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Results of an epidemiological study of dietary pattern and peculiarities of 12-36-month-old children in the Russian Federation. Part I

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Nutrition of 1-3-year-old children is a pressing issue. Impact of this age period on health level development is rather high. The article presents a technique of epidemiological study and analysis of the first results of such a study dedicated to dietary pattern and peculiarities of 12-36-month-old children in different regions of the Russian Federation. According to the study, dietary pattern of children of this age requires considerable doctoral attention. The obtained results predetermine further analysis and comparison of dietary pattern defects with the estimated rates of consumption of the primary nutrients, energy, mineral substances and vitamins.
Keywords: *children, dietary pattern and peculiarities, regions of the Russian Federation.*

Introduction

Adequate, balanced nutrition is one of the primary health determinants at any age and especially in childhood. The younger the child, the more considerable is the impact of nutrition on further health condition.
Experts of the World Health Organization distinguish between 4 primary factors impeding children's development [1]: insufficient nutrition and external stimulation, iodine deficiency and iron-deficiency anemia. The two latter factors are alimentary-dependent conditions, as they are inseparably connected with food quality. It ought to be mentioned that consequences of alimentary-dependent conditions may be delayed and affect development of intellectual potential and physical condition; this may negatively influence health of the nation in whole.
Unfortunately, the rate of alimentary-dependent conditions in the whole population of Russia and in children in particular remains very high; this is a worrisome matter for pediatric health specialists. Thus, according to different data, the rate of iron-deficiency anemia in small children varies from 23 to 43% [2]. This means that the rate of latent iron deficiency may hypothetically reach 70-80%. Insufficient consumption of other nutrients – calcium, vitamin D etc. – is as frequent [3]. At the same time, increase in the rate of excessive body weight and obesity is being observed in Russia [4]. Thus, imbalanced nutrition, which is excessive in terms of caloric content, refined carbohydrates, saturated fats and deficient in terms of several other ingredients, is one of the pressing issues requiring a large-scale state-wide approach.
Traditionally, doctors and parents draw particular attention to organization of rational nutrition of infants, which would be adequate to the physiological demand thereof. The National Program on feeding optimization for infants in the Russian Federation adopted at the XVI Congress of

Pediatricians in 2009, which is actively being introduced into practical healthcare, has made a significant contribution in this process [5].

Unfortunately, dietary issues of 1-3-year-old children are not given sufficient consideration at the moment. According to an All-Russian poll conducted by Synovate Comcom, only 50% of doctors discuss these matters with parents.

Along with the first 12 months of life, the 2nd and the 3rd years of life constitute an important period for building up health and developing proper eating behavior [6]. Physiological and psychological peculiarities of children of this age predetermine high risk of deficiency of certain nutrients. A 12-36-month-old child's stomach is several times smaller than an adult's one, whereas the demand of mineral substances and vitamins expressed in terms of 1 kg of body weight is considerably higher. Food refusal and selective diet are often observed at this age.

The aforelisted psychophysiological peculiarities, along with insufficient attention of doctors and parents to dietary issues and early shift of children to general diet, negatively affect dietary pattern and lead to imbalanced diet, establishment of improper dietary habits and, therefore, to health disorders [7].

It has been observed that gastrointestinal tract (GIT) diseases are among the most widespread in the morbidity structure of children and adolescents; it is estimated that the visible tendency towards increase in the rate of this pathology will persist [8]. One of the causes of GIT pathology is improper nutrition. In 2008, A.N. Zavyalova confirmed the influence of eating behavior disorders on the increase in the rate of upper GIT diseases. The dietary range of vegetables in children with inflammatory upper GIT processes is extremely scanty and the vegetable consumption rate is low. Fresh fruit are more often present in daily diets of healthy children rather than in diets of children with upper GIT diseases (high significance). The most widespread substitution for rational and balanced meals is fast food. Chips, rusks, sweet sodas and French fries are more often observed in daily diets of children with inflammatory upper GIT diseases than in diets of healthy children ($p < 0.05$) [9].

A range of recent studies demonstrated that arterial hypertension and atherosclerotic alterations, obesity and diabetes, widely spread in the adult population, build up in early childhood [10-12].

