

COMPARATIVE EVALUATION OF CONSUMPTION PATTERN IN GROUPS OF DISABLED AND HEALTHY SCHOOL CHILDREN

Emilia Kolarzyk, Anna Janik

Department of Hygiene and Ecology, Collegium Medicum, Jagiellonian University, Cracow

Key words: healthy, disabled children, consumption pattern, daily nutrition ratio – composition, nutritional value

The study included 142 pupils [(106 healthy (H) and 36 disabled (DS)] attending integrated classes in the primary schools in Cracow. The qualitative and quantitative analysis of nutrition data included: general evaluation of daily nutrition ration (DNR), the number and complexity of dishes consumed every day and the composition and nutritional value of the DNR. Mean intake of basic macro-nutrients and their share as energy sources was also calculated. In the analysis of the consumption pattern, different groups of examined children were taken into account, according to the sex, age and ability (disabled and healthy). The obtained results are not satisfactory and indicate faults and anomalies in the food consumption of the studied children. In the children belonging to both abilities group, only 37% of DNR were fully satisfactory and the types of products and nutrients in separate dishes were similar. The DNR of the studied children did not fulfill the recommended daily intake for vitamins (B₂, PP, E), and minerals (Ca, Fe, Zn, Mg). The energy contributed by lipids, fats, and carbohydrates was correct in boys and girls H group, while in the DS group they deviated in a smaller or greater degree from the recommended values. Anomalies observed in the DS groups concerned too high amount of energy contributed by fats (girls – 35%, boys – 32%), and a rather small percentage of energy contributed by carbohydrates (girls – 52%). This group also often experienced disturbances of weight-height proportions (13.9%), indicating overweight and obesity, what with low coefficient of physical activity (1.5) and high value of fat E% may indicate problems with managing proper body mass. Energy percentage (E%) contributed by proteins was consistent with recommendations and proved to be the same for both DS sexes (13%).

INTRODUCTION

Department of Hygiene and Ecology of Jagiellonian University's Collegium Medicum has conducted many studies on food consumption among children and teenagers, since anomalies of consumption pattern may influence this population group in the most serious way. Since 1998, we have become interested in the study of disabled children, as the prevention of nutrition disturbances is particularly important in this group of children.

Improper state of nutrition may significantly and negatively influence the growth of any child, but disabled children are especially in danger of such turn of events. Abnormal weight-height proportions may impede the adaptive process of the disabled child among other children of the same age. In the case of children with motoric dysfunctions they may hamper the rehabilitation process and become a difficulty in nursing a child.

While comparing the results of studies on consumption pattern among healthy and disabled children, we were curious whether disability as an "illness" that touches the whole family of a child, influences taking care of children and if so, how it reflects the quantity and quality of eaten meals.

The main purpose of the study was the comparative evaluation of the consumption pattern, the composition and nutritional value of daily nutrition rations (DNR) in the groups of disabled and healthy school children.

MATERIAL AND METHODS

In the years 1998–1999 we have examined children attending two Cracow schools, which were the first to create integrated classes thus enabling disabled and healthy children to study together.

The study included 142 pupils (106 healthy and 36 disabled) attending classes from V to VIII (Table 1). Such a proportion between the number of examined disabled and healthy children was the result of principles of integrated teaching, due to which the number of children in a class should not exceed 20, including 3 disabled ones [Dz. Urz. MEN., 1993].

The study included 24-h dietary recall concerning the consumption in the preceding day and a basic anthropometric survey that is indispensable in the evaluation of the state of nourishment (body mass and height, thickness of skin folds, arm circumference) [WHO, 1988]. Data concerning the health state of individual children have been derived from the health cards and somatic development,

TABLE 1. Number of examined children divided into groups according to sex and the degree of ability.

Gender	Healthy	Disabled	Total number
Boys	55	21	76
Girls	51	15	66
Total number	106	36	142

what enabled the diagnosis and classification of health problems of disabled children. The nutrition recall has been carried out with due regard to generally accepted methods and indications concerning technics of study of the consumption pattern [Gronowska-Senger, 1998]. During the nutrition recall, the "Album of products and meals portions" created and published by the National Food and Nutrition Institute was used [Szczygłowa *et al.*, 1991]. Data concerning mentally retarded children, who were not able to give credible answers on their own, were collected from their mothers. In the nutrition recall questionnaire, some information about possible dietary food restrictions and their causes were also taken into account.

The qualitative analysis of nutrition data included: general evaluation of nutritional value of daily nutrition ration, the number and the degree of diversity of meals consumed every day.

Daily nutrition rations (DNR) were evaluated using the 1–3 scale, where 1 – satisfactory, 2 – poor, 3 – unsatisfactory.

The DNR was graded as satisfactory if it consisted of 4–5 meals, with at least 3 containing animal proteins and 2 including fruit and vegetables. The DNR that did not fulfill the requirements for the satisfactory group, but at the same time had more complex composition and more meals than the unsatisfactory group, was graded as poor. The DNR described as unsatisfactory consisted of 3 or less meals, only two or less of which included animal proteins and only 1 included fruit or vegetables.

The level of diversity of the meals was assessed using modified method of Bielińska [Gronowska-Senger, 1998]. Nine main sets of products that are present in main meals and occasional snacks were distinguished. The first set is a basic type that is included partly or as a whole in each meal. All the other types are the combinations of a basic type and other, different types (with the exception of set No IX, consisting only of fruit and vegetables).

The sets of products that were used to evaluate individual meals: (I) cereal or legume products and/or potatoes, sugars and/or sweets, vegetable oils and/or animal oils; (II) as in p. I + meat products (including fish, haslets) and/or eggs; (III) as in p. I + milk (kefir, yoghurt) and/or cheese; (IV) as in p. I + meat products (including fish, haslets) and/or eggs + milk (kefir, yoghurt) and/or cheese; (V) as in p. I + meat products (including fish, haslets) and/or eggs + vegetables and/or fruit; (VI) as in p. I + milk (kefir, yoghurt) and/or cheese + vegetables and/or fruit; (VII) as in p. I + meat products (including fish, haslets) and/or eggs + milk (kefir, yoghurt) and/or cheese + vegetables and/or fruit; (VIII) as in p. I + vegetables and/or fruit; (IX) vegetables and/or fruit.

