

ASSESSING SCHOOLCHILDREN'S ABILITY TO MAKE PROPER USE OF A FOOD AND NUTRITION PYRAMID

Magdalena Górnicka, Zuzanna Wiszniewska, Malwina Wojtaś, Agata Wawrzyniak, Aleksandra Kanigowska

Chair of Nutritional Assessment, Department of Human Nutrition, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences, Poland

ABSTRACT

Background. Being acquainted with nutritional recommendations does not necessarily imply that they are fully understood, nor on how they can be applied when correctly planning an adequate diet.

Objective. To determine whether children can recognise single portion sizes of various foodstuffs and to test their ability for planning a daily menu in accordance to the guidelines from a Food and Nutrition Pyramid.

Material and methods. Subjects under survey were n=100 children aged 10-11 years, attending two elementary schools: in Warsaw and Piaseczno. The school in Warsaw participated in two national education programmes on food and nutrition (ie. 'Fruit at School' and 'A Glass of Milk') whilst the other did not participate in any such programmes. The study tool was a questionnaire consisting of closed questions together with practical exercises on planning a dietary balanced menu using the Food and Nutrition Pyramid recommendations.

Results. Children could easily recognise single portion sizes (73% correct replies), however they found it more difficult to plan a suitable menu, where 60% met the given specifications; ie. numbers of different food type portions, menu diversity, number of meals as well as taking physical activity into account. Girls were significantly better at planning menus. It was also found that, compared to the guidelines, wheat and dairy products, vegetables and fats were under-represented whereas meat and fruit were chosen in excess. Nearly 80% of menus were sufficiently diverse but only 48% were composed of a typical/normal selection of foodstuffs.

Conclusions. Despite being provided with guidelines for preparing appropriate menus, most children failed this task. This was likely due to either not fully understanding the instructions or a lack of skills in adopting the Food and Nutrition Pyramid recommendations. Thus it is necessary to give more comprehensive explanations when teaching nutrition during school lessons as well as letting the children practice doing the practical aspects.

Key words: pupils, food pyramid, nutritional recommendations

STRESZCZENIE

Wprowadzenie. Znajomość zaleceń żywieniowych nie zawsze przekłada się na ich zrozumienie i praktyczne zastosowanie do planowania zbilansowanych posiłków.

Cel. Celem badań było określenie stopnia znajomości wielkości pojedynczej porcji różnych produktów przez dzieci oraz ocena umiejętności planowania jednodniowego jadłospisu zgodnie z zaleceniami zawartymi w Piramidzie Zdrowego Żywienia.

Materiał i metoda. Badaniem objęto 100 dzieci w wieku 10-11 lat uczęszczających do szkół podstawowych: jednej w Warszawie, objętej programami edukacyjnymi „Owoce w szkole” i „Szklanka mleka” oraz drugiej w Piasecznie, nieobjętej żadnym programem edukacyjnym. Badanie przeprowadzono za pomocą autorskiego kwestionariusza ankiety z wykorzystaniem pytań zamkniętych oraz zadania praktycznego obejmującego zaplanowanie zbilansowanego jadłospisu z wykorzystaniem zaleceń przedstawionych w Piramidzie Zdrowego Żywienia.

Wyniki. Rozpoznanie pojedynczej porcji produktów nie stanowiło dla respondentów trudności (73% prawidłowych odpowiedzi), zaplanowanie prawidłowego jadłospisu sprawiało trudności, średnio 60% jadłospisów spełniało wyznaczone kryteria (odpowiednia liczba porcji poszczególnych grup produktów, urozmaicenie, liczba posiłków, uwzględnienie aktywności fizycznej). Badani uzyskiwali mniejszą od zalecanej liczbę porcji produktów zbożowych, warzyw, produktów mlecznych oraz olejów i tłuszczów, zaś powyżej zaleceń - owoców oraz produktów mięsnych. Prawie 80% jadłospisów było urozmaiconych, natomiast komponowane poszczególne posiłki tylko w 48% miały typowe zestawienie produktów.

