

SUPPLEMENTS OF A DIET CONSUMED BY CHILDREN AGED 4 YEARS

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Nutritional patterns of 400 children (212 girls and 188 boys) selected at random from the whole territory of Poland, aged 4, have been assessed. The study was realised in Spring 2005 by way of a 7-day consumption record participated by mothers and kindergarten caretakers. The share of children using dietary supplementation, taking into account all analysed components, was 26.2 (22.2% girls and 30.9% boys). Diets of children consuming dietary supplements contained excessive contents of almost all analysed vitamins; certain vitamins exceeded the recommended levels even 4-5 times.

INTRODUCTION

The balanced amount of energy and food components in everyday nutrition not only ensures the appropriate development of young organisms, but also allows to stay healthy in the future. More frequent use of dietary supplements is observed that aims at completing the not always appropriate nutrition in the case of even small children. Supplementation applied in appropriate way allows keeping the healthy balance of food components, while both too high and too low consumption increases the risk of numerous diseases.

The analysis of dietary supplementation applied in a group of children aged 4 has been the purpose of this study.

MATERIAL AND METHODS

In the study 400 children (212 girls and 188 boys) selected at random from the whole territory of Poland on the basis of PESEL (personal identification number) register, aged 4, have been assessed. The examination was carried out in Spring 2005. Information on food intake and supplementation has been collected by way of 7-day consumption record, carried out by mothers and kindergarten caretakers. The assessment of the food intake by children was aided by "Album porcji produktów i potraw [Register of food and dishes portions]". The collected data allowed for the application of the "Dieta 2 [Diet 2]" programme for computations and the assessment of energetic value and contents of food components, as well as the amounts of individual components originating from supplementation. Detailed data on sample selection for research were published earlier [Charzewska & Weker, 2006].

RESULTS AND DISCUSSION

Supplementation of a diet

The supplementation of all components was applied in 26.2% children (22.2% girls and 30.9% boys). Supplementation in children concerned first of all calcium and selected vitamins. It most often comprised vitamin C; vitamins B₁, B₂, PP and B₆; vitamin A; vitamin D; vitamin E; vitamin B₁₂; calcium and folic acid (Table 1). The supplements only, without food, usually delivered the amounts of food components which exceeded the amounts recommended by Polish norms at safety level for this group of children. The amount delivered ranged from 107.0% of norm for vitamin A up to 182.6% of the norm for vitamin B₁₂. Exceptions were calcium, folic acid, vitamin D and vitamin PP. The intake of these components from supplements was considerably lower (Table 2).

Supplementation and diet

Relatively high consumption of vitamins from supplements suggested the need for analysing the intake of these components by children as follows: only from food and combined intake both from food and supplements. The comparison of the intake of food components only with food in children using and not using diet supplementation did not indicate any significant differences in the intake of food components between both groups. The exception was calcium and vitamin C, because children using diet supplementation consumed significantly higher amounts of these components also with food. Having taken into account the total intake of individual components; with food and from supplements, a significantly higher intake of all analysed food components was found in this group in comparison with the amount consumed only with food in children not using diet

TABLE 1. Daily intake of nutrients in daily diets of children aged 4 years, nonusers and supplement users.

Nutrients	Nonusers			Supplement users				
	N	%	Sources	N	%	Sources		
			Food			Food	Supplements	Food and supplements
			$\bar{X} \pm SD$			$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$
Calcium	364	91.0	742.2 ± 249.6*†	36	9.0	837.0 ± 320.9*	126.0 ± 153.1	963.0 ± 405.2†
Vitamin A	321	80.3	1198 ± 732†	79	19.8	1328 ± 683	535 ± 286	1864 ± 755†
Vitamin E	330	82.5	8.15 ± 3.24†	70	17.5	8.07 ± 2.89	8.62 ± 12.59	16.19 ± 12.76†
Vitamin B ₁	318	79.5	1.007 ± 0.287†	82	20.5	1.023 ± 0.305	1.329 ± 1.213	2.353 ± 1.299†
Vitamin B ₂	318	79.5	1.760 ± 0.54†	82	20.5	1.844 ± 0.625	1.404 ± 1.691	3.284 ± 1.800†
Vitamin PP	318	79.5	11.36 ± 3.30†	82	20.5	11.37 ± 3.38	10.00 ± 14.66	22.33 ± 16.24†
Vitamin B ₆	318	79.5	1.70 ± 0.69†	82	20.5	1.74 ± 0.78	1.34 ± 1.66	3.08 ± 1.88†
Vitamin C	303	75.8	82.4 ± 40.2*†	97	24.3	94.4 ± 52.8*	79.6 ± 64.9	174.0 ± 83.2†
Folate	374	93.5	200.90 ± 57.19†	26	6.5	217.06 ± 54.09	53.61 ± 80.71	270.68 ± 107.88†
Vitamin B ₁₂	346	86.5	3.55 ± 1.75†	54	13.5	3.59 ± 1.39	1.82 ± 1.20	5.41 ± 1.90†
Vitamin D	324	81.0	2.41 ± 1.46†	76	19.0	2.56 ± 1.60	8.34 ± 4.00	10.90 ± 4.33†