During the quantitative assessment of the consumption pattern of the examined children, the mean energy value and the level of respective nutrients in the DNR was calculated without taking into account technological losses. These values were compiled with the data concerning quantities recommended (on the safe intake level for respective nutrients and the average group requirement for energy) in different sex and age groups [Ziemiański *et al.*, 1995]. The mean intake of selected basic energy compounds (proteins, fats and carbohydrates) and their percentage share as energy sources (E%) in the nutrient ration was also calculated. All the above-mentioned calculations were

made with the use of self-made computer program, which took into account the product composition on the basis of the National Food and Nutrition Institute's publication – "Nutrition value chart" [Kunachowicz *et al.*, 1998]. In the analysis of the consumption pattern, different groups of the examined children were taken into account, according to the sex, age and ability (disabled and healthy).

In both disabled and healthy groups of boys and girls the basic metabolic rate (BMR) was also estimated using the WHO recommended regression formulas applied to body mass values. These data, when compiled with the mean DNR value, allowed to define the energy expenditure coefficient of the studied children [Eastwood, 1999].

RESULTS

The studied children were the representatives of several consecutive school years and their age interval was between 11 and 15 years. Mean age of the studied healthy boys and girls equalled 12.7 years, while the average age in the disabled children group was higher and amounted respectively in girls group – 13.39 years and in boys group – 13.81 years.

The most numerous group among the disabled children included children with infantile cerebral palsy (25%), mental retardation (19.4%) and mental deficiency (13.8%). Other common occurrences among the disabled children were emotional disturbances, growth deficiencies and serious sight defects (11.1% each). As a result of the fact that disabled children represented different, often coexisting types of health disturbances, the number of observed psychosomatic dysfunctions did not coincide with the number of studied children and was noticeably higher (Table 2).

The evaluation of the consumption pattern was carried out on 140 school children, who provided full information on the food intake in the preceding day. Most of the examined children consumed daily 4 or 5 meals – 76% of healthy and

TABLE 2. The occurrence of specific diseases and disturbances of health status in the group of disabled children.

The problem of health status	Number (N=36)	Percentage
	of stated cases	
Mental deficiency	5	13.8
Border mental deficiency	1	2.7
Mental retardation	7	19.4
Developmental deficiency	4	11.1
Emotional disturbances	4	11.1
Aphasia	1	2.7
Down's syndrome	3	8.3
Infantile cerebral palsy	9	25.0
Sight defect	4	11.1
Dysgraphia	1	2.7
Children' arthritis	1	2.7
Asthma bronchialis	2	5.5
Hearing defect	1	2.7
Epilepsis	3	8.3
Ichthyosis	2	5.5
Speech defect	3	8.3
Nycturia	1	2.7

68% of disabled children. Three meals a day were consumed by 19% of healthy and 26% of disabled children. In both studied groups the consumption of only two meals each day was observed. This problem concerned 4.7% of healthy and 5.8% of disabled children (Figure 1). What is disturbing, is the fact, that among the group of children who consumed only two meals a day, 2/3 of a group started their school day without eating a breakfast, and a dinner was their first daily meal. 35% of all studied children did not eat lunch at school.

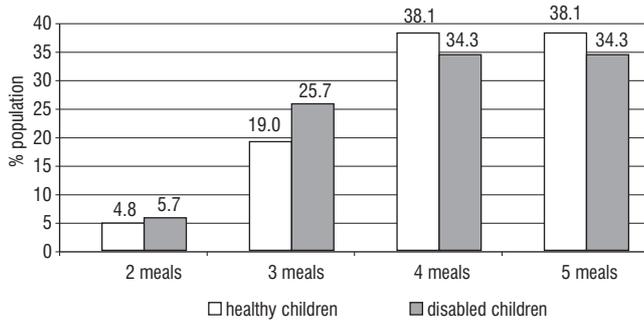


FIGURE 1. Number of meals consumed daily in the groups of disabled and healthy children.

In the group of healthy boys and girls the percentage distribution of number of basic meals eaten every day was similar, especially of 2, 4 and 5 meals. Greater differences concerning 3 daily meals proved to be not statistically significant, when checked using the test for 2 structure indicators (per cents). Among the healthy children the percentage of persons eating both 4 and 5 meals day by day was found to be with the same frequency and was estimated for girls as 35.3% and for boys as 40.7%. Three meals every day were consumed by 25.5% of girls and 13% of boys. Only 2 meals every day were eaten by 3.9% of girls and 5.5% of boys (Figure 2A).

In the group of disabled children distinct differences concerning 4 or 5 meals consumed every day were seen. These differences were statistically significant (the test for 2 structure indicators (per cents), $p < 0.05$). In the group of disabled girls, the consumption of five meals every day was the most often seen (53.3% of the examined disabled girls), 4 meals were eaten by 13.3%. In the group of disabled boys the consumption of 4 meals was dominating (50% of the examined persons), 5 meals were eaten only by 20% of disabled boys. The percentage of persons eating only 3 meals every day was similar and reached 25% for boys and 26.6% for girls. Two meals were eaten by 5% of disabled boys and 6.6% of disabled girls (Figure 2B).

The percentage of persons eating only 2 meals every day was similar in the group of healthy (5.5%) and disabled (5%) boys and was a little bit higher in the group of disabled girls in comparison with healthy girls, but the difference was not statistically significant (the test for 2 structure indicators (per cents), $p > 0.05$) – (Figure 2A and 2B).

In the Figure 3A the distribution of the consumption frequency of particular kinds of meals in the groups of disabled and healthy children was shown.

This distribution was similar as far as I breakfasts, lunches and dinners were concerned.

