level of iron consumption was shown in the study by Socha et al., taking into consideration nutritional methods of female students in Białystok (on average 8.5 mg) [10].

In the study of Bolesławska et al., including 1752 adults of Greater Poland region, it was found that the share of iron in diet was too low in comparison to the recommendation and current norm [11].

Research by Dybkowska et al., was however elaborated differently. The study was conducted on 409 adults living in Warsaw and their average consumption of iron was 10–12.7 mg, which was in accordance with the norm [12].

Analyzing the frequency of consumption of iron rich products, according to Dybkowska et al., products which supplied essential amount of this element included: bread and grain products (30–35%), meat and meat products (25–26%), vegetables (20–21%). The rest of the products supplied around 18–25% of the mineral component [12]. Similar values were also given in the study by Bolesławska et al. [11].

The results of above-mentioned analysis are similar to the results established in this research work, taking into consideration the value of consumed dietary iron. In majority of the studies the level of consumed iron was recognized as inadequate in the student group, especially among women. This can be due to the use of low calorie diets and general women's trend to stay slim. Greater iron consumption among men can be assumed to be conditioned by their greater calorific diet as well as more frequent consumption of meat and meat products. Too little iron consumption is in part caused by inadequate level of knowledge on the subject of anemia.

In Poland programs preventing anemia or population educating campaigns do not exist. Widespread knowledge on this subject would enable rapid recognition of this illness and implementation of appropriate treatment, in particular prophylaxis related to conscious nutrition. A prophylactic action, which can prevent iron deficiency, is the enrichment of such food products as cereal or fruit juices addressed to the groups of increased risk of iron deficiency as well as supplementation with pharmaceutical preparations [2].

Conclusions

1. Majority of the students do not consume adequate amount of iron in reference to the recommended norms for this age group.
2. Men in comparison to women consume more iron derived from the diet, which also stems from men's diet, which is higher in calorific value.
3. Chronically ill patients as well as heavily menstruating women suffer more frequently from anemia than those people who do not take any medications chronically and women with normal menses.
4. Women with heavy menstruations consume a little more iron than those women with normal menses, however these are still inadequate amounts in order to satisfy the demand.

5. Higher consumption of vitamin C and fiber in the diet in general translates to a higher consumption for iron.
6. Students from the Medical University and women have the greatest knowledge on the subject of iron deficiency anemia among the four Poznan universities.

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