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THE SOURCE OF PHOSPHORUS IN DIET OF 17 YEAR OLD YOUTH

ŹRÓDŁA FOSFORU W DIECIE 17-LETNIEJ MŁODZIEŻY

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Summary

Introduction. Phosphorus is an element naturally occurring in foods. A large amount of this compound is also added to foods such as emulsifiers, stabilizers, and rippers. The growing popularity of high-processed foods is becoming a problem, because in the diets children and young people followed excess phosphorus intake.

The purpose of this work was an evaluation of consumption of phosphorus and showing its sources in daily food ration of school children of age 17 years from Kuyavian-Pomeranian province.

Materials and methods. Information about the composition of ingested food ration was obtained by interview of 24 hours. On the basis of information on consumption and a phosphorus content in 100 g of food products, phosphorus content in daily food ration was calculated. The values obtained were compared with the norm for people aged 16-18 years old (EAR = 1050 mg/person/day). Next the percentage of phosphorus from the

six food groups in food rations for girls and boys were calculated, defining the structure of the element consumed. Differentiation of gender-related phosphorus intake was conducted by Mann-Whitney U test. Statistical analysis was performed using Statistica.

Results. The analysis showed that the diet of young people was characterized by a high content of phosphorus. The average content of phosphorus in the daily food ration of boys was 1939.8 ± 62.7 mg/person/day, representing 184.7% of the average demand for phosphorus (EAR). In the group of girls, phosphorus intake was significantly lower than in boys - 1245.7 ± 38.4 mg/person/day, representing 118.6% of the EAR. The main sources of phosphorus in the diet were grain products, potatoes and animal products (milk and dairy products, meat, sausages, fish and eggs).

Conclusions. Excessive intake of phosphorus was found in the diet of young people. 3 groups of food products were the source of over 80% of ingested phosphorus.

Streszczenie

Wstęp. Fosfor jest pierwiastkiem naturalnie występującym w żywności. Spora ilość tego związku dodawana jest również do żywności m.in. jako emulgatory, stabilizatory i spulchniacze. Rosnąca popularność żywności wysokoprzetworzonej staje się problemem, gdyż w dietach dzieci i młodzieży obserwuje się nadmiar spożycia fosforu.

Celem pracy była ocena spożycia fosforu i wyznaczenie głównych jego źródeł w całodiennej racji pokarmowej 17-letniej młodzieży z województwa kujawsko-pomorskiego.

Materiał i metody. Informacje o składzie spożytej racji pokarmowej uzyskano metodą wywiadu z 24

godzin. Na podstawie informacji o spożyciu oraz zawartości fosforu w 100 g produktów spożywczych obliczono zawartość fosforu w całodiennej racji pokarmowej. Uzyskane wartości porównano z normą dla osób w wieku 16-18 lat (EAR=1050 mg/osobę/dzień). Następnie obliczono procent fosforu z 6 grup żywności w racjach pokarmowych dziewcząt i chłopców, określając strukturę spożytego pierwiastka. Zróżnicowanie struktury spożytego fosforu związane z płcią przeprowadzono testem U Manna-Whitney'a. Analizę statystyczną przeprowadzono przy pomocy programu Statistica.

Wyniki. Analiza wykazała, że dieta młodzieży charakteryzowała się wysoką zawartością fosforu. Średnia zawartość fosforu w całodiennej racji pokarmowej chłopców wynosiła $1939,8 \pm 62,7$ mg/osobę/dzień, co stanowiło 184,7% średniego zapotrzebowania na fosfor (EAR). W grupie dziewcząt spożycie fosforu było istotnie niższe niż u chłopców i wynosiło $1245,7 \pm 38,4$

mg/osobę/dzień, co stanowiło 118,6% EAR. Głównymi źródłami fosforu w diecie były produkty zbożowe, ziemniaki oraz produkty pochodzenia zwierzęcego (mleko i produkty mleczne, mięso, wędliny, ryby i jaja).

Wnioski. Stwierdzono nadmierne spożycie fosforu w diecie młodzieży. Źródłem ponad 80% spożytego fosforu były 3 grupy produktów spożywczych.