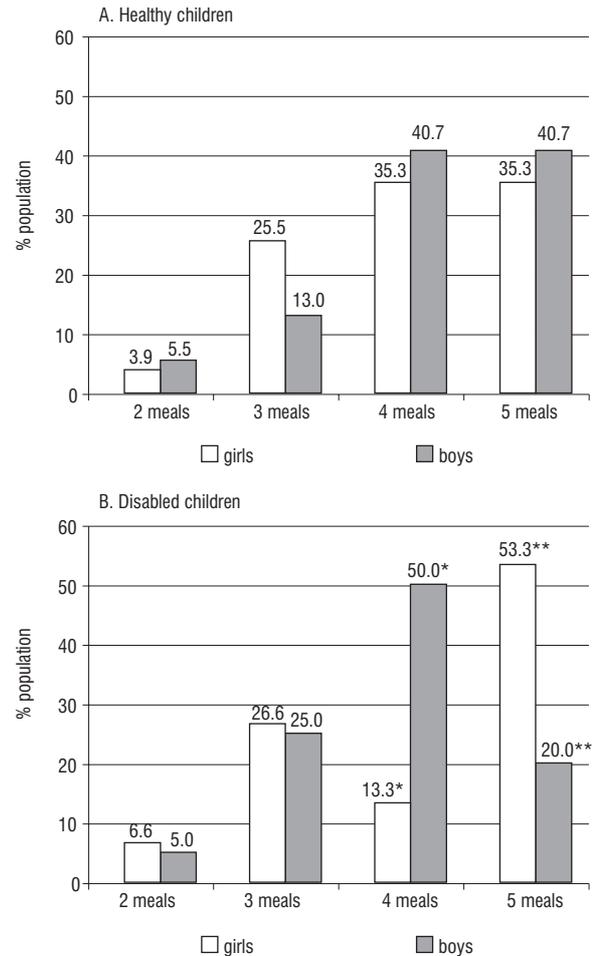


FIGURE 2. Number of meals consumed daily in the groups of healthy (A) and disabled (B) girls and boys; $p^* < 0.05$, $p^{**} < 0.05$.

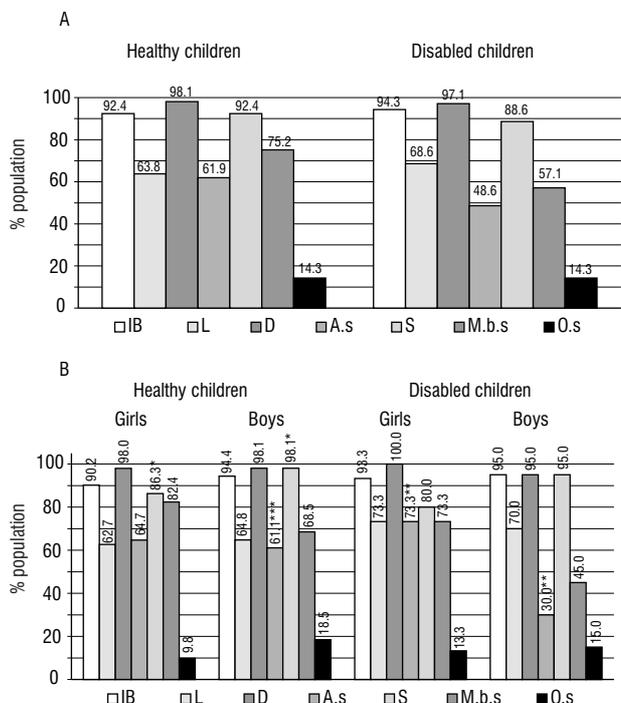


FIGURE 3. The schedule of frequency of particular meals consumption in the group of disabled and healthy children (A) and disabled and healthy girls and boys (B). $p^* < 0.05$; $p^{**} < 0.01$; $p^{***} < 0.01$; IB – I breakfast; L – Lunch; D – Dinner; A.s. – Afternoon snack; S – Supper; M.b.s. – Meal before sleeping; O.s. – Occasional snack.

A little bit bigger differences were seen in the percentage distribution of afternoon snacks, suppers and occasional snacks. These differences checked for every kind of meal with the use of the test for 2 structure indicators (per cents) were not statistically significant, $p > 0.05$.

Statistically significant differences were stated by the consumption frequency of some kinds of meals in the groups of healthy and disabled children with the division in groups depending on gender. In the group of healthy children, boys significantly more frequently than girls consumed supper (the test for 2 structure indicators (per cents), $p < 0.05$). On the other hand, in the group of disabled children the statistically significant difference concerned the frequency of afternoon snacks consumption (the test for 2 structure indicators (per cents), $p < 0.01$ (Figure 3B). Also differences in frequency of consumption of this meal were observed among healthy and disabled groups of boys (the test for two structure indicators (per cents) - $p < 0.01$).

Occasional and irregular eating between meals was observed in most of the studied children. It was the most common occurrence in the healthy girls group (82%), while in the disabled boys group it happened most infrequently (45%). Generally, eating between meals was more popular trait in girls groups (82% in healthy group, 73% in disabled group), than in boys groups (68% healthy, 45% disabled), however, boys were more likely to eat an additional meal directly before going to sleep (18.5% healthy, 15% disabled) (Figure 3B).

No explicit differences in the quality evaluation of DNR inside the groups and between ability groups were observed. In both ability groups 37% of DNR were graded as satisfactory. DNR of 1/3 of the studied healthy and disabled children was graded as poor (29% and 31%, respectively). DNR of a comparable amount of children was graded as unsatisfactory (33% and 31%) (Table 3).

As we can see from the distribution shown in Table 4, similar types of product sets occurred in the particular meals of the examined healthy and disabled children.

TABLE 3. Evaluation of daily nutrition rations.

The group of examined children	1. satisfactory		2. poor		3. unsatisfactory	
	N	%	N	%	N	%
Healthy girls	19	37	14	28	18	35
Healthy boys	20	37	16	30	18	33
Together healthy children	39	37	30	29	36	34
Disabled girls	6	40	4	27	5	33
Disabled boys	7	35	7	35	6	30
Together disabled children	13	38	11	31	11	31

% – per cents of population, N – number of population.

Existing differences in the frequency of the type of product set in a given meal proved to be statistically insignificant ($p > 0.05$) in every meal except for breakfast among the groups of healthy and disabled children when checked using the test for 2 structure indicators (per cents) on every meal.

In the case of breakfasts, the differences in frequency of group I product set were statistically significant on the level of $p < 0.05$, while for group II product set on the level of $p < 0.01$. The occurrence of group I product set was significantly more frequent in the composition of breakfast consumed by healthy children than by the disabled, while in the composition of breakfasts of disabled children more group II products were observed.