Corresponding author: Magdalena Górnicka, Chair of Nutritional Assessment, Department of Human Nutrition, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences, Nowoursynowska street 159c, 02-776 Warsaw, Poland phone +48 22 59 37 122, fax +48 22 59 37 117, e-mail: magdalena_gornicka@sggw.pl

Wnioski. Uczniowie mimo podanych wytycznych jak prawidłowo zaplanować jadłospis w większości nie poradzi sobie z tym zadaniem, co mogło wynikać z niepełnego zrozumienia poleceń lub nieumiejętności zastosowania zaleceń zawartych w Piramidzie Zdrowego Żywienia. Wskazuje to na konieczność wprowadzenia bardziej obszernych wyjaśnień podczas omawiania zagadnień żywieniowych w czasie zajęć szkolnych i wielokrotnego ćwiczenia praktycznego wykorzystywania omawianych zaleceń.

Słowa kluczowe: uczniowie, piramida zdrowego żywienia, zalecenia żywieniowe

INTRODUCTION

In order to provide adequate nutritional education, recommendations that are targeted to wide sections of society need to be made very clear and easy to understand. Most commonly the message is presented as text, although graphical forms are also used such as pyramids, rainbows or circles/plates, where various foodstuffs are displayed so as help consumers remember them more [17, 18]. In food pyramids, the recommended number of foodstuff portions are usually shown where portion size are already pre-defined. The Food and Nutrition Pyramid for children used in the current study was prepared by the National Institute of Food and Nutrition in Warsaw, where portion sizes were established on the basis of previously worked out food ration recommendations for children aged 1-12 years [21], converted to domestic measures.

Teaching children about how many food portions should be consumed, becomes only practically meaningful if the child knows exactly what, for example, constitutes a single portion of fruit or of wheat products. Without this knowledge, using any food pyramid correctly will be problematical.

Related studies of this topic, up to now, stress the importance of consuming foodstuffs in portions that are appropriate to age and energy, requirement for preventing overweight and obesity. The frequently enlarged menus or double size portions that are energy dense/rich all contribute to the increasing appearance of obesity in children and adolescents [7]. Nowadays, the average portions of popular food items and meals in restaurants, fast-food outlets are larger than they were 20 years ago, sometimes up to 2-5 fold [4, 25]. Increases in portion size have also been noted for milk, bread, wheat flakes, juice and peanut butter whereas meat portions have decreased [15]. A previous study has in fact demonstrated that schoolchildren aged 10-11 attending third-fourth classes at elementary (primary) school do not really understand the concept of recommended food portions [24]. As a result, the present study has focused on determining to what degree children of this age group understand/are familiar with food portion size as well as assessing their abilities in planning a menu for a single day according to provided instructions and recommendations on nutrition; these taking into account

food diversity, numbers of meals and the child's level of physical activity.

MATERIAL AND METHODS

Subjects were 100 children, aged 10-11 years attending fourth class at two elementary schools as follows; one was in Warsaw (designated as group P) which participates in the 'Fruit in School' and 'A Glass of Milk' educational programmes whilst the other was in Piaseczno, which was not at all involved in any such programmes (designated as group BP). The study was conducted through a questionnaire, in matrix form, designed by the authors consisting of test questions as well as practical exercises to which had been added a diagram representing a Food and Nutrition Pyramid used previously on children aged 1-12 years.

In order to assess whether portion size had been correctly understood, children were asked to pick the right answer to the question of which picture represented a single portion from two options showing pictures of various foodstuffs in pairs. The practical exercises partly consisted of planning a menu and of leisure time. Here, subjects were firstly provided with a list of foodstuff examples, divided into product groups, each having the amounts given that are equivalent to a single portion. The child's task was to design a one day menu for one of their peers in accordance to the Food and Nutrition Pyramid guidelines. The second part comprised of selecting one answer of a series of activities about how to spend leisure time, where one half described active options eg. swimming, dancing whilst the other were passive eg. watching TV or solving jigsaw puzzles. Choosing an active option gave one mark whereas the passive option gave zero marks. When evaluating the practical exercises, the following criteria were adopted; agreement with the numbers of portions from specific foodstuff groups with recommended values, diversity, correct meal composition and selecting active pastimes for spending leisure time. Each correct answer was awarded 1 mark and an incorrect one zero marks.

The summary results are presented in two ways (Table 1). Firstly the marks achieved are crudely divided into two categories: those showing that their understanding is sufficient (high marks) or insufficient

(low marks); termed ‘Criteria I’. A more detailed breakdown of marks is achieved by having the marks now subdivided into 5 categories of understanding; termed ‘Criteria II’.