*p<0.05 significant differences between average value of nutrients from food in group nonusers and supplements users; †p<0.05 significant differences between average value of nutrients from food and food and supplements in group nonusers and supplements users

supplementation (Table 1). When the per cent of realisation of the standard ranged from 24.1% for vitamin D to 355.9% for vitamin B₁₂ in diets of children who did not use diet supplementation; in children using diet supplementation the values were respectively higher and ranged from 109.9% for vitamin D to 541.5% for vitamin B₁₂ (Table 2).

Diet

It is disturbing that up to 62% of children consuming only diet, the UL (Tolerable Upper Intake Level) for vitamin A (which for this age group is 900 µg/day) [Trumbo *et al.*, 2001] was exceeded, and in children using diet supplementation the percentage reached 97.5%. Exceeded UL has also been observed in 13.5% children not using diet supplementation for vitamin PP (UL assumed as 15 mg/day) and in 80.5% children using diet supplementation. In the latter group, exceeding UL (400

µg/day) for folic acid has been stated in 7.7% children.

In children using diet supplementation, calcium has been delivered in 64.8% from preparations containing only this component, in 21.1% from preparations containing, apart from calcium, also vitamin D, and in 12.2% from multi-element preparations containing other vitamins and minerals. Vitamins have been delivered in almost 100% from multi-element preparations, except for vitamin C. Vitamin C was delivered in 61.6% from multi-element preparations, and in 33.3% from preparations containing vitamin C only or, additionally rutin.

The majority of children – 83.8% – consumed one preparation a day, not less than 13.3% consumed two different preparations, and 2.9% a combination of at least three supplements or more.

Prudence necessary for appropriate nutrition consists in maintaining the balance in the intake of individual food com-

TABLE 2. Per cent of RDA in daily diets of children aged 4 years, nonusers and supplement users.

Nutrients	Nonusers			Supplement users				
	N	%	Sources	N	%	Sources		
			Food			Food	Supplements	Food and supplements
			$\bar{X} \pm SD$			$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$
Calcium	364	91.0	92.7 ± 31.2*†	36	9.0	112.8 ± 46.2*	15.7 ± 19.2	128.6 ± 58.8†
Vitamin A	321	80.3	239.8 ± 146.6†	79	19.8	265.7 ± 136.6	107.0 ± 57.2	372.7 ± 151.0†
Vitamin E	330	82.5	135.9 ± 54.1†	70	17.5	134.6 ± 42.8	143.6 ± 209.6	278.2 ± 212.8†
Vitamin B ₁	318	79.5	112.0 ± 32.1†	82	20.5	113.7 ± 33.9	147.7 ± 134.7	261.4 ± 144.3†
Vitamin B ₂	318	79.5	160.7 ± 50.6†	82	20.5	168.8 ± 57.5	127.7 ± 153.7	296.5 ± 163.7†
Vitamin PP	318	79.5	94.8 ± 28.0†	82	20.5	94.6 ± 28.2	91.4 ± 122.2	186.0 ± 135.4†
Vitamin B ₆	318	79.5	143.1 ± 61.8†	82	20.5	149.1 ± 72.6	111.4 ± 138.2	260.4 ± 159.6†
Vitamin C	303	75.8	183.1 ± 89.5*†	97	24.3	209.7 ± 117.3*	177.0 ± 144.2	386.6 ± 185.0†
Folate	374	93.5	223.5 ± 61.2†	26	6.5	241.2 ± 61.3	59.6 ± 89.7	300.8 ± 122.2†
Vitamin B ₁₂	346	86.5	355.9 ± 175.3†	54	13.5	358.9 ± 139.2	182.6 ± 119.8	541.5 ± 190.1†
Vitamin D	324	81.0	24.1 ± 14.6†	76	19.0	25.6 ± 16.0	83.4 ± 40.0	109.0 ± 43.3†

