



## ANALYZING NUTRITION RATIIONS AT PRE-SCHOOL CHILDREN FACILITIES IN A LARGE INDUSTRIAL CITY IN RUSSIA

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*Our research goal was to assess nutrition rations (menus) offered to children at pre-school children facilities after they had raised the costs of their services.*

*We performed hygienic assessment of cycle menus in order to establish whether they conformed to the existing standards; the assessment was performed in 28 pre-school children facilities in different districts of a large Russian city. All the calculations were made with our own software program called "Menu" that contained a database on a chemical structure of food products and product charts for dishes and culinary products.*

*Model menus offered to children at pre-school children facilities were able to satisfy their needs in macro-nutrients (by 102–127 %), vitamins (by 102–176 %), and minerals (by 102–162%). However, vegetable fats were not provided in sufficient quantities (20 %). We revealed that there was a deficiency of certain products in a ration and it amounted to 10 % regarding vegetables and wheat flour; more than 20 %, potatoes; more than 30%, sour milk drinks and vegetable oil. We also revealed that there were discrepancies between a stated quantity of a product and its actual provision in a ration or dishes and culinary products were not provided in a quantity stated in an official menu; sometimes the same dishes were offered to children for two days. Greater payments made by parents to a pre-school facility for taking care of their children didn't result in better nutrition provided by such facilities.*

*Our research results revealed that any sanitary-epidemiologic surveillance aimed at preventing risks of alimentary dependent diseases should concentrate on eliminating deficiency of certain products (sources of essential nutrients such as animal proteins, vegetable fats, food fiber, and vitamins). Optimizing nutrition in pre-school facilities will require certain social and preventive activities.*

**Key words:** nutrition, pre-school children facilities, menu, chemical structure, a set of products, nutrient charts for dishes, age-related needs, elimination of products deficiency.

The RF President Order No. 240 issued on May 29, 2017 fixes that the decade from 2018 to 2027 is The Decade for Childhood. The order stipulates activities that should be implemented in this decade and make for the next generation in Russia to be healthy [1]. Providing children and teenagers with healthy nutrition is a vital component in the process.

At the same time, in many regions in the country there have been persistent violations detected at pre-school children facilities (PSCFs) and related to nutrition provided for children who attend such facilities. These violations generally involve deficiency of certain products in daily rations such as sources of full-fledged proteins or, on the contrary, ex-

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cessive consumption of macaroni, cereals, confectionary, and sugar. These violations can probably result from food products being not affordable due to insufficient budgetary allocations provided for pre-school children facilities as inflation processes and growing prices for food products are not taken into accounts when budgets are drawn up [2].

In 2018 municipal authorities fixed new differentiated charges for services provided by pre-school children facilities in a large industrial city in Russia (Perm); to be exact, the charges doubled<sup>1,2</sup>. Given that, it seems interesting to assess daily menus and establish whether they conform to existing hygienic requirements and are sufficient for providing children with rational nutrition

**Our research goal** was to assess daily rations (menus) provided for children at pre-school children facilities after charges for their services had been increased in 2018.

**Data and methods.** We assessed nutrition provided for children at PSCFs using cyclic menus (drawn up for 10–20 days); menus were in free access on PSCFs official web-sites. The first stage in our research involved preliminary assessment of existing nutrition rations in 28 PSCFs located in seven administrative districts in the city; overall, 10,202 children aged 3–7 attended those facilities; 28 examined PSCFs accounted for 20 % of the total municipal PSCFs located in the city.

At the second stage we selected nutrition rations provided for children who attended PSCFs and daily spent 10–12 hours there. We applied calculation procedures to examine nutrition rations. Cyclic menus (their nutrient and biological value, to be exact) offered at PSCFs

were analyzed as per basic parameters fixed in the existing regulatory documents, SER 2.4.1.3049-13<sup>3</sup> and Methodical Guidelines 2.3.1.2432-08 MR<sup>4</sup>. We calculated product sets, chemical structure and energy value for each ration with “Menu” software package which we had developed ourselves. The package contained a database on chemical structures of food products based on the reference book called “Chemical structure of food products made in Russia” [3] as well as on technological charts and nutrient-grams for dishes and culinary products that took into account losses involved in cooking processes and were created on the basis of “A collection of technological standards, precipices, and culinary products for pre-school children facilities” [4], a manual which was to be obligatory applied at PSCFs.