Table 1. Criteria adopted for evaluating the levels of children’s understanding of the Food and Nutrition guidelines

Criteria I		Criteria II	
% marks awarded	Level of understanding	% marks awarded	Level of understanding
0 – 50	insufficient	0 – 20	inadequate
		21- 40	low
51 – 100	sufficient	41 - 60	adequate
		61 – 80	good
		81- 100	very good

The data were also grouped into variables consisting of gender and type of school (ie. whether educational programmes on nutrition had been previously introduced). Statistical analysis was performed via the Statistica 8.0 Software package using the *Chi*² test adopting p ≤ 0.05 as the critical level for significance.

RESULTS AND DISCUSSION

Knowing the right sizes of food portions

Recognising single portions of foodstuffs as such, caused few problems amongst subjects with an average mark of 73% of the total available score; results between genders being virtually identical (73.0% girls vs 73.2% boys). Pupils from the school not having educational programmes on nutrition showed an insignificant increase in marks compared to the school that adopted these programmes; 74.8% vs 72.5%. The greatest problem found, was in subjects correctly assigning a single portion of fish fillets (only 36% right), followed by ice cream and tomatoes. In the case of ice cream, a third of the subjects specified four scoops as one portion which almost certainly reflects the great liking children have for sweet foodstuffs. This however signifies that a considerable section of children may have a tenden-

cy to eat too many sweet things, eventually resulting in overweight or tooth decay. Approximately 75% of subjects were aware that a portion of vegetables refers to an entire vegetable piece not just to one slice. Nearly all children understood that a portion of fruit is, for example, a whole orange.

Numerous studies indicate that giving children larger portions of food to eat that are above their nutritional needs leads to increased energy intake [4-7, 14, 15]. Such over consumption, through larger portions, can lead to an increased energy expenditure of 25-30%, [9]. Furthermore, it has been demonstrated that when a child is allowed to determine portion size by itself, then less food is consumed (by 17-25%) compared to when large food portions are offered [5, 7].

Planning skills required for designing a daily menu or choosing types of physical activity

Table 2, in part, show the criteria adopted from which designing an appropriate menu or selecting physical activities can be assessed, based on the Food and Nutrition Pyramid. In the first instance, subjects were checked whether their planned menus used those same numbers of portions, within specified foodstuff groups, that had been recommended in the tasks to be performed. Subjects in fact showed that they barely coped adequately, obtaining average scores of 44.1% from the available points. In this case girls showed that they performed better than boys as did those pupils from the school that participated in nutritional education programmes, (group P, Table 2). To a similar degree, 47.8% pupils could cope with planning the numbers of meals, which if Criteria I are adopted, demonstrate insufficient understanding, whereas the expanded Criteria II version shows a barely adequate level.

The foodstuff diversity of chosen menu components was also assessed, where children attained an average mark of 80.5% of the possible total, thus showing a satisfactory level of understanding the guidelines that covered this particular area.

Based on the ‘Daily Physical Activity’ theme stated in the Food and Nutrition Pyramid, an evaluation on

Table 2. The percentage of pupils who included four healthy lifestyle criteria into their answers

Assessment criteria	Average total (n=100)	Gender		p*	Average total (n=100)	School		p*
		girls (n=56)	boys (n=44)			P (n=51)	BP (n=49)	
		Number of portions	44.1			47.7	39.6	
Diversity	80.5	86.3	73.0	0.11	80.4	76.7	84.3	0.37
Number of meals	47.8	49.2	46.0	0.65	47.8	56.0	39.2	0.07
Physical activity	87.3	93.0	80.0	0.05**	87.0	82.0	92.0	0.16

Legend:

P - school participating in nutritional education programmes

BP - school non-participating in nutritional education programmes,

* *Chi*² result

** - Statistical significance at p≤0,05

how physical activity is planned, demonstrated that a large majority of pupils (87.3%) achieved a score of one; this being a very satisfactory outcome (Table. 2). It thus appears that children heeded the pyramid guidelines and practically applied them to ensure that daily physical exercise is performed as required. Girls and pupils from schools without education programmes gained somewhat higher marks, although this was not statistically significant. The most popular choices were tennis/football (41), followed by riding a bike (21), swimming/dancing (18) and going on family walks (9). Those choosing the passive options selected computer games (9), puzzles/board games (3), drawing/painting (3) and watching TV (1). It should however be emphasised that the actual leisure time spent on doing the active options, as chosen by the children, may not in reality be strictly followed. Other studies demonstrate that children and adolescents in fact do not do enough sports coupled with increased time spent in watching TV or sitting by the computer [1, 19]. Furthermore, children do not associate doing regular physical activity with health; only 16% of subjects from a 2007 study regarded that a lack of physical activity results in obesity [23]. These findings are disturbing, given the global rise of overweight and obesity seen in both children and adolescents.