Key words: consumption phosphorus, sources of phosphorus, school children

Słowa kluczowe: spożycie fosforu, źródła fosforu, młodzież szkolna

INTRODUCTION

Phosphorus is an element naturally occurring in foods, and its rich source in the diet are bread and cereal products, milk and dairy products, meat and meat products and fish, eggs, legumes, nuts [1]. In addition to the naturally occurring phosphorus in raw food, a large part of it can come from substances added to food. Phosphorus compounds are added to foods with a considerable degree of processing, for technological, economic and organoleptic properties using emulsifiers, stabilizers, release agents, clarifying agents, anti, binding and regulating acidity [1,2]. This applies in particular to meat and meat products, processed cheese, powdered soup concentrates, confectionery and sugary cola drinks [2]. The growing popularity of highly processed foods, convenience, including foods like 'fast food', bad eating habits in the diets of children and young people and adults is observed to be high in phosphorus [3, 4, 5, 6, 7, 8, 9]. Research shows that the problem of excessive consumption of phosphorus, is found mainly in schoolchildren and students, and the highest content of this element was found in the diets of boys and men aged 16-18 and 19-25 years and girls aged 13-15 and 16-18 years [4, 8, 10]. Excessive intake of phosphorus is disturbing because it may cause distortion of the body's mineral economy and, consequently, reduce the absorption of calcium, parathyroid stimulation; increased bone resorption and low calcium intake lead to bone demineralization [1]. This can be especially detrimental during the growing period, which lasts until the closure of bevacizumab, which is about 20 years of age, which is deposited 80-95% of peak bone mass. Therefore, it is important to monitor the intake of phosphorus in the diet of young people and raise awareness about the presence of phosphorus in food products.

The purpose of this study was to determine the phosphorus content in daily food ration of 17-year-old

adolescents and to determine the structure (%) of this element in their diet.

