

Analysis and optimisation of calcium content in menus and dairy offer in Croatian kindergartens

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Summary

The importance of healthy diet from the earliest age as well as its influence on human health is indisputable. Unbalanced diet in childhood can, along with unhealthy lifestyle (stress, smoking, physical inactivity), cause a number of diseases at a later age. Two-week menus in 26 kindergartens from continental and coastal Croatia have been analysed, taking into consideration the type of kindergarten (public, private, or religious). The aim of this research is to determine the quality of the offer regarding the intake of milk and dairy products, which, regarding their bioavailability, represent a major source of calcium, an essential nutrient in the intensive growth phase of children and young people. Using basic statistics, significant differences were not determined neither in the regional offer of milk and dairy products in the different types of kindergartens nor in the content of calcium and phosphorus. Milk and dairy products were adequately represented in the weekly offer in both regions under observation, and the average offer contained 9.7 ± 1.5 servings. Average content of calcium in daily menus is 714.5 ± 235.9 mg, which is in agreement with dietary reference intake recommendations (300-800 mg) and Croatian recommendations (400-700 mg). Use of fuzzy logic in creating new daily menus, by combining the existing offers enabled significant enlargement of the set of nutritionally acceptable menus as well as a greater diversity of meals.

Key words: milk and dairy products, calcium, kindergartens, fuzzy logic

Introduction

Kindergartens are public institutions in which programmes of preschool education take place for children aged one (with exceptions of 6 months old) until they start attending elementary school. Depending on the programme, children spend in kindergarten between 5 and 10 hours a day, which means that the majority of their nutritional requirements are consumed there. According to the recommendations (Ministry of Health and Social Welfare, 2007), children who spend 8-10 hours in the kindergarten should be offered 4 meals: breakfast, evenings lunch and afternoon snack which cover approx.

10, 25, 35 and 10 % of children's daily energy needs representively. In Croatia, the capacities of the kindergartens are sufficient for 56.64 % of all children aged 1-7. From the total number of children in the kindergarten, 12.97 % go to private or religious ones, while the remaining 87.03 % go to public kindergartens.

Irregular diet in childhood, rich in saturated fat and monosaccharides, increases the risk of a number of chronic diseases such as vascular disease, hypertension, caries, obesity, diabetes, osteoporosis, atopic and autoimmune diseases, or inflammatory bowel diseases as Crohn's disease or ulcerative coli-

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tis (Nicholls and Grindrod, 2009). Initiation of these diseases can already begin in childhood as well as their prevention.

Calcium plays an important role in the prevention of various diseases, so it can be of use as a protection from hypertension - sufficient intake of Ca can lower the blood pressure and thus reverse the effect of high intake of sodium (Kourlaba et al., 2009; Saks et al., 2001). Considering that bone function includes the storage of calcium and phosphorus, a reduction in the content of these elements in bone may trigger homeostasis and the maintenance of normal physiologic functions of the growing organism during a short period of time (Tala de Souza et al., 2002). Milk is regarding its bioavailability a great source of calcium, and it also provides other nutrients including magnesium, phosphorus, and vitamin D in amounts and forms that are suitable for the absorption of each of these nutrients. Being rich with other nutrients, cereals, seeds, fish eaten with bones, or dried fruit are also valuable sources of calcium and phosphorus. That is why the selection of milk and dairy products as a part of kindergarten menus has been specially analysed.

Regarding the new Food standard for planning children's diet in kindergartens (Vučemilović and Vujić Šisler, 2007), which found its application in a number of kindergartens during 2008, the aim of this research is to use computational analysis to evaluate if the investigated menus from the kindergartens which have accepted the new standard, fulfil the requirements of children aged 1-6 for Ca and P, and whether the intake of dairy products corresponds to the recommendations by the programme of the Ministry of Health (Ministry of Health and Social Welfare, 2002 and 2007). The aim in this research was to compare the kindergarten meals regarding to the milk offer and the dairy product offers, with particularly respect to calcium and phosphorus, considering the kindergarten type and placement. Linguistic variables are oftenly used in meal planning such as "increase" intake, "insignificant" deviation, etc., which are "fuzzy". Because of this, the next step of the research was to present the possibility of using a computer program based on fuzzy logic in meal offer analysis as well as in creating new meal offers, observing as much as possible nutrients which increases the nutrient quality of the offers.