A low proportion of pupil's replies took into account recommendations on the numbers of portions in specific foodstuff groups. The largest discrepancies were seen in wheat products, fats/oils and fruit, (Table 3). Girls however achieved high scores (88.0% correct replies) in selecting the recommended 4-8 portions of beverages. Likewise, better results were also obtained by pupils from schools doing the nutritional education programmes.

Results show that children have a low awareness of how many portions of specific foodstuff groups should be consumed daily. Most studies up till now confirm that pupils possess insufficient knowledge of this topic [3, 8]. Youngsters aged 13-15 years show that only $\frac{3}{4}$ of

those studied recognise that vegetables and fruit need to be eaten at each meal and barely $\frac{1}{4}$ know that at least 2 glasses of milk should be drunk daily [10, 23].

Children decidedly showed problems with choosing the recommended numbers of vegetable and animal fats portions, (Table 3). Butter or margarine frequently appeared in menus with bread at breakfast or dinner. Oil was rarely chosen, which is normally used for frying food at lunchtimes or on salad dressings where, in both cases to children, this is not a visible part of the prepared meal. It also seems that children don't know how to combine oil with other foodstuffs and therefore it can be missed altogether and the correct numbers of portions are not so attained.

The presented study demonstrates that, compared with recommendations, pupils chose smaller amounts of portions in the following foodstuffs; wheat products, vegetables, dairy products and fats; those chosen in excess were fruit and meat. These observations are consistent with studies on nutrition in schoolchildren where food rations are deficient in vegetables, fruit, brown bread, dairy products and vegetable oil coupled with too much meat and associated products like cold meats [11, 12]. It can be surmised that, to a certain degree, children make up menus based on their own daily experiences of eating/nutrition.

On average, girls used a more wider selection of foodstuffs from all groups in their menus than did boys and their replies were more accurate. Some boys tended to give careless answers as shown by the narrower range of selected foodstuffs and some left more than half the questions unanswered. Thus the average numbers of foodstuff portions were lowered.

The make-up of the following meals was checked for suitability; breakfast, second breakfast, lunch, teatime and dinner. This entailed making reasoned choices of foodstuffs that fitted each of these meals, for example sandwiches for breakfast or cereals with milk or for lunch meat with starchy dishes and vegetables.

Table 3. The percentage of pupils who properly followed recommendations when planning portions of different foodstuffs

Foodstuff group	Average total (n=100)	Gender		p*	Average total (n=100)	School		p*
		girls	boys			P	BP	
		(n=56)	(n=44)			(n=51)	(n=49)	
Wheat based	27.8	30	25	0.55	29.0	27	31	0.73
Vegetables	42.9	46	39	0.44	42.8	35	51	0.11
Fruit	43.6	44	43	0.87	37.9	35	41	0.57
Dairy	55.1	52	59	0.47	46.1	53	39	0.16
Meat	53.1	54	52	0.80	53.2	61	45	0.11
Fats	30.0	30	29	0.93	29.6	33	26	0.46
Beverages	71.3	88	50	0.000**	75.8	88	63	0.04**

Legend:

P - school participating in nutritional education programmes

BP - school non-participating in nutritional education programmes,

* Chi^2 result

** - statistical significance at $p \leq 0,05$

Table 4. The percentage of pupils that correctly designed their meals

Assessed meal	Average total (n=100)	Gender		p*	Average total (n=100)	School		p*
		girls (n=56)	boys (n=44)			P (n=51)	BP (n=49)	
Breakfast	62.3	61	64	0.77	61.7	71	52	0.05**
Second breakfast	52.8	59	45	0.18	41.1	48	34	0.21
Lunch	47.7	57	36	0.04**	36.2	45	27	0.05**
Teatime	60.0	67	51	0.07	46.4	65	27	0.000**
Dinner	41.1	49	31	0.10	31.9	29	35	0.57

Legend:

P - school participating in nutritional education programmes

BP - school non-participating in nutritional education programmes,

* χ^2 result

** - statistical significance at $p \leq 0,05$

Table 4 shows that pupils achieve insufficient levels of understanding according to Criteria I and an adequate level using Criteria II, (average of 52%). Most studies indicate that shortcomings in children's nutrition are in either missing or having irregular meals [2, 12, 13, 16, 20]. The current study however shows that only some meals are intermittently deficient by up to half the recommended content.