Most of the lunches, afternoon snacks, occasional snacks and snacks before sleeping consumed by the healthy children had a grain-fat-sugar composition. In the disabled children group such nutrient composition was a characteristic of occasional snacks, snacks before sleeping as well as afternoon snacks that were consumed mostly by girls. Breakfasts and suppers of the studied children consisted mainly of group II and III products, thus containing animal proteins (from meat and/or eggs and milk and/or cheese), most often supplemented with bread. A relatively small amount (13%)

TABLE 4. Frequency of typical food products' sets occurrence in meals of the examined children in percentage of general number of children eating given meal.

Meal	Number of persons eating given meal	The type of products' set								
		I	II	III	IV	V	VI	VII	VIII	IX
Healthy children [%]										
I breakfast	97	19.6*	28.9**	37.1	3.1	4.1	-	1.0	6.2	-
Lunch	67	34.3	14.9	11.9	-	7.5	7.5	-	11.9	11.9
Dinner	102	2.9	5.9	2.9	1.0	59.8	5.9	2.0	18.6	1.0
Afternoon snack	64	45.3	4.7	14.1	-	-	7.8	-	17.2	10.9
Supper	97	7.2	32.0	20.6	8.2	16.5	6.2	5.2	4.1	-
Meal before sleeping	15	80.0	-	-	-	-	-	-	13.3	6.7
Occasional snacks	79	58.2	1.3	5.1	-	2.5	3.8	-	12.7	16.5
Disabled children [%]										
I breakfast	33	6.1*	57.6**	27.3	3.0	3.0	3.0	-	-	-
Lunch	23	17.4	30.4	8.7	-	13.0	8.7	-	8.7	13.0
Dinner	34	-	5.9	5.9	2.9	64.7	2.9	-	17.6	-
Afternoon snack	17	41.2	17.6	5.9	-	5.9	-	5.9	59.0	17.6
Supper	31	12.9	25.8	25.8	6.5	6.5	9.7	3.2	9.7	-
Meal before sleeping	5	60.0	-	-	-	-	-	-	20.0	20.0
Occasional snacks	20	55.0	-	-	-	-	5.0	-	15.0	25.0

¹see Material and Methods, * $p < 0.05$, ** $p < 0.01$.

of breakfast portions consisted of milk soups (milk with corn flakes or wheat flakes, normal and enriched).

Dinner portions of over 60% of the studied children usually consisted of two dishes containing products assigned to group V, therefore including also animal proteins (from meat and/or eggs) with fruit and vegetables, apart from the standard I group products. With the exception of dinners, fruit and vegetables rarely appeared in the composition of lunch, afternoon snacks, snacks before sleeping or occasional snacks.

The mean energy value of DNR of the studied children in connection with the estimated basic metabolic rate allowed to define the energy expenditure coefficient in separate studied groups. This coefficient was calculated for healthy children and reached 1.7 for boys and 1.6 for girls, placing them on a moderate (boys) and slightly below moderate (girls) physical activity level whereas for disabled children this coefficient was 1.5, that is low physical activity level.

Table 5 presents mean energy values of DNR of the studied children, the average intake of basic energetic nutrients and their percentage as energy sources (E%). The energy proportions contributed by proteins, fats and carbohydrates were correct in healthy boys and girls groups, while in the disabled children groups they deviated in different degree from the recommended values. Anomalies observed in the disabled children groups concerned too high amount of energy contributed by fats (girls – 35%, boys – 32%) and a relatively small percentage of energy contributed by carbohydrates (girls – 52%). The protein intake and the energy percentage obtained (E%) were consistent with recommendations and proved to be the same for both disabled children sexes – 13%. A wide range of values of standard deviations both for mean energy value and for mean intake of basic energetic nutrients indicates significant individual differences in the intake.

High level of fat consumption in the DNR of disabled children, together with low physical activity finds a reflection in comparatively often noted in this group (13.9 % of the examined persons) disturbances of weight-height proportions, which indicate overweight and obesity (body mass/height over 90 percentile on the proportion tables) [Sifting test for somatic development disorders revealing., IMiDZ, 1992] that are observed frequently in the healthy group (Figure 4).

The calculated mean values of nutrients in DNR of the studied children were presented in Figures 5 and 6. As far as the basic energetic nutrients (such as proteins, fats and carbohydrates) are concerned, in all of the studied groups of children the recommended values for fats were fully met. The study showed low carbohydrates intake (especially in the group of disabled girls aged 10–12 years and disabled and healthy boys group aged 13–15 years). High protein intake

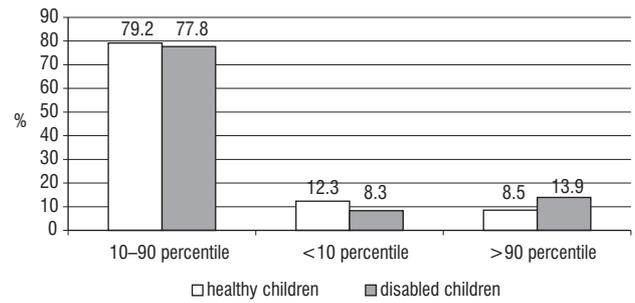
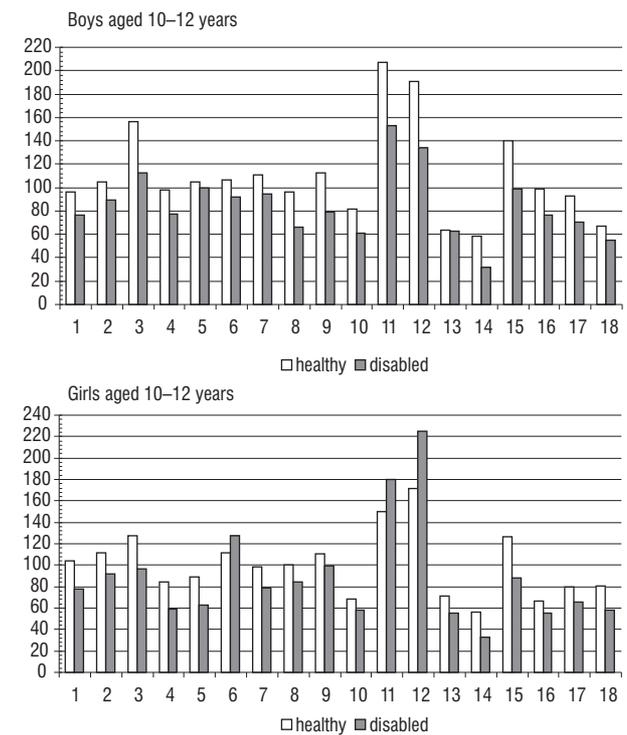


FIGURE 4. Body weight/height proportions (the estimation in accordance with percentile diagram).