The third stage involved processing all the obtained data and developing recommendations on adjusting nutrition rations provided for pre-school children. Obtained results were drawn up to form a database with Excel; they were statistically processed with Statistica 6.0 applied software package; we calculated certain parameters used in descriptive statistics.

**Results and discussion.** Cyclic (draft) menus were approved only by a head of a pre-school children facility at all 28 examined PSCFs as it is not obligatory to submit them for approval to Rospotrebnadzor authorities (SER 2.4.1.3049-13, item 15.3). Children are provided with 4 or 5 meals a day at a PSCF, a breakfast, brunch (not always), lunch, mid-afternoon snack, and dinner; such scheme is optimal when children spend 12 hours a day in a PSCF; each meal conforms to hygienic stan-

<sup>1</sup> On Approval on differentiated charges to be paid by parents (legal representatives) for educational and nursing services provided by municipal pre-school children facilities dealing with childcare and education in Perm for 2015: The Regulation by Perm City Administration dated October 31, 2014 No. 801. *KODEKS: the electronic fund for legal and reference information*. Available at: <http://docs.cntd.ru/document/432445827> (20.11.2019).

<sup>2</sup> On Approval on differentiated charges to be paid by parents (legal representatives) for educational and nursing services provided by municipal pre-school children facilities dealing with childcare and education in Perm for 2019: The Regulation by Perm City Administration dated October 25, 2018 No. 829. *KODEKS: the electronic fund for legal and reference information*. Available at: <http://docs.cntd.ru/document/550218824> (20.11.2019).

<sup>3</sup> SER 2.4.1.3049-13. Sanitary-epidemiologic requirements to organizing and maintaining proper functioning of pre-school children facilities. *KODEKS: the electronic fund for legal and reference information*. Available at: <http://docs.cntd.ru/document/499023522> (20.11.2019).

<sup>4</sup> MR 2.3.1.2432-08. Standards fixed for physiological needs in nutrients and energy for various population groups. Available at: [https://rospotrebnadzor.ru/documents/details.php?ELEMENT\\_ID=4583](https://rospotrebnadzor.ru/documents/details.php?ELEMENT_ID=4583) (20.11.2019).

dards as per nutrition structure. However, as we assessed a total volume of dishes included into all meals, we revealed that helpings and culinary products were somewhat smaller in their mass in 10 pre-school children facilities (36 % of the examined PSCFs) and it more frequently happened with evening meals.

Dishes included into a ration should be variable to provide children with all the necessary nutrients in maximum quantities. Nevertheless, we revealed that some dishes were repeatedly offered to children during two subsequent days (for example, semolina and wheat cereal, shchi, mashed potatoes, boiled macaroni, omelet, stewed cabbage, cutlets made of fish and poultry) and it violated requirements fixed in SER (item 15.5).

We analyzed nutrient structures of rations and revealed that calorie contents as well as contents of proteins, fats, and carbohydrates corresponded to age-related standards at all the examined PSCFs (Table 1).

Thus, calculated protein quantity in nutrition rations amounted to 65–73 g (median value was equal to 68 g); fats, 66–71 g (median value,

68 g); carbohydrates, 256–276 g (median value, 266 g); energy value, 1,883–2,025 kcal (median value, 1,972 kcal). Macronutrients ratio was close to a recommended standard, 1:1:3.9. Taking into account additional meals consumed by children at home, we can assume that theoretically their meals contain necessary nutrients in more than sufficient quantities.

Contributions made by specific nutrients into overall energy value (12–15 % by proteins; 30–32 %, by fats; 55–58 %, by carbohydrates) of examined menus corresponded to a basic principle of rational nutrition, notably, achieving proper balance between all the components (the 2<sup>nd</sup> level).

But still, we should note that we detected vegetable fats deficiency (74 % of SPN or not more than 20 % of the overall fats, the standards being not less than 30 %), that is the 3<sup>rd</sup> level of proper balance was not achieved.

Besides, there was another problem related to vitamin and mineral contents of meals provided for children; although they were sufficient for completely satisfy age-related physiological needs, they were still imbalanced (Table 2).