The most problems were found in planning dinner and lunch (Table 4). For breakfast, pupils most often chose bread with cold meats or cheese, milk with cereals and fruit. Likewise for second breakfast sandwiches, fruit and yogurts were chosen. Lunch was dominated by either chicken cutlets or filets of fish with potatoes or groats, tomato soup and sometimes coleslaw. For teatime, ice cream, pancakes, fruit and dairy desserts were picked whereas dinner was made up of sandwiches, fruit, pancakes, cheeses, milky drinks and ice cream. It was noticed that choices made for teatime and dinner were made with the least care; for example dinner could be just made up of ice cream or bread without anything else added. In addition, pupils gave foodstuffs inappropriate to the meal in question or they selected unusual combinations, for instance choosing chicken cutlets for second breakfast, soup for teatime or oil and yogurt in one meal; all these earning them zero points. This may have been caused by the children focusing too much on the required number of portions, whilst not applying reasoning and logically planning for specific meals; for this however girls were better than boys, especially for lunch. Pupils from schools participating in the aforementioned education programmes on nutrition gave more correct menus. Other studies have demonstrated similar choices of foodstuff as those made in the presented study [12, 16, 22].

In summary, the pupil subjects showed a good understanding of foodstuff portion sizes. However, despite being provided with indicators and guidelines on how to correctly plan a menu, most pupils failed. This may have been due a lack of understanding and skill in applying the recommendations made in the Food

and Nutrition Pyramid. This suggests that the rational basis for nutrition as shown in the Food and Nutrition Pyramid is not translated into how children plan their nutritional behaviour. The study has shown that girls perform better than boys, but that there were no significant differences in knowledge or skills between pupils from schools participating in educational programmes than with those that do not. Nutritional education at school should therefore be concentrated on teaching practical skills, so that pupils are able to organise and correctly make up daily meals; this could be achieved through introducing culinary/kitchen workshops.

CONCLUSIONS

1. Even though guidelines had been provided to pupils for preparing appropriate menus, most children failed this task. This was likely due to either not fully understanding the instructions or a lack of skills in adopting the Food and Nutrition Pyramid recommendations. A better understanding of the guidelines may be helped by placing numbers of foodstuffs into to specified groups which correspond to the recommended numbers of foodstuff portions per given group.
2. The findings indicate that the rational basis for nutrition as shown in the Food and Nutrition Pyramid is not translated into how children plan their nutritional behaviour. It would therefore seem necessary to teach children the practical skills required for applying nutritional recommendations.

REFERENCES

1. Charzewska J., Wajszczyk B., Chabros E., Rogalska-Niedźwiedz M.: Aktywność fizyczna w Polsce w różnych grupach wieku i płci. W: Diagnostyka stanu odżywienia, aktywności fizycznej i żywieniowych czynników ryzyka otyłości i przewlekłych chorób niezakaźnych w Polsce