Studies performed in various countries also demonstrated high rate of improper qualitative and/or quantitative food composition, which hugely increases the risk of deviations in development or occurrence of particular diseases [13, 14]. The most widespread deviations were rare consumption of fruit and vegetables, early introduction of whole cow milk, consumption of fast foods etc. All this resulted in excessive increase in caloric content of food and insufficient consumption of iron, calcium, vitamins A and D [15-18].

Studies of dietary pattern of infants conducted in Russia in the 1990s registered insufficient consumption of meat and specialized supplemental feeding products and high consumption (up to 3-4 portions per day) of whole cow milk [19]. Subsequent studies of dietary pattern of 12-24-month-old children demonstrated that 20% of the children do not consume meat and fish products on a regular basis; 20% of the children do not consume fruit and vegetables on a daily basis. The studies revealed insufficient consumption of specialized porridges and high consumption of whole milk. High risk of micronutrient deficiency development was assumed on the basis of these data [20].

According to the Research Institution of Nutrition of the Russian Academy of Medical Sciences, the dietary pattern has changed in recent years in Russia. Consumption of vegetables, fruit and dairy products has slightly increased. However, Russia remains far from a perfect situation, e.g., rates of consumption of fruit and vegetables are 1.76 and 0.71 times per day, whereas the recommended standard is 4-6 times per day; of dairy products – 1.57, whereas the recommended standard is 2 times per day [21]. Apparently, alterations of dietary pattern of the total population have naturally resulted in alterations of dietary pattern of small children.

This epidemiological study was conducted under the guidance of the specialists employed at the SCCH (FSBI) and the Russian Medical Academy of Postgraduate Education and with the support of Nutricia, LLC.

The study was aimed at analyzing dietary pattern and peculiarities of 12-36-month-old children in different regions of the Russian Federation and developing a system of nutritional measures for dietary optimization.
The primary objectives were as follows:
◊ appraisal of rates of nutrient consumption by 6-36-month-old children;
◊ identification of the most deficient nutrients in diet thereof;
◊ description of the children's nutritional status.

Patients and methods

STUDY SUBJECTS

The study was conducted at municipal hospitals of 20 cities of the Russian Federation located in 7 Federal Districts.
The study involved 2,050 6-36-month-old children: 462 6-12-month old children, 794 12-24-month-old children and 794 24-36-month-old children (see calculations in subsection "Statistical data manipulation).
After the collected forms were processed for purposes of statistical analysis, 399 forms of 6-12-month-old children (group I), 717 forms of 12-24-month-old children (group II) and 699 forms of 24-36-month-old children (group III) were acknowledged eligible. Statistical analysis involved 1,815 forms.
The study involved only urban children. The study did not involve children from families with low social status and migrants.
The program was conducted in strict compliance with ethical principles listed in the Declaration of Helsinki, ICH GCP and the current legislation of the Russian Federation. The program was non-interventional; the procedures remained in the framework of standard medical practice. The patients did not undergo any additional or monitoring tests. Epidemiological methods were used for analyzing the collected data. Before the program was launched, the algorithm thereof had been approved by the Interdisciplinary Ethics Committee in written form; the mentioned committee performed further ethical support of the program.

STUDY METHODS

The study utilized questionnaire method. The form consisted of 2 parts. The first part of the form was filled by a doctor. The questionnaire was compiled in such a manner as to obtain the following information:
◊ breast feeding duration;
◊ age at the beginning of supplemental feeding and type of the first supplemental feeding;
◊ duration and frequency of use of breast milk equivalents and formulas for children over 6 and 12 months of age;
◊ frequency of consumption of meat, fish, specialized vitamin-enriched infant foods and such non-infant foods as sauces (mayonnaise, ketchup), chips and sweet sodas.
The questionnaire allowed obtaining data on place and method of feeding (use of a bottle or a cup), night feedings, frequency of salt and sugar addition into infant foods. It also helped to register data on the previous diseases (respiratory and intestinal infections, GIT diseases, allergic status, caries, chronic diseases [which may affect child's appetite and digestive function], and other significant concurrent diseases) and collect family anamnesis (social status, education level of the parents, number of children in the family, number of older siblings, subjective parental evaluation of the child's diet, family nutrition).
The questionnaire contained a section dedicated to evaluation of anthropometric parameters (height, body weight, head circumference). Evaluation of a child's health status involved the standard pediatric examination.