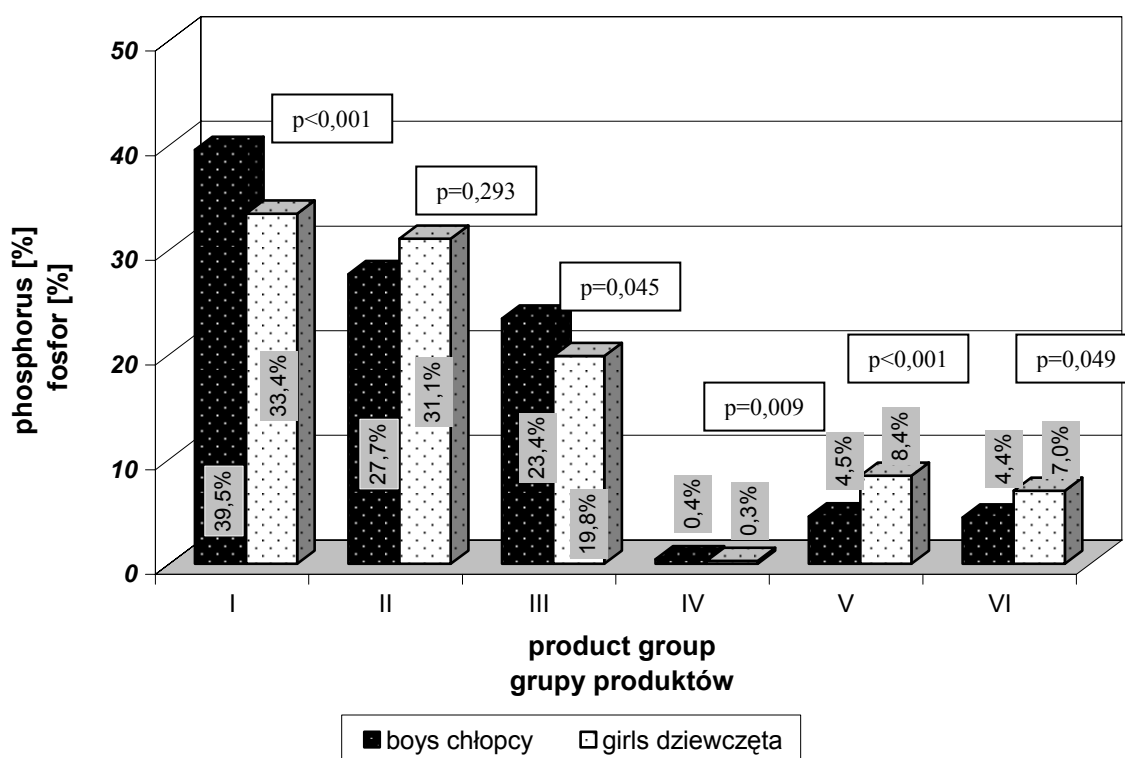
MATERIALS and METHODS

The study was conducted in spring 2003 on a group of 232 persons (130 boys, 102 girls). They included 17-year-old youth from high schools of Kuyavian-Pomeranian province. Information about the composition of ingested food ration was obtained by interview with the last 24 hours, using the Album of products and dishes.

On the basis of information on consumption of all products, phosphorus content of 100 g of food products [11] calculated the amount of phosphorus [mg/day] in the entire food ration for girls and boys. The values obtained were compared with the norm for people aged 16-18 years - the average phosphorus needs of the group (level of EAR = 1050 mg/person/day) [12]. Next, the percentage of phosphorus from 6 food groups: 1 cereals and potatoes; 2 milk and dairy products; 3 meat, sausages, fish and eggs; 4 fats; 5 vegetables and fruits; 6 sugar and sweets [13] in food rations for girls and boys, defining the structure of the element consumed was calculated. Differentiation of gender-related phosphorus intake was conducted by Mann-Whitney U test. Statistical analysis was performed using Statistica version 6.0 StatSoft.

RESULTS

The phosphorus content in daily food rations of boys and girls are shown in Table 1. Demonstrated statistically significant differences in phosphorus content of the diet related to sex. Mean content phosphorus in the daily food ration of boys was 62.7 ± 1939.8 mg / person / day, representing 184.7% of the average requirement (EAR) for phosphorus. But in the group of girls, phosphorus intake was significantly lower than in boys and it was 1245.7 ± 38.4 mg/person/day, representing 118.6% of the average demand for phosphorus (EAR).



I - cereal products & potatoes – produkty zbożowe i ziemniaki; II - milk & dairy products – mleko i produkty mleczne
 III - meat, smoked meat, fish & eggs – mięso, wędliny, ryby i jaja; IV – fats – tłuszcze; V - fruit & vegetables – warzywa i owoce; VI - sugar and sweets – cukier i słodczyce

Print 1. The structure of phosphorus [%] in daily food rations of school children of age 17 years

Ryc. 1. Struktura fosforu [%] w całodziennych racjach pokarmowych 17-letniej młodzieży

The studies were also conducted to assess the amount of phosphorus consumed from different food groups. Demonstrated statistically significant differences in the percentage of phosphorus coming from most of the analyzed groups based on gender. Such differentiation was not observed only in the group of milk and dairy products ($p = 0.293$). Among the 6 analyzed groups of phosphorus, the diets of most boys and girls have provided a total of cereals and potatoes - respectively 39.5% and 33.4% (Fig. 1). A large amount of phosphorus was also delivered by milk and dairy products (27.7% boys, girls 31.1%), less meat, sausages, fish and eggs (23.4% boys, girls 19.8%). The remaining two groups of products (vegetables and fruit, sugar and sweets) proved to be a poor source of phosphorus, providing respectively 4.5% and 4.4% for boys and 8.4% and 7.0% for girls.

It was proved that most of the phosphorus came from three groups of products (1 - cereals and potatoes, 2 - milk and milk products, 3 - meat, sausages, fish and eggs), bringing the total of 90.6% and 84.3% of this element the food rations of boys and girls.