Materials and methods

Menus are collected from the kindergartens from all parts of Croatia (areas of Zagreb, Osijek, Rijeka, Split and islands) that are using the recommendations of the latest food standards (Vučemilović and Vujić Šisler, 2007) in their meal planning. Using the database of the composition of food (USDA, 2008) and according to the standards and recommended intake (Ministry of Health and Social Welfare, 2007), menu offers from 26 kindergartens were calculated. 9 kindergartens were private (5 from the continental part and 4 from the coastal part of Croatia), and 17 were public kindergartens (9 from the continent, and 8 from the coast). Often, there is one central kitchen that supplies several kindergartens in its vicinity. For that reason, not many kindergartens were taken into consideration.

Analysis, evaluation and planning of daily menus is based on combining the offers that fulfil 80 % of daily needs (Ministry of Health and Social Welfare, 2007) because the majority of children (78 %) spend 8-10 hours a day in kindergarten (Ministry of Science, Education and Sports, Croatia, 2009). Two-week offers, selected by a random sampling, were observed for each kindergarten. The daily offers consisted of breakfast, elevenses (a snack between breakfast and lunch), lunch and a snack offered after the afternoon nap. Basic statistics were performed using program *Statistica v.7.1*.

The analysis and optimisation of a large number of meals on the menu were performed using a computer programme (Gajdoš Kljusurić and Kurtanjek, 2003) adapted for the analysis and optimisation of children's diet. The following values in the meal offers were monitored: energy, proteins, carbohydrates, fat, minerals Ca, Mg, Fe, Zn, Cu and P, and vitamins A, thiamine, riboflavin, niacin, B₆ and C. All these nutrients were monitored during meal offer analysis and new meal offers planning, with a special attention paid to the ratio of milk and milk products regarding the bioavailability of calcium and phosphorus in them, all according to the directives prescribed by the programme of the Ministry of Health (Ministry of Health and Social Welfare, 2007).

A computer program was used to determine whether it is possible to combine daily offers with parts of the menus from some other days and whether

in this case the daily offer still fulfils the energy and nutritional needs of children. Combinations were made for each kindergarten separately as well as amongst them. For evaluation of a large number of possible daily combinations, Prerow value, PV, was used to estimate the coordination between the computer generated calculation and the recommendations as follows:

$$PV = \min \mu(x_i) \cdot \frac{n-1}{\sum_{i^{\text{th}} = \min}^n \mu(x_i)}$$

where PV is Prerow value, n is the number of the monitored nutrients, $\mu(x_i)$ is the function of each nutrient, $i = 1, 2, \dots, n$, i.e. the monitored nutrient.

PV value can be between 0 and 1, the acceptable value is >0.7 . Combinations with $PV < 0.7$ are nutritionally unacceptable because they can have a number of adverse effects on human health, especially over a longer period of time (Wirsam and Hahn, 1999).

Results and discussion

Taking into consideration that the majority of children spend up to 10 hours a day in kindergartens, and that 80 % of their daily nutritional requirements should be fulfilled in that period, it is essential that the offer and intake of food are in agreement with the recommendations.