The second part of the questionnaire consisted in a diet diary filled by a parent (or a caregiver). During the first visit to a doctor/researcher, parents would familiarize themselves with study aims, sign a standard form informed consent to the study and receive electronic scales in order to determine the amount of products eaten by their children. The doctor would conduct a detailed briefing on the diary filling procedure. The study utilized a method of 3-day food ration (2 weekdays and 1 weekend day). Diaries were to be filled in not more than 2 weeks.
Before the study, doctors/researchers had undergone training dedicated to methods of form filling and briefing parents. Research centers were continuously monitored on a remote and on-site basis throughout the study in order to control observation of the approved study algorithm by the center's personnel. Completeness and correctness of data entry in the individual registration cards (forms) and their compliance with the source documents were also controlled.

STATISTICAL DATA MANIPULATION

The sample size calculation was based on the need in a reasonably accurate evaluation of parameters, particularly on determination of the amount of children with nutritional imbalance. That is why the sample size calculation was based not on the statistical power concerns, but on the achievement of limits of confidence intervals, which are necessary to provide adequate accuracy of evaluation. Accuracy was calculated in relation to the total general population of 4,459,769 people (number of children of the age under consideration in the Russian Federation estimated on the basis of the official statistical data). The calculated sample size was 1,801. Taking into consideration that data of ca. 10-15% of the children involved in the program will be found ineligible for analysis by the end of the study, the program involved 2,050 patients.
Regional sample distribution was performed on the basis of the official statistical data on birth rate in different regions of the Russian Federation (tb. 1). Each researcher received an instruction on the necessary number of children (including age) to be involved in the study at his/her center.
Statistical analysis was performed on the basis of software complex SPSS/PASW Statistics, Version 18 (SPSS Inc., Chicago, Illinois, USA).
Nutritional value was determined with program Dietplan 6 (Forestfield Software Ltd., Great Britain). The program helps to calculate daily consumption of the primary nutrients on the basis of various factors (age, gender, weight, physical activity etc.) and contain reference values of nutrient consumption and caloric content of food recommended by the Committee of Medical Aspects of Food Policy (1991). The program is adapted to the norms and standards adopted in Russia [22-25].

Results

Factual material was collected in the period from November 2011 to May 2012.
The following dietary pattern peculiarities of small children were established on the basis of the universal 3-day-long monitoring of actual diets of the children.
The average daily amount of food complied with the age norms: 6-12-month-old children – 1,114.92±241 g, 12-24-month-old children – 1,325.34±334.1 g, 24-36-month-old children – 1,438.44±390.6 g.
Most children observed the recommended food intake frequency (tb. 2). Ca. 25% of the children were shifted to 4-5 meals per day only upon the attainment of the age of 2. A large number of children over 1 year of age with 8-9 meals per day reflects occurrence of night feedings and snacks. Night feedings were observed in 35.6% of 1-2-year-old children and 7.6% of 2-3-year-old children.
The observed negative issues included excessive salt and sugar consumption. Thus, 70.7% of 1-2-year-old children and 80% of 2-3-year-old children consumed salted food. 70.3% of mothers of 1-2-year-old children and 83.2% of mothers of 2-3-year-old children added sugar to food.

In general, the following defects were observed in the dietary pattern of children over 1 year of age:

• Insufficient meat consumption (pic. 1). Less than 25% and 20% of group II and group III children, respectively, consumed meat 5 or more times per week (regularly).

• Low amount of vegetables and fruit in the ration (pic. 2), especially in the period from 12 to 36 months of age. More than 50% of 1-2-year-old children and more than 60% of 2-3-year-old children did not consume fruit on a daily basis.

• Excessive consumption of sweets (candies, pastry) (pic. 3).

• Use of products not intended for pediatric consumption: fast food, sausages etc. (tb. 3). More than 22% of 1-2-year-old children and more than 50% of 2-3-year-old children consumed sausages.