*p<0.05 significant differences between average value of nutrients from food in group nonusers and supplements users; †p<0.05 significant differences between average value of nutrients from food and food and supplements in group nonusers and supplements users

ponents. The comparison of the amount of food components delivered in food products in diets of children aged 4, both consuming and not consuming diet supplements, indicates that not all vitamins should be supplemented. The intake of vitamin B₁₂ only from products and dishes has been 3.5 times higher and that of vitamin A and folates over two times higher than safety norms foresee. Having included supplementation, the intake of vitamin B₁₂ exceeded the recommended level five times, that of vitamins A and C four times, while in the case of folates and vitamins B₂ and E – almost three times. Although we have not met the problem of excessive intake of water-soluble vitamins, apart from niacin, the problem of appropriate dosing of oil-soluble vitamins is topical. The intake of vitamin A was particularly disadvantageous, as in almost all children consuming these components in diet supplements the UL has been exceeded. Similar results were received by observations of other authors [Balluz *et al.*, 2000; Pietruszka & Brzozowska, 2002]. Excessive intake of vitamin A may result in headaches, hyperexcitability, nausea and dyspepsia, and large doses can cause liver damage [Ziemiański, 2001].

A doubtless advantage of supplementation has been the improvement in consumption of calcium and vitamin D, as one 4-year-old in three had lower intake in the group using diet supplementation. In the group consuming only food one in two children in the case of calcium and almost all children in the case of vitamin D have had intake predominantly too low. Too low level of vitamin D in the organism leads to insufficient intestinal absorption and insufficient resorption of calcium and phosphorus in kidneys. In vitamin D insufficiencies, the organism's calcium homeostasis is disturbed, which results in bone changes [Charzewska & Rogalska-Niedźwiedz, 2002; Książyk, 2004; Calvo *et al.*, 2005; Loranc, 1996]. According to the latest recommendations of the National Paediatric Consultant concerning rachitis and osteoporosis prophylaxis, all children in Poland should receive 400 IU (10 µg/day) of vitamin D from diet and pharmaceutical preparations, combined with the recommended intake of calcium from food and outdoor stays [Dobrzańska *et al.*, 2004]. Doubtless advantages from the supplementation and fortification of food products with vitamin D for appropriate serum levels of 25(OH)D were indicated in the Optiford study, particularly in countries located in northern parts of Europe, including Poland [Tylavsky *et al.*, 2006].

At the same time, in the studied group only every fifth child aged 4 consumed vitamin D in pharmaceutical preparations. The necessity to deliver the recommended amount of calcium in diet raises no doubts, and its dominating amount in bone tissue indicates its significant contribution to bone mineralization and ensuring the appropriate development of bones and teeth. It is currently believed that calcium deficiency in a diet in the childhood can result in enamel hypoplasia and increased development of caries, and its constant deficiencies cause impairment of the growth of children and adolescents [Książyk, 2004; Abrams, 2005].

CONCLUSIONS

Based on the conducted analysis it can be stated that about 1/3 of children administer diet supplements. On the one hand, using supplementation to a moderate degree can have certain

advantages, helping to maintain the appropriate level of intake of certain food components: calcium, vitamin D. On the other hand, excessive intake has been observed in the group which used supplementation: the norm was exceeded on average 4-5 times for vitamins B₁₂, C and A. Consequently, it must be underlined that supplements should be carefully selected to the given target group, and that their composition should be adjusted to the needs of the target group.

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SUPLEMENTACJA DIET DZIECI W WIEKU 4 LAT

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Oceniono sposób żywienia się 400 dzieci (212 dziewcząt i 188 chłopców) wylosowanych z terenu całej Polski, w wieku 4 lat. Badanie przeprowadzono wiosną 2005 roku za pomocą siedmiodniowego zapisu spożycia, z udziałem matek i opiekunek przedszkolnych. Udział dzieci stosujących suplementację biorąc pod uwagę wszystkie analizowane składniki wynosił 26,2% (w tym 22,2% dziewcząt i 30,9% chłopców). W dietach dzieci przyjmujących suplementy stwierdzono zbyt dużą zawartość niemal wszystkich analizowanych witamin, przekraczającą dla niektórych z nich 4-5 krotnie normę.