1 – energy; 2 – fats; 3 – proteins; 4 – carbohydrates; 5 – cellulose; 6 – non saturated fatty acids (NSFA); 7 – vit. B₁; 8 – vit. B₂; 9 – vit. B₆; 10 – niacin; 11 – vit. C; 12 – retinol equiv.; 13 – vit. E; 14 – calcium; 15 – phosphorus; 16 – iron; 17 – magnesium; 18 – zinc.

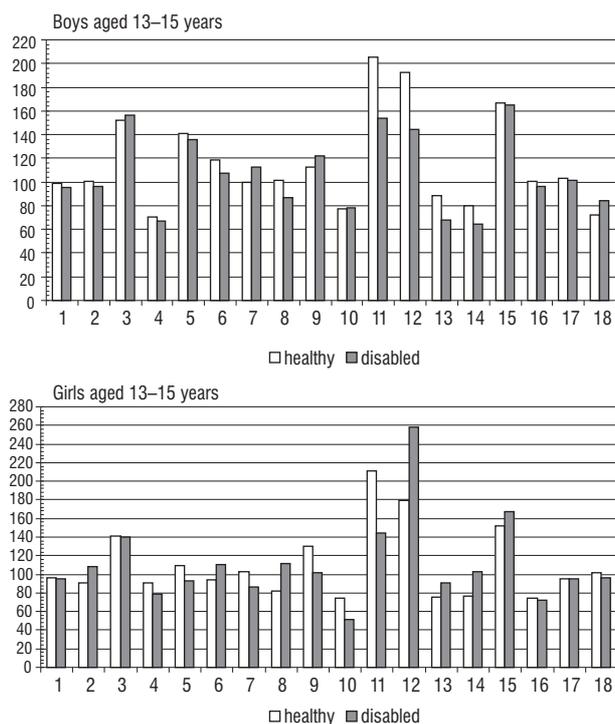
Figure 5. Mean level of energy and nutrients intake in daily diet of the examined children (as a percentage of recommended intake).

was also observed, mainly in the healthy boys group, where it reached 160% of the recommended intake of safety level.

The recommendation for the phosphorus intake was also exceeded in most of the studied children (126–168%). Finally, there was a very high intake (the highest for all the nutrients) of vitamin C and A. It exceeded the recommended

TABLE 5. Mean level of energy and basic energetic nutrients intake in daily nutritional rations of the examined children.

The groups of examined children	Mean values for selected groups						
	Energy	Proteins generally [g]		Fats generally [g]		Carbohydrates generally [g]	
	x±s	x±s	E %	x±s	E %	x±s	E %
Healthy girls	2059±639	63±19.9	13	70±29	30	311±103	57
Disabled girls	1945±680	61±20	13	76±31	35	268±102	52
Healthy boys	2343±751	75±35	13	79±37	30	353±116	57
Disabled boys	2239±972	74±3.4	13	78±36	32	332±147	55



1 – energy; 2 – fats; 3 – proteins; 4 – carbohydrates; 5 – cellulose; 6 – non saturated fatty acids (NSFA); 7 – vit. B₁; 8 – vit. B₂; 9 – vit. B₆; 10 – niacin; 11 – vit. C; 12 – retinol equiv.; 13 – vit. E; 14 – calcium; 15 – phosphorus; 16 – iron; 17 – magnesium; 18 – zinc.

FIGURE 6. Mean level of energy and nutrients intake in daily diet of the examined children (as a percentage of recommended intake).

values, reaching 200% of safe level in the case of vitamin C and 160% for vitamin A. In all children groups, such high level of vitamin intake was caused by high consumption of fruit and fruit-vegetable juices (mainly peach-carrot juices). In the diet of the studied children a low intake of vitamin E, B₂, PP and minerals: Ca, Fe, Mg, Zn was observed. The amount of calcium in DNR of younger children (10-12 years) varied from 350 mg (disabled children) to 644 mg (healthy children), covering the recommendations in 32 to 58%. Among older children (13-15 years), calcium intake varied from 837-1 128 mg. Therefore, the recommended values for calcium were met in 64 to 102%. Disturbingly low iron intake was also observed among healthy and disabled younger and older girls. In the younger group iron intake did not reach 70% of the recommended value, while in the older group it slightly exceeded 2/3 of the one. In the boys group, a low iron intake was observed only in the younger (10-12 years), disabled group.

As for other minerals, the recommended daily intake for zinc was fully met in both older (13-15 years) girls groups, while for other children it varied from 55 to 84%. Low levels of magnesium intake were noticed mainly among younger disabled children and younger healthy girls. The intake of remaining nutrients came close to recommended values, and as a result it covered requirements for these compounds.

DISCUSSION

The anomalies observed in the food consumption pattern appeared with the same intensity in the whole studied children group. Regardless of the ability, sex and age,

the quality evaluation of daily nutrition ration was equally low. The fact, that only 37% of DNR were estimated as fully satisfactory has to raise concern, particularly in the case of children with different, often very serious health disturbances. Among the studied children there was a negative tendency of over consumption of products assigned to the I group, which dominated in meals like: lunches, afternoon snacks, meals before sleeping and occasional snacks. Frequent consumption of the grain-fat-sugar products was often accompanied by low frequency of fruit and vegetable consumption, mainly in the disabled children group, especially girls.