The mentioned dietary pattern defects caused nutritional imbalance: excessive consumption of fats, especially of saturated fats, and insufficient consumption of macro- and microelements – iron, calcium, iodine, zinc, vitamins. Children require considerably more essential nutrients than adults. Deficit thereof in the diet affects both physical status and future intellectual development and cognitive activity of the person. It ought to be especially mentioned that the consumption rate of specialized pediatric products, such as milk formulas for children over 1 year of age, was extremely low: only 28.5% of the observed patients consumed special formulas for children over 1 year of age at the age of 1-2 years. It is important to remember that vitamin- and mineral-enriched products is a fairly simple means of correcting vitamin-mineral composition of the diet. Thus, 300 ml of a milk formula allows satisfying 33%, 45%, 36.3% and 39% of daily demand in iron, vitamin D, calcium, zinc, respectively, etc. (this calculation is based on the dry milk beverage “Malyutka 3” for children over 12 months of age manufactured by Nutricia, LLC).

Without any doubt, the obtained data require further analysis and comparison of dietary pattern defects with the estimated rates of consumption of the primary nutrients, energy, mineral substances and vitamins. Moreover, it is necessary to specify interconnection of eating behavior disorder with children’s physical development.

It is important to mention that 29% of mothers are more or less concerned about nutrition of their children. The other mothers considered their children’s nutrition proper. This indicates low information awareness of the population in the sphere of proper nutrition and dictates the need in establishing educational programs for parents aimed at popularization of proper nutrition basics. Efficacy of educational programs for parents may be very high, as, according to the studies, the most receptive to family behavioral and dietary standards are 1-3-year-old children: they are more influenceable by their mothers than school-age children [7].

Comparison of results of the study concerning the dietary pattern of infants with data of the previously conducted studies [19, 20] demonstrates certain efficacy of the conducted educational projects. This particular study demonstrated that 69.4% of infants do not consume whole cow milk; this reflects positive dynamics in comparison with the previous studies and demonstrates efficacy of the measures aimed at implementing principles of the National Program on feeding optimization for infants in the standard practice.

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Table 1. Distribution of children by groups and territories on the basis of the birth rate data

0	Population	Share, %	Sample	6-12 months of age	13-24 months of age	25-36 months of age
Total	4,459,769	100%	2,050	462	794	794
Central FD	718,869	16%	330	74	128	128
Moscow	296,147	7%	136	31	53	53
Northwestern FD	382,336	9%	176	40	68	68
Southern FD	819,013	18%	377	85	146	146
Volga FD	925,026	21%	425	96	165	165
Ural FD	422,940	9%	195	44	75	75
Siberian FD	685,674	15%	315	71	122	122
Far Eastern FD	209,764	5%	96	22	37	37

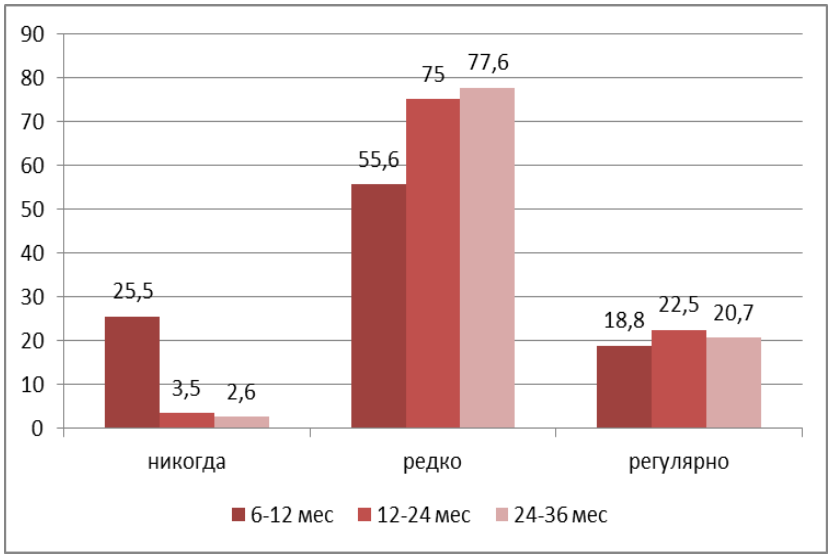
Note. FD – Federal District.