- (1960-2005). *Jarosz M. (red.) IŻŻ*, Warszawa 2006, 321-337.
2. *Czeczulewski J.*: Częstość spożywania pierwszych i drugich śniadań przez uczniów klas IV-VI na przykładzie szkół podstawowych miasta Biała Podlaska. *Rocz Panstw Zakł Hig* 2001;52(3):321-328.
 3. *Fahlman M., Dake J., McCaughy N., Martin J.*: A pilot study to examine the effects of a nutrition intervention on nutrition knowledge, behaviors, and efficacy expectations in middle school children. *J School Health* 2008;78:216-222.
 4. *Fisher J., Kral T.*: Super-size me: Portion size effects on young children's eating. *Physiol Behav* 2008;94:39-47.
 5. *Fisher J., Rolls B., Birch L.*: Children's bite size and intake of an entrée are greater with large portions than with age-appropriate or self-selected portions. *Am J Clin Nutr* 2003; 77:1164-1170.
 6. *Fisher J., Arreola A., Birch L., Rolls B.*: Portion size effects on daily energy intake in low-income Hispanic and African American children and their mothers. *Am J Clin Nutr* 2007; 86:1709-1716.
 7. *Fisher J.*: Effects of age on children's intake of large and self-selected food portions. *Obesity* 2007;15:403-412.
 8. *Garcia-Lascurain M., Kicklighter J., Jonnalagadda S., Boudolf E., Duchon D.*: Effect of a nutrition education program on nutrition-related knowledge of English-as-second-language elementary school students: a pilot study. *J Immigrant Minority Health* 2006;8: 57-65.
 9. *Gottesman M.*: Educating parents about portion sizes for preschoolers. *J Pediatr Health Care* 2005;19:54-59.
 10. *Jeżewska-Zychowicz M.*: Ocena poziomu wiedzy żywieniowej młodzieży w wieku 13-15 lat w perspektywie prewencji chorób dietozależnych. *Żyw Czł Met* 2004;31,S 2/2, 86-98.
 11. *Kollajtis-Dolowy A., Kosińska M., Boniecka I.*: Częstość i ilość spożycia wybranych produktów spożywczych w grupie 10-12-letnich dzieci z terenu Grójca. *Żyw Czł Met* 2007;34:176-181.
 12. *Kollajtis-Dolowy A., Matysiuk E., Boniecka I.*: Zwyczaje żywieniowe wybranej grupy dzieci 11-12-letnich z Białegostoku. *Żyw. Nauka Technol. Jak.* 2007;55:335-342.
 13. *Kowalska A.*: Zwyczaje żywieniowe dzieci i młodzieży szkolnej na przykładzie województwa dolnośląskiego. *Roczn Naukowe* 2005; 7:87-91.
 14. *McConahy K., Smiciklas-Wright H., Mitchell D., Picciano M.*: Portion size of common foods predicts energy intake among preschool-aged children. *J Am Diet Assoc* 2004;104: 975-979.
 15. *McConahy K., Smiciklas-Wright H., Birch L., Mitchell D., Picciano M.*: Food portions are positively related to energy intake and body weight in early childhood. *J Pediatr* 2002; 140:340-347.
 16. *Ostalska J., Bzdęga J., Klarecki D.*: Promocja zdrowego żywienia wśród dzieci objętych kształceniem zintegrowanym klas I-III wybranych szkół podstawowych z gminy Warszawa – Bielany. *Żyw Czł Met* 2005, 32, supl. cz.1, 284-289.
 17. *Painter J., Jee-Hyun R., Yeon-Kyung L.*: Comparison of international food guide pictorial representations. *JADA* 2002, 102, 483-489.
 18. *Przysławski J.*: Zalecenia żywieniowe dla różnych grup ludności. W: *Bromatologia. Zarys nauki o żywności i żywieniu. Gertig H., Przysławski J.* PZWL, Warszawa 2006, 362-366
 19. Stan zdrowia ludności Polski w 2004 r. GUS, Warszawa, 2006.
 20. *Suliga E.*: The consumption frequency and the caloric value of breakfasts among the school children and teenagers. *Rocz Panstw Zakł Hig* 2006;57(1):73-79, (in Polish).
 21. *Turlejska H., Pelzner U., Szponar L., Konecka-Matyjek E.*: Zasady racjonalnego żywienia – zalecane racje pokarmowe dla wybranych grup ludności w zakładach żywienia zbiorowego. ISBN, Gdańsk 2006.
 22. *Ukleja A., Heropolitańska-Janik J., Sińska B., Kunachowicz H., Mileska M.*: Ocena stanu wiedzy żywieniowej dzieci w wieku 10-14 lat, po prelekcji na temat zasad racjonalnego żywienia. *Żyw Czł Met* 2003;30:428-433.
 23. *Weker H., Barańska M., Riahi A.*: Problem otyłości a wiedza żywieniowa u młodzieży w wieku 13-15 lat. *Rocz Panstw Zakł Hig* 2007;58(3):321-326.
 24. WNEP (2007): Developmentally appropriate nutrition education for youth ages 6-11. www.uwex.edu/ces/wnep/files/03resyth.pdf, Internet 17.03.2010.
 25. www.nhlbi.nih.gov, 2010

Received: 30.11.2012

Accepted: 11.04.2013