Table 1

Calorie contents and chemical structure of rations provided for children at pre-school children facilities

Nutrients	Absolute value ( <i>n</i> = 28)	SPN*	% of SPN ( <i>n</i> = 28)
Calorie contents, kcal	1,972 (1,883; 2,025)	1,800	110 (105; 113)
Proteins, g	68 (65; 73)	54	127 (121; 135)
Animal proteins, g	40 (38; 43)	35	114 (109; 122)
Fats, g	68 (66; 71)	60	114 (110; 118)
Vegetable fats, g	13 (12; 14)	18	74 (68; 78)
Carbohydrates, g	266 (256; 276)	261	102 (98; 106)

Note: SPN\* means standard physiological need.

Table 2

Contents of certain vitamins and minerals in rations provided at pre-school children facilities

Nutrients	Absolute value ( <i>n</i> = 28)	SPN	% of SPN ( <i>n</i> = 28)
Thiamin (B <sub>1</sub> ), mg	0.9 (0.9; 1.0)	0.9	102 (98; 108)
Riboflavin (B <sub>2</sub> ), mg	1.5 (1.4; 1.5)	1.0	147 (140; 153)
Vitamin C, mg	64 (58; 79)	50	129 (116; 157)
Vitamin A, µg RE	0.9 (0.4; 1.2)	0.5	176 (87; 237)
Vitamin E, mg	8.7 (8.3; 9.3)	7.0	124 (118; 133)
Calcium, mg	911 (889; 938)	900	101 (99; 104)
Phosphor, mg	1,284 (1,223; 1,318)	800	160 (153; 165)
Magnesium, mg	287 (272; 295)	200	143 (136; 147)
Iron, mg	16 (15; 17)	10	161 (153; 169)

Table 3

A set of products used to make up rations at pre-school children facilities

Products	Absolute value in grams ( $n = 28$ )	RC*	% of RC ( $n = 28$ )
Wheat bread	85 (77; 97)	80	106 (97; 122)
Rye bread	50 (45; 50)	50	100 (90; 100)
Wheat flour	24 (20; 27)	29	82 (70; 92)
Potato flour	3 (2; 5)	3	100 (73; 153)
Macaroni	12 (11; 13)	12	98 (89; 108)
Cereals and bans	51 (47; 58)	43	118 (109; 135)
Potatoes	189 (177; 207)	234	80 (76; 88)
Vegetables	295 (275; 317)	325	90 (85; 98)
Fresh fruits and berries	120 (107; 135)	114	105 (94; 118)
Dried fruits and berries	15 (11; 19)	11	132 (103; 173)
Fruit, vegetable, and berry juices	100 (93; 100)	100	100 (93; 100)
Meat	65 (58; 75)	60.5	107 (96; 123)
Poultry	32 (27; 38)	27	119 (98; 141)
Sausage	7 (6; 7)	7	102 (81; 103)
Fish fillet	41 (35; 49)	39	106 (89; 125)
Milk	346 (309; 372)	270	128 (114; 138)
Sour milk products	103 (74; 144)	180	69 (49; 96)
Curds	40 (38; 43)	40	101 (95; 108)
Cheese	6 (5; 7)	6,4	95 (77; 103)
Cream	9 (7; 12)	11	80 (67; 113)
Eggs	24 (20; 27)	24	98 (85; 112)
Butter	32 (29; 33)	21	151 (138; 159)
Vegetable oil	7 (6; 8)	11	64 (53; 69)
Confectionary and bakery	21 (19; 23)	20	106 (96; 115)
Sugar	53 (48; 55)	47	112 (103; 117)

Note: RC\* means recommended consumption as per SER 2.4.1.3049-13.

A child's body should be provided with calcium and phosphor in proper quantities. Insufficient consumption of calcium causes higher rachitis risks and can aggravate the disease; excessive calcium quantities can result in pathologic calcification of the kidneys and other internal organs. Consequently, when assessing nutrition rations provided for children, we should take into account adhering to proper ratios between calcium and phosphor contents as it is a significant preventive factor. We established that calcium to phosphor ratio was 1: 1.4 in the examined ratios and it didn't conform to hygienic recommendations (1: 0.88). Median value for phosphor quantity in rations was equal to 1,284.0 and it was substantially higher than the recommended one (800 mg).