Nutrition faults found their reflection in the quantity analysis of daily nutrition rations. Low intake of group B vitamins, vitamin E and minerals (Ca, Fe, Zn, Mg) that was observed, is disturbing due to possible health complications resulting from inadequate nutrient intake. The relation between low calcium level in the diet and occurrence of different health problems, including osteoporosis, arterial hypertension and colon neoplasms, was often drawn attention in modern scientific literature [Allender *et al.*, 1996; Barger-Lux & Heaney, 1994]. Adequate calcium intake during childhood and puberty has a definitive role in the value of the so called “peak bone mass” and the rate of its loss in the adult age [Matkovic *et al.*, 1995; Chan, 1991; Ruiz *et al.*, 1995]. As the Jackman *et al.* studies showed [1997], daily calcium intake for boys and girls older than 10 years should not be lower than 1 300 mg/day. Despite that fact, the calcium intake observed in our study ranges from 350 to 1 128 mg/day and is far from optimal values [Jackman *et al.*, 1997], which assure maximum calcium absorbance and may not cover the requirement for this compound. Our results on the insufficient calcium intake are not isolated and find confirmation in other authors’ studies on the calcium intake in Poland [Szponar *et al.*, 1991; Wajszczyk *et al.*, 2001; Gronowska-Senger *et al.*, 1998; Rutkowska *et al.*, 2000; Rogalska-Niedźwiedz *et al.*, 1992; Czapska *et al.*, 2000]. The obtained results are even more worrying, as in the years 1980-1996 a decrease in milk and milk products consumption in Poland was observed. It resulted in deepening a negative tendency of supplying smaller share of calcium by these products [Sekuła *et al.*, 1997; Rutkowska *et al.*, 2000].

Next problem, present not only in the children and teenager structure of consumption, is the iron deficiency in diet, which might cause mild iron deficiency without clinical anaemia symptoms and also lead to sideropenic anaemia. There is quite a lot of data indicating, that even mild iron deficiency constitutes a health danger, leading to bad general feeling, headaches, dizziness, sleep and concentration disorders. Due to Lozoff and Pollitt research [Lozoff *et al.*, 1982; Pollitt, 1985, cit. Ziemiański *et al.*, 1994], iron deficiency can be the cause of behavioural changes and hampering of the psychic development. In these studies, it had been noticed that moderate iron deficiency cause lower activity of the studied persons, problems with concentration, enhanced weariness and increased muscular tension.

The degree of realization of the recommended intake for iron that was observed in our studies and equalled 2/3, seems to be highly unsatisfactory, mainly because it concerned not only healthy children, but also most of the examined disabled children. The obtained results are similar to the

results of other studies concerning the iron intake in our country. They indicate frequent occurrence of iron deficiencies in diets of different population groups, and relatively frequent occurrence of sideropenic anaemia in Polish population, especially among teenagers and women in reproductive age [Wajszczyk *et al.*, 2001; Rutkowska *et al.*, 2000; Rafalski & Świtoniak, 1994; Rogalska-Niedźwiedz *et al.*, 1995].

In addition, low levels of magnesium and zinc in daily nutrition rations of the examined children find confirmation in the results of other authors' studies. Many of them indicate that the degree of realisation of the recommended values for the minerals is too low [Lamand *et al.*, 1994; Szajkowski, 1996; Rutkowska *et al.*, 1994, 2000; Wojtasik *et al.*, 2000].

The results of domestic research concerning vitamin B intake show that children and teenagers do not fulfill the recommended intake for vitamins in a satisfactory degree, and the observed deficiencies concern mainly vitamins B₁, B₂, B₆ and PP [Charzewska *et al.*, 1992; Chwojnowska *et al.*, 1992]. Likewise, the degree of realization of the recommended intake for the above-mentioned vitamins among children, that was revealed in our study proved to be unsatisfactory, especially as far as vitamins PP and B₂ are concerned. However, the recommendations for vitamins B₆ and B₁ were fully met.

Population studies indicate that recommended values for vitamin E are fulfilled by daily nutrition rations in 45 to 86 % [Duda, 1992 a,b; 1993; Nadolna *et al.*, 1994]. Studies carried out by the National Food and Nutrition Institute in Warsaw indicate, that there is a constant increase in the vitamin E intake in population [Troszczyńska *et al.*, 2000]. It is a very positive tendency, mainly due to the role played by antioxidative vitamins in prevention of civilization diseases, such as coronary heart disease, recommended intake norms for vitamin E in 55% to 91%.

We were not able to find in the available literature any positions concerning nutrition of disabled children attending integration schools. Therefore, we could not compare our results with analogous studies from different regions. Lack of such studies might indicate that this problem may be treated with lesser attention by nutrition specialists.

The obtained results are not satisfactory and indicate faults and abnormalities in the consumption pattern of the examined healthy and disabled children. In daily nutrition rations of disabled children, apart from lack of fulfilling the recommendations for series of nutrients, there was a too high amount of energy contributed by fats, followed by low level of physical activities (coefficient of physical activity 1.5). It was also observed that this group often (13.9%) experienced disturbances of weight-height proportions, indicating overweight or obesity, what may in turn indicate problems with managing proper body mass. This seems to be connected with improper food consumption (E% from fats above 30%). We have obtained similar results in previous pilot studies on nutrition of disabled children [Janik *et al.*, 1999].

Occurrence of similar anomalies in consumption pattern of both healthy and disabled children seems to indicate lack of knowledge on rules of proper nutrition, on the side of parents, tutors, and older children (13–15 years). What is even more disturbing is the fact, that parents of disabled

children seem to underestimate the meaning of proper nutrition in growth, rehabilitation and maintaining health state of their children. Meanwhile, improper nutrition may have a negative influence on disease status, hampering, or even making the proper rehabilitation of a disabled child impossible.

CONCLUSIONS

1. No significant differences in the consumption pattern of healthy and disabled children were observed, and nutrition anomalies occurred with similar frequency in both groups.

2. Disabled children more often experienced disturbances of weight-height proportions, indicating overweight or obesity, what with low coefficient of physical activity (1.5) and high value of energy contributed by fats may in turn indicate problems with managing proper body mass.

3. The errors committed in the nutrition of the examined children indicate the necessity of disseminating, especially among parents and tutors of disabled children, knowledge on rational nutrition and its significant influence on the health state, growth and rehabilitation of a disabled child.