The majority of children in kindergartens are aged 4-6 (Ministry of Science, Education and Sports, Croatia, 2009). Major sources of calcium for that age bracket are milk (approx. 40 % of daily Ca intake) and milk products (approx. 20 % of daily Ca intake), while the remaining sources of Ca are various cereals, seeds and legumes (oat flakes, chickpeas, sesame, corn), which are offered as mash or bread and rolls, and vegetables. Table 1 shows the average values of calcium and phosphorus content regarding the tested regions of Croatia and based on the data comparison, a significant difference in the amounts of these two nutrients was not observed (P value >0.5). DRI recommendations for calcium for children aged 1-3 are 500 mg/day, and for the age 4-8 800 mg/day, while the recommendations given by the programme (Ministry of Health and Social Welfare, 2007) are 600 mg/day for children aged 1-3 and 700 mg/day for children aged 4-6. Using the same statistical analysis, it was determined that there were no statistically significant differences between the Ca and P content of the continental and coastal menus, and that the amounts of monitored minerals do not differ among kindergarten types (public vs. private, or religious).

From the results in Table 1 it can be seen that the average content of Ca and P in menus is in agreement with Croatian (Ca=700 mg/day; P=600 mg/day) as well as DRI recommendations (Ca=800 mg/day; P=500 mg/day). Presently Ca from milk and dairy products makes 68.7 % of total offer on the daily menu. Its ratio in the meals can be divided in

Table 1: Average values of calcium (Ca) and phosphorus (P) amounts in menus for children aged 4-6, regarding kindergarten type

Tablica 1: Prosječna količina kalcija (Ca) i fosfora (P) u jelovnicima za djecu od 4 do 6 godina, prema vrsti dječjeg vrtića

Kindergartens Vrtići (N=26)	Public kindergarten*		Private or religious kindergarten#	
	Državni vrtići*		Privatni ili vjerski vrtići#	
	Ca (mg) mean±sd srednja vrijednost±sd	P (mg) mean±sd	Ca (mg) mean±sd	P (mg) mean±sd
Continental Croatia ¹ Kontinentalni dio RH ¹	787.9±178.3	851.5±183.5	688.6 ± 207.3	842.6±123.9
Coastal Croatia ² Priobalni dio RH ²	715.9±159.2	828.6±135.9	695.0 ± 197.6	796.5±106.8
Average/Prosjek	732.8±152.3	846.5±119.9	704.8 ± 127.8	811.6±109.6

(N^{1*}=5; N^{1#}=9; N^{2*}=4; N^{2#}=8)

Table 2: Comparison of daily offers of Ca and P from milk and dairy products and total (years 2001 and 2008) in Croatia

Tablica 2: Usporedba dnevne ponude za Ca i P iz mlijeka i mliječnih proizvoda i ukupno (godine 2001. i 2008.) u RH

Average, Croatia Prosjeak, Hrvatska	Milk and dairy/day (\pm SD)		Total/day (\pm SD)	
	Mlijeko i mliječni proizvodi/dan (\pm SD)		Ukupno/dan (\pm SD)	
	Ca (mg)	P (mg)	Ca (mg)	P (mg)
year 2001* 2001. godina*	369.9 \pm 122.9	272.2 \pm 92.2	n.d.	n.d.
year 2008 2008. godina	479.1 \pm 139.4	329.6 \pm 99.5	714.5 \pm 235.9	823.7 \pm 202.5

*from Colić Barić & Brlečić, 2001; n.d. - not determined

*preuzeto iz Colić Barić & Brlečić, 2001; n.d. - nije utvrđeno

the following order: 39.6 % in breakfast, 17.3 % in the afternoon snack, 8.0 % in elevenses, and 3.7 % in lunch. The meal that is the main source of phosphorus is lunch (39.5 %), than follows breakfast (36 %), afternoon snack (15.7 %) and elevenses (8.8 %). The main foodstuffs representing the source of phosphorus are fish, meat, potatoes, rice, cereals, eggs and dairy spreads.