Table I. The content of phosphorus in daily food rations of school children of age 17 years [mg/day]

Tabela I. Zawartość fosforu w racjach pokarmowych 17-letniej młodzieży [mg/dzień]

	phosphorus content [mg/person/day] zawartość fosforu [mg/osobę/dzień]				P
	boys (n=130) chłopcy (n=130)		girls (n=102) dziewczęta (n=102)		
	X ± SEM	Me ± QD	X ± SEM	Me ± QD	
phosphorus content of food rations zawartość fosforu w racjach pokarmowych	1939,8 ± 62,7	1819,5 ± 849,0	1245,7 ± 38,4	1173,5 ± 532,0	<0,001
EAR - Estimated Average Requirement (%) EAR - średnie zapotrzebowanie grupy (%)	184,7 ± 6,0	176,2 ± 83,3	118,6 ± 3,7	111,8 ± 50,7	<0,001

X - mean value, SEM - standard error of mean, Me - median, QD - interquartile range (IQR)

p - significance level - test U Mann-Whitney

X - wartość średnia, SEM – błąd standardowy średniej, Me - mediana, QD - rozstęp kwartylny,

p - poziom istotności - test U Manna-Whitneya

DISCUSSION

Consumption of too much phosphorus by 17-year-old boys and girls of Kuyavian-Pomeranian province shown in our study is confirmed by the results of studies presented in recent years. At the same time it draws attention to the higher intake of phosphorus by boys and men as compared to its consumption by girls and women [4,8,14]. Szponar et al. (2003) determined the amount of phosphorus in the diet of the Polish population in a wide range of ages (from 1 to 60 years of age and above) on the basis of individual food consumption in households [8]. Phosphorus intake was recorded in excess of average demand for phosphorus in all age groups except for children younger than 3 years old [8]. The highest phosphorus content in daily diets were found in the group of boys aged 16-18 years (1661 ± 607 mg/person/day) and men aged 19-25 years (1758 ± 565 mg/person/day). However, the diets of girls and women had slightly lower phosphorus content than those of boys and men, and the highest values were observed in age groups 13-15 and 16-18 years (1147 ± 435 and 1125 ± 480 mg/person/day) [8]. The phosphorus content of the diet of girls increased with age (up to 18 years of age). Among women aged 19-25 years and older content of this element was lower and remained at a similar level at about 1008-1016 mg/person/day [8]. Excessive intake of phosphorus in the diet of 16-17-year-old school students was also observed by Ostrowska et al. (2003). Demonstrated amount of phosphorus in the diets of boys and girls equaled 1647 ± 667 and 1053 ± 390 mg/person/day [4]. Also Maruszewska et al. (2005) reported a high intake of phosphorus in the diets of 16-19-year-old boys and girls respectively 1709 ± 850 and 1210 ± 556 mg/person/day [14]. A similar amount of phosphorus in the diet of slightly older age group was reported by Stefanska et al. (2005) [10].

Our study showed that three groups of products (cereals and potatoes, milk and dairy products, meat, sausages, fish and eggs) provided respectively about 91% and 84% phosphorus in the diet of boys and girls. In the studies presented by Rutkowska et al. (1993) the above-mentioned three groups of products, when added, cereal products and potatoes, which she analyzed separately, also provided much phosphorus, i.e. 87-91% [15]. However, grain products, including potatoes (about 32-34%) required slightly less phosphorus than demonstrated in our study (33.4-39.5%), meat products a bit more (about 2.6-6.2%),

although the author analyzed a group of eggs separately. A similar percentage of phosphorus in the whole diet was supplied by the group - milk and dairy products [15]. Kunachowicz and Wojtasik (2005) also pointed out that the main source of phosphorus are grain products (25-35%), dairy products (20-30%) and meat and meat products 20-25% [1]. These three product groups contributed slightly less phosphorus in the results of research presented by Dybkowska et al. (2004). Bread and cereal products, milk and dairy products and meat and meat products delivered 22-27%, 24-26% and 22-23% of phosphorus content to the diet of Warsaw adult population [9].

The study showed that food rations of 17-year-old youth were too high in phosphorus. This was particularly evident in the diet of the boys, in which the phosphorus content exceeded the norm by about 85%. The increase in phosphorus content in processed foods leads to excessive consumption of this element and may interfere with the body's mineral balance, impede the proper development of bone mass during adolescence and in later life increase the risk of osteoporosis.

CONCLUSIONS

1. Diet of young 17-year old students was characterized by a too high content of phosphorus, which may impair the body's mineral balance and hinder the achievement of high peak bone mass in adults.
2. The main source of phosphorus in the diet of 17 year old youth constituted cereals, potatoes and animal products (milk and dairy products, meat, sausages, fish and eggs).

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