REFERENCES

1. Allender P.S., Cutler J.A., Follmann D., Cappucio F.P., Pryero J., Elliott P., Dietary calcium and blood pressure: a meta-analysis of randomized clinical trials. *Ann. Intern. Med.*, 1996, 124, 9, 825–831.
2. Barger-Lux M.J., Heaney R.P., The role of calcium intake in preventing bone fragility, hypertension, and certain cancers. *J. Nutr.*, 1994, 124, 8 suppl., 1406–1411.
3. Chan G.M., Dietary calcium and bone mineral status of children and adolescents. *Am. J. Dis. Child.*, 1991, 145, 6, 631–634.
4. Charzewska J., Chwojnowska Z., Rogalska-Niedźwiedz M., Zmiany w żywieniu młodzieży z Warszawy w latach 1985–1990. *Żyw. Człow. Metab.*, 1992, 19, 1, 17–25 (English abstract).
5. Czapska D., Ostrowska L., Karczewski J., Zawartość wybranych biopierwiastków w całodziennej racji pokarmowej studentów Akademii Medycznej w Białymstoku. *Roczn. PZH*, 2000, 51, 4, 353–359.
6. Chwojnowska Z., Charzewska J., Rogalska-Niedźwiedz M., Chabros E., Zmiany w sposobie żywienia uczniów z warszawskich szkół podstawowych w przełomowym okresie lat 1989 i 1990 z uwzględnieniem płci i wieku badanych. *Żyw. Człow. Metab.*, 1992, 19, 3, 165–175 (English abstract).
7. Duda G., Badania nad występowaniem tokoferoli w całodziennych racjach pokarmowych wybranych populacji z regionu Wielkopolski. I. Tokoferole w racjach pokarmowych dzieci przedszkolnych i szkół podstawowych. *Żyw. Człow. Metab.*, 1992, 19, 4, 252–262 (English abstract).
8. Duda G., Badania nad występowaniem tokoferoli w całodziennych racjach pokarmowych wybranych populacji z regionu Wielkopolski Cz. II. Tokoferole w racjach pokarmowych młodzieży szkół ponadpodstawowych i studentów. *Żyw. Człow. Metab.*, 1992, 19, 4, 263–272 (English abstract).

9. Duda G., Tocopherols in food rations of selected populations of the Wielkopolska Region. IV. Aged people. *Pol. J. Food Nutr. Sci.*, 1993, 2/43, 2, 69–76.
10. *Dziennik Urzędowy Ministerstwa Edukacji Narodowej*, 1993, Nr. 9, poz. 36.
11. Eastwood M., 1999, *Principles of Human Nutrition*. Aspen Publishers, Inc., Gaithersburg, Maryland, pp. 85–88.
12. Gronowska-Senger A., Ocena Żywienia. 1998, *In: Żywnienie człowieka*, (ed. Gawęcki J., Hryniewiecki L.). PWN, Warszawa, pp. 468–480 (in Polish).
13. Gronowska-Senger A., Drywień M., Hamułka J., Analiza stanu żywienia dzieci w wieku przedszkolnym i szkolnym w oparciu o istniejące piśmiennictwo z lat 1980–1995. *Roczn. PZH*, 1998, 49, 377–383 (English abstract).
14. Jackman L.A., Millane S.S., Martin B.R., Wood O.B., McCabe G.P., Peacock M., Weaver C.M., Calcium retention in relation to calcium intake and postmenarcheal age in adolescent females. *A. J. Clin. Nutr.*, 1997, 66, 2, 327–333.
15. Janik A., Adamska-Skuła M., Miodońska K., Suder Z., Kruczek A., Sposób odżywiania i zachowanie prawidłowej masy ciała ważnymi czynnikami w rehabilitacji dzieci niepełnosprawnych. *Problemy Hig.*, 1999, 59, 46–54 (English abstract).
16. Kunachowicz H., Nadolna I., Przygoda D., Iwanow K., 1998, *Tabele wartości odżywczej produktów spożywczych*. (Food composition tables). Wyd IŻŻ, Warszawa.
17. Lamand M., Tresol J.C., Bellanger J., The mineral and trace element composition in French food items and intake levels in France. *J. Trace. Elem. Electrolytes Health Dis.*, 1994, 8, 3–4, 195–202.
18. Matkovic V., Ilich J.Z., Andon M.B., Hsieh L.C., Tzagournis M.A. Laggar B.J., Goel P.K., Urinary calcium, sodium, and bone mass of young females. *Am. J. Clin. Nutr.*, 1995, 66, 2, 327–333.
19. Nadolna I., Kunachowicz H., Badania analityczne nad składem i wartością odżywczą racji pokarmowych. Cz. V. Zawartość retinolu, Beta-karotenu, i witaminy E. *Żyw. Człow. Metab.*, 1994, 21, 3, 243–252 (English abstract).
20. Rafalski H., Świtoniak T., Rozpowszechnienie i przyczyny niedoboru żelaza u kobiet w wieku rozrodczym. Cz. I. Rozpowszechnienie niedoboru żelaza. *Żyw. Człow. Metab.*, 1994, 21, supl., 9–26 (English abstract).
21. Rogalska-Niedźwiedz M., Charzewska J., Chwojnowska Z., Chabros E., Zawartość wapnia w dietach młodzieży. *Żyw. Człow. Metab.*, 1992, 19, 4, 244–251 (English abstract).
22. Rogalska-Niedźwiedz M., Charzewska J., Wajszczyk B., Chabros E., Chwojnowska Z., Lachowicz A., Żywniowe uwarunkowania niedokrwistości u młodzieży. *Żyw. Człow. Metab.*, 1995, 22, 4, 299–312 (English abstract).
23. Ruiz J.C., Mandel C., Garabedian M., Influence of spontaneous calcium intake and physical exercise on the vertebral and femoral bone mineral density of children and adolescents. *J. Bone. Miner. Res.*, 1995, 10, 5, 675–682.
24. Rutkowska U., Kunachowicz H., Iwanow K., Wojtasik A., Gościński R., Jakość zdrowotna krajowych racji pokarmowych – badania analityczne i ocena teoretyczna. Cz. V. Zawartość wapnia, fosforu, magnezu, żelaza i potasu. *Żyw. Człow. Metab.*, 2000, 27, 1, 20–41 (English abstract).
25. Rutkowska U., Iwanow K., Chojnowska J., Nadolna I., Kunachowicz H., Badania analityczne nad składem i wartością odżywczą racji pokarmowych. Cz. III. Zawartość miedzi, cynku i manganu. *Żyw. Człow. Metab.*, 1994, 21, 1, 16–24 (English abstract).
26. Sekuła W., Niedziałek Z., Figurska K., Morawska M., Zmiany w spożyciu mleka i przetworów mlecznych w Polsce w warunkach gospodarki rynkowej. *Nowa Med.*, 1997, 4, 9, 2–6.
27. Szajkowski Z., Badania nad zawartością i wzajemnymi relacjami wybranych składników mineralnych w całodziennych racjach pokarmowych wytypowanych populacji z regionu Wielkopolski. Cz. II. Zawartość i wzajemne relacje między Zn i Cu. *Żyw. Człow. Metab.*, 1996, 23, 1, 66–76 (English abstract).
28. Stopnicka B., Szamrej I.K., Jerulank I., Ocena indywidualnego sposobu żywienia dzieci w wieku szkolnym w szkołach podstawowych województwa białostockiego. *Żywn., Żyw. Zdr.*, 1998, 7, 4, 392–400.
29. Szczygłowa H., Szczepańska A., Ners A., Nowicka L., *Album porcji produktów i potraw*. 1991, Wyd. IŻŻ, Warszawa.
30. Szponar L., Wysocka B., Kierzkowska E., Wapń w pożywieniu wybranych grup ludności. *Pol. Tyg. Lek.*, 1991, 46, 30–31, 575–578 (English abstract).
31. Test przesiewowy do wykrywania zaburzeń w rozwoju somatycznym. 1992, *In: Testy przesiewowe u dzieci i młodzieży w wieku przedszkolnym i szkolnym*. Siatki centylowe proporcji masy do wysokości ciała. Wyd. IMiDz., pp. 12–17 (in Polish).
32. Troszczyńska A., Nadolna I., Rutkowska U., Kunachowicz H., Jakość zdrowotna krajowych racji pokarmowych. Badania analityczne i ocena teoretyczna. Cz. VIII. Zawartość witamin rozpuszczalnych w tłuszczach. *Żyw. Człow. Metab.*, 2000, 27, 2, 142–152 (English abstract).
33. Wajszczyk B., Charzewska J., Rogalska-Niedźwiedz M., Chabros E., Chwojnowska Z., Niedokrwistość a zawartość wybranych składników odżywczych w całodziennych racjach pokarmowych dziewcząt i młodych kobiet. *Żyw. Człow. Metab.*, 2001, 28, 1, 3–16 (English abstract).
34. WHO Technical Report Series, 854, Physical status: the use and interpretation of antropometry. Report of a WHO Expert Committee. WHO, Geneva, 1995.
35. Wojtasik A., Iwanow K., Rutkowska U., Kunachowicz H., Jakość zdrowotna krajowych racji pokarmowych – badania analityczne i ocena teoretyczna. Cz. VI. Zawartość miedzi cynku i manganu. *Żyw. Człow. Metab.*, 2000, 27, 2, 115–129 (English abstract).
36. Ziemiański Ś., Bułhak-Jachymczyk B., Budzyńska-Topolowska J., Panczenko-Kresowska B., Wartanowicz M., Normy żywienia dla ludności w Polsce (energia, białko, tłuszcze, witaminy, i składniki mineralne). *Nowa Med.*, 1995, 2, 5, 1–27.
37. Ziemiański Ś., Budzyńska-Topolowska J., Niedokrwistość a żywnienie. *Żyw. Człow. Metab.*, 1994, 21 supl., 88–110.