However, for a good absorption of calcium in children, the amount of vitamin D is essential, as well as the ratio of calcium and phosphorus (Ca:P). The organism synthesizes adequate amount of vitamin D if hands and face are exposed to sunlight for at least 15 min a day (Biesalski and Grim, 2005; Webster-Gandy et al., 2006), which is a daily routine in kindergartens. Until recently it was considered that Ca:P should be 1:1, but more recent recommendations increase this ratio in favour of P, so the average ratio is 1:1.5 or even 1:2 (as opposed to Ca:P in human milk, where it is 2:1) (Alpers et al., 2008). The analysis shows that the ratio in the offered meals varies from 1:1.13 to 1:1.5 (average being 1:1.22), which is in agreement with the latest recommendations.

Food served to children every day should meet the needs for the expected energy intake, be of adequate amount and nutritive value, and offer diversity in order to develop healthy eating habits at the earliest age. Moreover, the number of meals in kindergartens should correspond to the length of a child's stay there, as proposed by the law (Ministry of Health and Social Welfare, 2007). Therefore, special attention should be paid to the intake of nutrients relevant for the growth, above all to calcium

intake from the sources that enable its best bioavailability, i.e. milk and dairy products (Iuliano-Burns, et al, 1999; Gueguen and Pointillart, 2000). Care should also be taken about the same meal frequency in order to avoid monotony (Komenović, 2006; Percil, 1999).

Average frequency of milk and dairy products in all menus was also calculated and it is shown in Table 3.

In the last 7 years, the offer of milk and dairy products as a part of the menus in preschool institutions achieved advances, as presented in tables 2 and 3.

Apart from satisfying the alimentary requirements, kindergarten diet also has educational role, as it creates habits for children who consume it every day (the right selection of foodstuffs, their amount in each meal, etc.).

The use of fuzzy sets in planning a diet shows that it is possible to model the recommendations for daily intake of nutrients, which represent crisp values, into membership functions for each nutrient, and to obtain applicable results based on optimisation achieved by the use of fuzzy logic (Wirsam and Hahn, 1999; Gajdoš Kljusurić and Kurtanjek, 2003). A model of membership function for Ca is shown in fig. 1.

Each of the kindergarten menus consists of breakfast, elevenses, lunch and afternoon snack, and there are 10,000 possible combinations in a two-week offer (10 breakfasts \times 10 elevenses \times 10 lunches \times 10 afternoon snacks). In total, there were 26 \times 10,000 combinations analysed. Prerow value

Table 3: Frequency of dairy offer per week in kindergartens which use nutrition standards

Tablica 3: Učestalost ponude mlijeka i mliječnih proizvoda tijekom jednog tjedna u vrtićima koji koriste prehrambene standarde

Milk and dairy products Mlijeko i mliječni proizvodi	Average frequency (servings/5 days, \pm SD) Prosječna učestalost (serviranje/5 dana, \pm SD)			
	year 2001 2001. godina	year 2008 2008. godina		Average Prosjek
		Public Državni	Private Privatni	
Milk, cocoa, white coffee Mlijeko, kakao, bijela kava	5.1 \pm 0.6	4.1 \pm 2.0	4.4 \pm 0.9	4.2 \pm 1.7
Creamy pudding (blancmange) Puding	0.6 \pm 0.5	0.5 \pm 0.5	0.9 \pm 0.7	0.7 \pm 0.6
Fermented dairy products Fermentirani mliječni proizvodi	0.8 \pm 0.6	1.4 \pm 0.8	1.9 \pm 0.8	1.6 \pm 0.8
Cheese Sirevi	0.3 \pm 0.5	1.4 \pm 0.7	1.3 \pm 0.7	1.3 \pm 0.8
Dairy spreads Mliječni namazi	n.d.	1.2 \pm 0.8	1.4 \pm 0.7	1.2 \pm 0.7
Semolina, grits or rice pudding Griz, krupica ili riža na mlijeku	n.d.	0.6 \pm 0.6	0.7 \pm 0.6	0.7 \pm 0.6
Total: Milk and dairy products Ukupno: mlijeko i proizvodi	6.8 \pm 0.9		9.7 \pm 1.5	