Table 2. Number of food intakes in children of different age groups

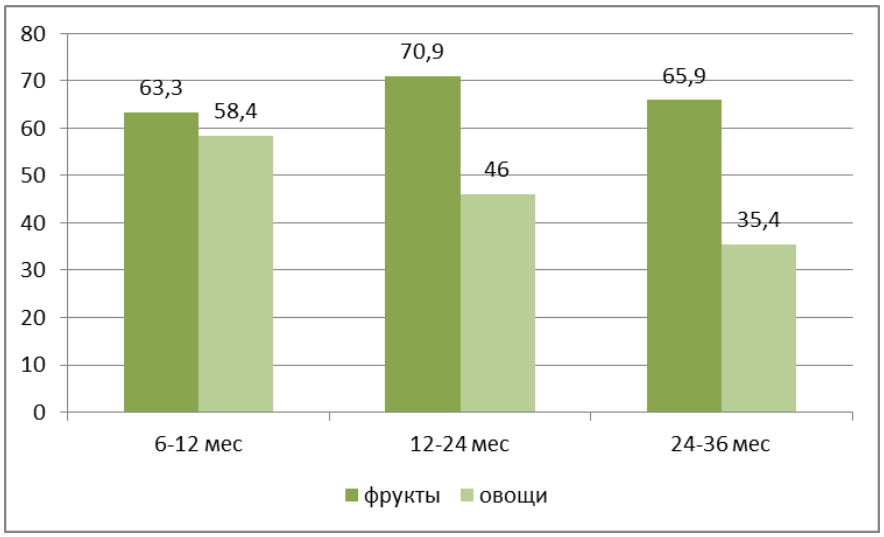
Age	8-9 meals	6-7 meals	4-5 meals	Less than 3 meals
6-12 months	52.6%	33.4%	12.5%	1.5%
12-24 months	35.8%	44.7%	17.7%	1.8%
24-36 months	23.3%	48.3%	26.7%	1.7%

Table 3. Percentage of children consuming non-infant foods

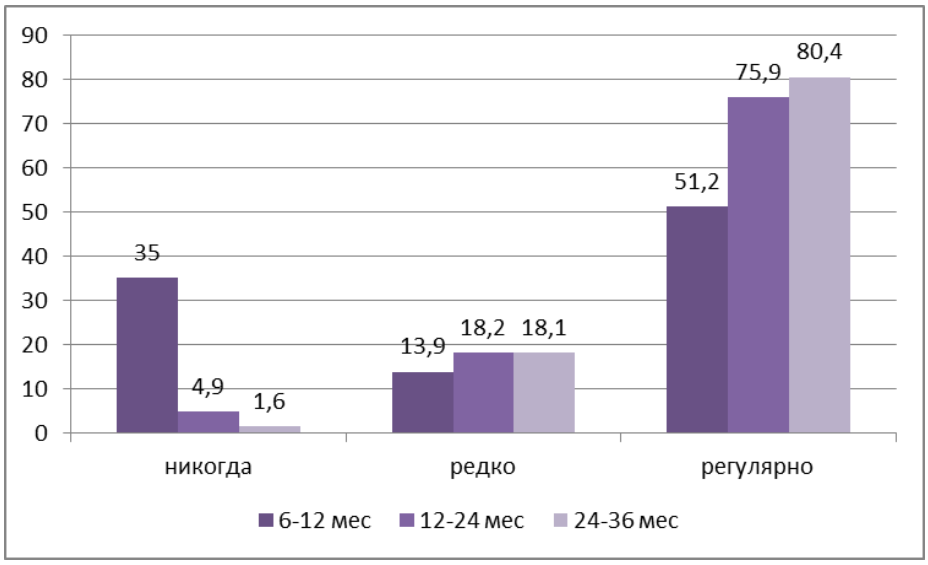
Foods	**Age of the children**		
	6-12 months	**12-24 months**	**24-36 months**
Chips	**-**	**6**	**24**
French fries	**-**	**4**	**13**
Ketchup	**-**	**4**	**18**
Mayonnaise	**-**	**8**	**28**
Sausages	**5**	**22**	**50 (2-3 times per week)**
Convenience foods (pizza, pelmyeni)	**-**	**28**	**58**
Chocolate		**40**	**80**
Sodas	**-**	**4**	**13**
Popcorn	**-**	**4**	**14**



Pic. 1. Rate of meat inclusion in the ration of small children.
Note. Никогда - never; редко – seldom; регулярно –regularly; мес. – months



Pic. 2. Number of children consuming fruit and vegetables (excluding potatoes) on a daily basis.
Note. Фрукты – fruits; овощи – vegetables



Pic. 3. Rate of sweets consumption in the ration of small children.
Note. Никогда - never; редко – seldom; регулярно –regularly; мес. – months