Table 3 contains data on a daily set of products offered by PSCFs. Cyclic menus offered by PSCFs where children daily spend

more than 8 hours should contain all the necessary products according to the requirements fixed in the sanitary legislation. However, our quantitative assessment of food products consumption (as components in cooked dishes and recalculated as per raw products) revealed that there was deficiency of certain products whereas others were present in excessive quantities

Regardless of a city district, children were offered the same products in quantities higher than recommended: cereals, beans (19 % excess), milk (28 %), dried fruits (32 %), butter (51 %), and poultry (19 %). Unnecessary surplus could reach 100 % in some PSCFs. On the contrary, vegetables and potatoes were provided to children in quantities lower than recommended consumption, deficiency reaching from 10 to 20 % accordingly. Vegetables were provided in insufficient quantities in only two PSCFs whereas potatoes were provided in low

quantities in half of all the examined PSCFs. We should also note that most menus contained certain products in rather low quantities such as sour milk products (31 % deficit), sunflower oil (36 %), cream (20 %), and wheat flour (18 %) which were used as ingredients to cook dishes.

Taking into account a consideration that documentary data can differ from actual consumption due to children refusing to eat some dishes and culinary products (it is confirmed by substantial quantities of food wastes accumulated at PSCFs) [5], we can assume that it is allowable to have some products provided in quantities higher than recommended consumption. But on the other hand, excessive quantities of certain products displace other products from rations resulting in their deficit and it undoubtedly violates hygienic requirements.

We should also note that optimal macronutrients contents are provided both due to some products offered to children in quantities within recommended consumption limits and due to above-mentioned products offered in excessive quantities. But quantitative nutrient structure of food can't be adequate as there is deficit of its significant components. Thus, for example, in case flour, potatoes, and vegetables are not provided in proper quantities, carbohydrates can be obtained from excessive quantities of cereals and sugar. When we examined a set of products in order to determine animal proteins sources, we established that sour milk products were not provided in proper quantities; it is rather bad as such products are, among other things, a significant factor that creates microbiocenosis in the intestines. Detected low quantities of vegetable fats result from insufficient use of sunflower oil whereas butter is provided in significantly excessive quantities and it makes overall fat consumption conform to hygienic requirements.

Excess vitamin quantities detected as per calculations should be considered conforming to the standards. Leading experts think that actual macronutrient quantities can be lower due to losses occurring when products are first stored and then processed while being cooked

[6]. Moreover, such quantities don't mean it is not necessary to perform additional vitamin fortification of dishes. As it is known from literature, even if rations have vitamins in sufficient quantities, their concentrations are usually low in blood of children who are chronically exposed to adverse environmental factors which is typical for large industrial cities, Perm being one of them [7].

Our research revealed that a draft menu didn't always meet the requirements fixed for food variety. And we should take into account that there are additional factors that prevent assessing actual repeatability, for example, an actual ration can deviate from data stated in a cyclic menu as per a list of offered dishes and culinary products as it was detected via social control procedures performed at PSCHs in the city and aimed at assessing how nutrition was organized<sup>5</sup>.

Therefore, despite each PSCF has a draft menu approved by its head and placed on its web-site for free access, we still managed to detect certain violations that contradicted sanitary legislation and principles of rational (healthy) nutrition provided for children.

A probable reason for such a situation can be absence of obligatory procedures requiring all draft menus to be approved or inspected by Rospotrebnadzor bodies.

Another, and the most significant, reason is absence of qualified staff; usually staff who are involved in developing and adjusting draft menus are rather low-skilled. We can't completely exclude a consideration that existing standards for food products consumption might be imperfect at the moment [8].

Given the fact, that nutrition quality is closely connected with economic factors as it was proven in a research work that focused on analyzing nutrition in families [9] another reason for improper draft menus can be insufficient financing.

Another question which we would like to find an answer to in our research is whether an increase in charges for PSCFs services had any positive influence on quality of nutrition provided for children in them. To do that, we

<sup>5</sup> The Report on activities performed by Perm Regional Civic Chamber in 2016. *Perm Regional Civic Chamber*. Available at: <http://oppk.permkrai.ru/docs> (28.11.2019).

should return to our previous research that was accomplished prior to the increase in charges during a period when they remained steady (2014). Data taken from menus indicated that children were similarly provided with all the necessary nutrients and energy according to their physiological needs, excluding vegetable oils, and they were offered all basic products in quantities equal to 90–118 % of recommended consumption [5]. However, apart from other deficit, present day rations contain significantly lower quantities of sour milk drinks (by 1.7 times,  $t$ -test = 2.78,  $p < 0.05$ ), curds (2.5 times,  $t$ -test = 3.1,  $p < 0.01$ ), and macaroni (by 3 times,  $t$ -test = 18.8,  $p < 0.01$ ). As prices are constantly growing, even higher charges that parents have to pay for PSCFs services can't provide sufficient funding for such organizations and it influences nutrition quality and structures of product sets used to cook dishes.