*from Colić Barić and Brlečić, 2001

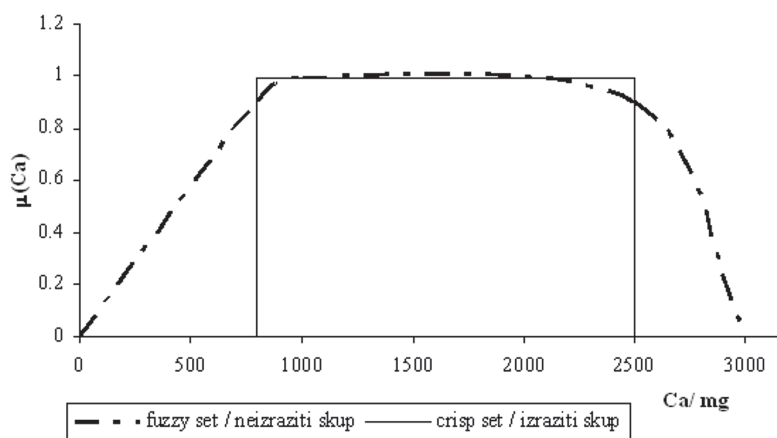


Figure 1: Recommended intake of calcium for children aged 3-8 using crisp and fuzzy set

Slika 1: Preporučeni unos kalcija za djecu od 3 do 8 godina, prikazan izrazitim i neizrazitim skupom

(PV), used to evaluate daily combinations, is acceptable for a nutritionist if it is higher than 0.7, according to the research by Wirsam et al. (1999) who claim that an offer with PV value lower than 0.7 is nutritionally unacceptable as it can have a number of

negative effects on human health, especially over a longer period of time. On the other hand, daily offers with PV values between 0.7 and 1 ($0.7 \leq PV \leq 1$) are acceptable and represent a nutritionally balanced offers (McBride, 1997; Wirsam, 1999). Table 4

Table 4: Examples of the evaluation of combinations

Tablica 4: Primjer ocjena kombinacija

Examples for combinations with evaluation				
Primjer kombinacije i ocjene				
Example of the offer for children aged 1-3			Example of the offer for children aged 4-6	
Primjer ponude za dob 1-3 godine			Primjer ponude za dob 4-6 godina	
No.	Combination/Kombinacija	PV	Combination/Kombinacija	PV
1	$B_1 + S_{11} + L_1 + S_{21}$	0.63	$B_5 + S_{15} + L_5 + S_{25}$	0.86
2	$B_1 + S_{11} + L_1 + S_{22}$	0.75	$B_5 + S_{15} + L_5 + S_{27}$	0.75
3	$B_1 + S_{12} + L_1 + S_{21}$	0.57	$B_2 + S_{15} + L_5 + S_{27}$	0.59

B_1 =milk and polenta; S_{11} =fruit tea with honey; S_{12} =yoghurt with oat flakes; L_1 =mashed potatoes, fried turkey upper leg, vegetable sauce, plain bread; S_{21} =fruit yoghurt (strawberry); S_{22} =fruit puree with biscuits; B_2 =white coffee, rye bread with butter and ham; B_5 =milk, cornflakes and honey; S_{15} =pear, tea; L_5 =vegetable soup with semolina, pasta in tuna and tomato sauce, salad with pumpkin-seed oil, plain bread; S_{25} =graham bread, melted cheese, tea with lemon and honey; S_{27} =rye bread, cheese spread, yoghurt

B_1 =palenta s mlijekom; S_{11} =voćni čaj s medom; S_{12} =jogurt i zobene pahuljice; L_1 =pire krumpir, pečeni pureći zabatak, umak od povrća, domaći kruh; S_{21} =voćni jogurt (jagoda); S_{22} =voćni biskvit; B_2 =bijela kava, raženi kruh sa maslacem i šunkericom; B_5 =mlijeko, kornflakes i med; S_{15} =kruška, čaj; L_5 =juha od povrća sa krupicom, tjestenina s tunom u umaku od rajčice, salata s bućinim uljem, domaći kruh; S_{25} =graham kruh, topljeni sir, čaj sa limunom i medom; S_{27} =raženi kruh, sirni namaz, jogurt

shows offers for infant nursery (aged 1-3) and kindergarten (aged 4-6).