Received May 2002. Revision received September 2002 and accepted February 2003.

PORÓWNAWCZA OCENA SPOSOBU ŻYWIENIA PEŁNOSPRAWNYCH I NIEPEŁNOSPRAWNYCH DZIECI W WIEKU SZKOLNYM

Emilia Kolarzyk, Anna Janik

Zakład Higieny i Ekologii, Collegium Medicum UJ, Kraków

Zbadano 142 uczniów w tym 106 pełnosprawnych (PS) i 36 niepełnosprawnych (NS) uczęszczających do klas integracyjnych szkół podstawowych miasta Krakowa. Badanie obejmowało 24-godzinny wywiad żywieniowy o spożyciu w dniu poprzedzającym badanie oraz dodatkowo pomiar masy i wysokości ciała.

Analiza jakościowa i ilościowa danych żywieniowych objęła ogólną ocenę całodziennej racji pokarmowej (CRP), liczbę posiłków spożywanych w ciągu dnia, stopień ich urozmaicenia oraz określenie składu i wartości odżywczej CRP badanych. Określono także średnie spożycie podstawowych składników energetycznych oraz ich procentowy udział jako źródeł energii (E%). W analizie sposobu żywienia uwzględniono podział badanych na grupy wg płci, wieku i typu sprawności (dzieci PS i NS). Otrzymane wyniki wskazują na błędy i nieprawidłowości popełniane w żywieniu badanych dzieci. U dzieci z obu grup sprawności tylko 37% CRP uznano za w pełni zadowalające, a typy zestawów produktów i dań w poszczególnych posiłkach były w obu grupach podobne. CRP badanych charakteryzowały się niskim stopniem realizacji norm na witaminy (B₂, PP, E) oraz składniki mineralne (Ca, Fe, Zn, Mg). Proporcje energii uzyskiwanej z białek, tłuszczów i węglowodanów były prawidłowe w grupach dziewcząt i chłopców PS, natomiast w większym lub mniejszym stopniu odbiegały od zaleceń w grupach dzieci NS. Nieprawidłowości stwierdzone wśród dzieci NS dotyczyły wyraźnie zawyżonej ilości energii pochodzącej z tłuszczów (dz. – 35%, chl. – 32%) oraz stosunkowo niskiej ilości energii pochodzącej z węglowodanów (dz. – 52%). Również w grupie dzieci NS obserwowano często (13,9%) zaburzenia proporcji wagowo-wzrostowych wskazujących na występowanie nadwagi i otyłości co przy niskim współczynniku aktywności fizycznej (1,5) i wysokiej wartości E% z tłuszczu może wskazywać na pewne trudności z utrzymaniem prawidłowej masy ciała. E% uzyskiwany z białka był zgodny z zaleceniami i wynosił dla chłopców i dziewcząt NS 13%.