There are unified requirements to organizing nutrition in pre-school children facilities in Russia; still, authors of various research works prove that products sets do not conform to hygienic standards in various regions in the country and in some cases even macro- and micro-nutrients contents are imbalanced. Insufficient quantities of vegetables, fruit, fish, milk, and milk products are a prevailing violation in structures of product sets [10–13]. Taking into account persistent violations detected in rations provided for pre-school children at home [14–16] optimization of nutrition at pre-school children facilities should become a top priority. Imbalanced and irrational nutrition provided for children is a pressing issue in other countries [17–20]. The Russian Federation adheres to its decisiveness to achieve stable welfare as regards food consumed by population, including nutrition provided for children, as our country signed the Rome Declaration on Global Food Security in 1992 among 159 world countries.

**Conclusions.** We analyzed nutrition rations (menus) provided for children who attended pre-school children facilities in a large industrial city in Russia. Our analysis revealed that draft menus offered at PSCFs can satisfy age-related needs in macronutrients (by 102–127 %), vitamins (102–176 %), and minerals (by 102–126 %), but vegetable oils are provided in insufficient quantities (20 % of recommended consumption), and calcium and phosphorus consumption is not balanced well. Vegetables and wheat flour were provided in quantities that were by 10 % lower than recommended; potatoes and cream, by 20 %; sour milk drinks and sunflower oil, by 30 %. We also detected situations when dishes and culinary products were provided with their weight being lower than it was stated in a menu; sometimes the same dishes were offered to children during two subsequent days. Consequently, higher charges that parents had to pay for education and childcare provided by pre-school children facilities are not a key factor that can result in improved quality of nutrition at PSCFs. At present, in order to prevent risks of alimentary-dependent diseases, sanitary and epidemiologic surveillance should be oriented at detecting and eliminating any food product deficiency (especially regarding food products that provide people with essential nutrients such as animal proteins, vegetable fats, dietary fibers, and vitamins). It is also necessary to update regulatory and methodical documents that stipulate how to organize nutrition; to develop and implement up-to-date cyclic menus with the help of experts; to train medical personnel employed at PSCFs how to adjust rations; it is also very important to provide state support for priority projects focused on eliminating vitamin and mineral deficiency in nutrition.

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## References

1. Kuchma V.R. 2018–2027 years – a decade of childhood in Russia: goals, objectives and expected results in the sphere of health saving of students. *Voprosy shkol'noi i universitetskoj meditsiny i zdorov'ya*, 2017, no. 3, pp. 4–14 (in Russian).
2. Tapeshkina N.V., Popkova L.V. The main tendencies nutrition of children in preschool institutions for the last 30 years in the Russian Federation (literature review). *Gigiena i sanitariya*, 2016, vol. 95, no. 2, pp. 202–206 (in Russian).
3. Khimicheskii sostav rossiiskikh produktov pitaniya [Chemical structure of food products made in Russia]. In: I.M. Skurikhin, V.A. Tutel'yan eds. Moscow, DeLi print Publ., 2002, 236 p. (in Russian).