Variables of the meals are $i=1, 2, \dots, 10$, and they represent the same meal. Variable $j=1, 2$ represents eleveses and snacks, where 1 is eleveses and 2 is the afternoon snack. Accordingly, the meals had the following labels: breakfast B_1, \dots, B_{10} ; eleveses S_{11}, \dots, S_{110} ; lunch L_1, \dots, R_{10} ; and afternoon snack S_{21}, \dots, S_{210} .

From the results of optimisation it can be seen that there are acceptable combinations (no. 2 for ages 1-3; no. 1 and 2 for ages 4-6), as well as unacceptable ones, which are possible to offer but they would have a negative effect, especially if offered for a longer time (table 2).

The analysis of the offered daily menus shows that 19.3 % of them do not fulfil all daily nutritional needs of children or meet the regulations.

The application of fuzzy logic enables the increase of diversity in offers for each kindergarten. By using various combinations, a maximum of 10,000 two-week offers for each kindergarten can be reached, from which those that are nutritionally acceptable ($PV \geq 0.7$) can be singled out by the use of fuzzy logic. Thus, for children aged 1-3, there is a set of 1338 nutritionally acceptable combinations, 400 of which have $PV \geq 0.8$, representing a well balanced offer. With these 400 combinations, menus

for 400 days, or almost 16 monthly menus, can be made and they would be different every day. It is also important to point out that there were 8662 badly balanced offers. The number of nutritionally acceptable combinations of menus for children aged 4-6, with $PV > 0.7$, was significantly higher, 3100, of which 1220 had almost optimum nutritive offer. On the other hand, among the nutritionally unbalanced combinations there were 6900 of them. Computer planning using fuzzy logic also enables detailed analysis of any offer, isolating crucial nutrient or nutrients that not meet the recommendations, as shown in table 5. Calcium, as a highly important nutrient, proved not to be critical during the analysis of the current offers nor in optimizing new ones, which is confirmed by the results shown in table 5, especially regarding the agreement of the number of meals with the programme of the Ministry of Health (Ministry of Health and Social Welfare, 2007).

The presented combination (table 5) is not acceptable because of too high content of retinol equivalent (RE, 3720.47 IU) and too low intake of carbohydrates (119.34 g) and Zn (1.53 mg). Therefore, it is enough that only one of 16 monitored nutrients has an unacceptable value ($PV < 0.7$) for a whole combination to be unacceptable, and in the given example there are 3 nutrients that do not correspond to the recommendations for that age bracket. The key to acceptability of this combina-

Table 5: Analysis of combination for children aged 1-3 ($B_1+L_4+S_{11}+S_{29}$, $PV=0.28$)Tablica 5: Analiza kombinacije za djecu dobi 1-3 godine ($B_1+L_4+S_{11}+S_{29}$, $PV=0,28$)

	Observed/Promatrano	PV	Content/Sadržaj
1	Energy/Energija (kcal)	0.81328	918.11
2	Proteins/Proteini (g)	0.91480	34.31
3	Fat/Masti (g)	0.95558	31.98
4	Carbohydrates/Ugljikohidrati (g)	0.67550	119.34
5	Ca (mg)	0.90030	401.22
6	Mg (mg)	0.97140	111.19
7	P (mg)	0.95236	649.99
8	Fe (mg)	0.99468	5.43
9	Zn (mg)	0.61200	1.53
10	Cu (mg)	0.95555	0.24
11	RE (IU)	0.31601	3720.47
12	B_1 (mg)	0.97000	0.37
13	B_2 (mg)	0.99642	0.45
14	Niacin (mg)	0.91483	10.08
15	B_6 (mg)	0.99900	0.42
16	Vitamin C (mg)	0.93818	103.49