4. Sbornik tekhnologicheskikh normativov, retseptur blyud i kulinarnykh izdelii dlya doshkol'nykh organizatsii i detskikh ozdorovitel'nykh uchrezhdenii [A collection of technological standards, recipes, and culinary products for pre-school children facilities and children recreational facilities]. In: A.Ya. Perevalov ed., Perm, 2013, 495 p. (in Russian).
5. Perevalov A.Ya., Lir D.N. Choice of studying method the food for children in organized groups in health risk assessment. *Health Risk Analysis*, 2014, no. 4, pp. 20–26. DOI: 10.21668/health.risk/2014.4.03.eng
6. Spirichev V.B. Chto mogut vitaminy: paradoksy pravil'nogo pitaniya [What vitamin can do: paradoxes related to rational nutrition]. Moscow, AST-PRESS KNIGA Publ., 2013, 288 p. (in Russian).
7. Ustinova O.Yu., Yambulatov A.M., Nikiforova N.V. Peculiarities of formation of vitamin deficiency in children of preschool age, subjected to chronic impact of chemical risk environmental factors. *Gigiena i sanitariya*, 2018, vol. 97, no. 1, pp. 70–75 (in Russian).
8. Shvetsov G.A. Voprosy organizatsii pitaniya v detskikh doshkol'nykh uchrezhdeniyakh [Issues related to organizing nutrition in pre-school children facilities]. *Gigiena i sanitariya*, 2006, no. 3, pp. 44–50 (in Russian).
9. Martinchik A.N., Baturin A.K., Keshabyants E.E., Fat'yanova L.N., Semenova Ya.A., Bazarova L.B., Ustinova Yu.V. Dietary intake analysis of Russian children 3–19 years old. *Voprosy pitaniya*, 2017, vol. 86, no. 4, pp. 50–60 (in Russian).
10. Petrov V.A., Semaniv E.A., Kovalevskaya S.M. Sostoyanie fakticheskogo pitaniya v doshkol'nykh munitsipal'nykh obrazovatel'nykh uchrezhdeniyakh (DOU) g. Vladivostok i puti ego pozitivnoi korrektsii [Actual nutrition provided for children in municipal pre-school children facilities in Vladivostok and ways to improve it]. *Zdorov'e. Meditsinskaya ekologiya. Nauka*, 2011, vol. 45, no. 2, pp. 12–15 (in Russian).
11. Boeva A.V., Tarmaeva I.Yu. Nutritional assessment of nursery schools' children in Irkutsk. *Sibirskii meditsinskii zhurnal (Irkutsk)*, 2015, vol. 135, no. 4, pp. 82–85 (in Russian).
12. Tapeshkina N.V. Specificities of the structure and organization of nutrition of children who go to children's preschool institutions. *Voprosy detskoj dietologii*, 2015, vol. 13, no. 4, pp. 68–73 (in Russian).
13. Mazhaeva T.V., Chugunova O.V., Grashchenkov D.V. Some aspects of the structure and organization of child nutrition in a number of regions Russia. *Voprosy pitaniya*, 2016, vol. 85, no. 6, pp. 95–102 (in Russian).
14. Tapeshkina N.V. The structure of the nourishment of preschoolers during the weekend (short report). *Voprosy pitaniya*, 2014, vol. 83, no. 2, pp. 64–67 (in Russian).
15. Lir D.N., Perevalov A.Ya. Analysis of actual home nutrition of urban children of pre-school and school age. *Voprosy pitaniya*, 2019, vol. 88, no. 3, pp. 69–77 (in Russian).
16. Tkachuk E.A., Tarmaeva I.Yu., Tsyrenzhapova N.A., Boeva A.V. characteristics of mineral composition of food used in primary schools. *Kazanskii meditsinskii zhurnal*, 2014, vol. 95, no. 3, pp. 434–438 (in Russian).
17. Bueno M.B., Fisberg R.M., Maximino P., Rodrigues Gde P., Fisberg M. Nutritional risk among Brazilian children 2 to 6 years old: a multicenter study. *Nutrition*, 2013, vol. 29, no. 2, pp. 10–405. DOI: 10.1016/j.nut.2012.06.012
18. Fisher J.O., Wright G., Herman A.N. Snacks are not food. Low-income, urban mothers' perceptions of feeding snacks to their preschool-aged children. *Appetite*, 2015, vol. 84, pp. 7–61. DOI: 10.1016/j.appet.2014.09.007
19. Morales-Ruan M.D.C., Villalpando S., Garcia-Guerra A. Iron, zinc, copper and magnesium nutritional status in Mexican children aged 1 to 11 years. *Salud Publica Mex*, 2012, vol. 54, no. 2, pp. 34–125. DOI: 10.1590/S0036-36342012000200008
20. Lazarevic K., Stojanovic D., Bogdanović D. Energy and nutritional value of the meals in kindergartens in Nis (Serbia). *Rocz Panstw Zakl Hig*, 2014, vol. 65, no. 2, pp. 31–127.

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