B_1 =milk and polenta; S_{11} =fruit tea with honey; S_{29} =banana and peach fruit puree;

L_4 =vegetable soup with millet, chicken in vegetable sauce, gnocchi, bread

B_1 =palenta s mlijekom; S_{11} =voćni čaj s medom; S_{29} =voćni pire od banane i breskve;

L_4 =juha od povrća s prosom, pileтина u umaku od povrća, njoki, kruh

tion is a nutritionist who will, based on the critical parameters, evaluate a potentially negative effect on health. Since this is the case of a daily exceeding of the value, it is possible that the excessive intake of RE will be annulled during the week.

Conclusions

The analysed menus from public, private and religious kindergartens indicate the diversity of milk and dairy products offered, which is in agreement with the recommendations, as well as the adequate intake of calcium and phosphorus. A progress has also been observed in the past 7 years, which is a result of the continuous work of qualified teams.

Statistical analysis does not show any significant differences in the offers of milk and dairy products, nor in the intake of calcium and phosphorus among the analysed menus from the continental and coastal Croatia.

The use of fuzzy logic in analysis of a diet, enables a significantly larger number of combinations than which exist at the moment. It also gives a possibility to accept some combinations of daily

menu if they vary slightly from the recommendations ($PV \geq 0.7$). Minimum time period for planning menus is one week, so it is possible to annul slightly positive or negative deviations on daily basis. The application of fuzzy logic also showed a possibility of rapid detection of a critical nutrient, which enables a nutritionist's quick intervention and correction of the offer. It is often considered that replacing food-stuffs (e.g. a spread in the snack) is a minor intervention in daily nutritive offer, but computer analysis and planning show it is not so, and that such replacements can change daily intake and the balance of crucial nutrients.

Analiza i optimiranje udjela kalcija te mlijeka i mliječnih proizvoda u obrocima hrvatskih predškolskih ustanova

Sažetak

Važnost pravilne prehrane za zdravstveni status neosporna je kao i njezin utjecaj od najranije dobi. Nepravilna prehrana u dječjoj dobi, uz nepovoljan stil života (stres, pušenje, tjelesnu neaktivnost),

može biti uzročnikom niza bolesti u kasnijoj dobi. Analizirani su dvotjedni jelovnici 26 dječjih vrtića kontinentalne i primorske Hrvatske uz razlikovanje tipa vrtića (državni i privatni ili vjerski). Cilj rada bio je utvrditi adekvatnost ponude s obzirom na zastupljenost mlijeka i mliječnih proizvoda u jelovniku, jer ove namirnice zbog svoje bioiskoristivosti predstavljaju glavni izvor kalcija, nutrijenta čija se važnost osobito očituje u intenzivnoj fazi rasta i razvoja djece i mladih. Primjenom ANOVA nisu ustanovljene značajne razlike u regionalnoj ponudi kao niti razlike u ponudi različitih tipova vrtića glede ponude mlijeka i mliječnih proizvoda te sadržaju kalcija i fosfora. Mlijeko i mliječni proizvodi primjereno su zastupljeni u tjednoj ponudi u obje promatrane regije, a prosječna ponuda sadržava $9,7 \pm 1,5$ serviranja mlijeka i mliječnih proizvoda. Prosječna količina kalcija u dnevnom jelovniku dječjih vrtića je $714,5 \pm 235,9$ mg što je u skladu sa DRI preporukama (300-800 mg) i hrvatskim preporukama (400-700 mg). Također, primijenjena je neizrazita logika u osmišljavanju novih dnevnih jelovnika kombinacijom postojećih ponuda što je omogućilo znatno proširenje skupa nutritivno prihvatljivih jelovnika kao i veću raznolikost.

Ključne riječi: mlijeko i mliječni proizvodi, kalcij, dječji vrtići, neizrazita logika

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