DOI: 10.17816/PED9222-29

COMPLEMENTARY FOOD – IMPORTANT COMPONENTS OF THE CHILD'S RATION: EFFECTS ON HEALTH AND WAYS OF OPTIMIZATION

© E.M. Bulatova [1], N.M. Bogdanova [1], A.M. Shabalov [1], V.A. Razheva [2], I.A. Gavrina [3]

[1] St. Petersburg State Pediatric Medical University, Ministry of Healthcare of the Russian Federation, Russia;
[2] Maternity Hospital No 2, Saint Petersburg, Russia;
[3] City Polyclinic No 4, Saint Petersburg, Russia

For citation: Bulatova EM, Bogdanova NM, Shabalov AM, et al. Complementary food – important components of the child's ration: effects on health and ways of optimization. *Pediatrician (St. Petersburg).* 2018;9(2):22-29. doi: 10.17816/PED9222-29

Received: 30.03.2018 Accepted: 18.04.2018

Relevance of the research. Timing, order and sequence of complementary feeding remain the subject of discussion until now. **The aim of the study.** Estimate influence of different outlines of introduction of complementary foods on nutritional status and food behavior in children of first year of life. **Materials and methods.** Examined 96 children in age of 4-6 months during introduction of complementary foods. Main group – 50 children (27 breast-feed (BF) children and 23 on milk formulas (MF)), in whose diet were introduced only complementary foods, which were made in special factories. Comparison group – 46 children (33 – BF and 13 – MF) received complementary foods made at home and in special factories. Duration of follow-up was 3 months. Physical examination, mother's diary analysis, evaluation of tolerance of complementary foods, bacteriological examination of feces. **Results.** On the background of introduction of complementary foods in the main group, increased the number of children with normal fatness (BF from 66.8% to 74.2%, MF from 82.7 to 88.4%), in comparison group, their number decreased (BF from 84.8% to 78.8%, MF from 69.3 to 62.3%). In the main group when a child refuses a product, mother continues offer it insistently. 61.5% of children began to eat unloved product at the end of first year of life. In comparison group, where mother changed unloved product at once, only 25% of children began to relate to it positively. In the main group dyspeptic disorders were mild in 4% of children. In in comparison group prevailed diarrheal syndrome, related to contamination with pathogenic strains of *E. coli* in 13% of children. **Conclusions.** Using of industrial made complimentary foods according to the optimal order, with determined mothers perseverance provides equalization of fatness, allows to form a correct food behavior and decreases risk of intestinal colonization by pathogenic microorganisms.

Keywords: children; complementary foods; nutritional status; food behavior; dyspeptic disorders.

ПРИКОРМ – ВАЖНАЯ СОСТАВЛЯЮЩАЯ РАЦИОНА РЕБЕНКА: ВЛИЯНИЕ НА ЗДОРОВЬЕ И ПУТИ ОПТИМИЗАЦИИ

© Е.М. Булатова [1], Н.М. Богданова [1], А.М. Шабалов [1], В.А. Ражева [2], И.А. Гаврина [3]

[1] ФГБОУ ВО «Санкт-Петербургский государственный педиатрический медицинский университет» Минздрава России;
[2] ЛПУ «Родильный дом № 2», Санкт-Петербург;
[3] СПбГБУЗ «Городская поликлиника № 4», Санкт-Петербург

Для цитирования: Булатова Е.М., Богданова Н.М., Шабалов А.М., и др. Прикорм — важная составляющая рациона ребенка: влияние на здоровье и пути оптимизации // Педиатр. – 2018. – Т. 9. – № 2. – С. 22–29. doi: 10.17816/PED9222-29

Поступила в редакцию: 30.03.2018 Принята к печати: 18.04.2018

Актуальность исследования. Сроки, порядок и последовательность введения в рацион детей продуктов прикорма до настоящего времени остаются предметом для дискуссии. **Цель исследования:** оценить влияние различных схем введения продуктов прикорма на нутриционный статус и пищевое поведение детей первого года. **Материалы и методы.** Обследовано 96 детей 4–6 мес. на фоне введения прикорма: основная группа — 50 детей (27 на грудном вскармливании (ГВ) и 23 на искусственном вскармливании (ИВ)), в рацион которых вводили только продукты прикорма промышленного производства; группа сравнения — 46 детей (33 — ГВ и 13 — ИВ), которые получали прикорм преимущественно домашнего приготовления. Продолжительность наблюдения составила 3 месяца. Всем детям проведено физикальное обследование, проанализирован «дневник наблюдения матери», выполнены оценка переносимости продуктов прикорма, бактериологическое исследование кала. **Результаты.** На фоне введения прикорма в основной группе увеличилось количество детей с нормальной упитанностью (ГВ: с 66,8 до 74,2 %; ИВ: с 82,7 до

88,4 %), а в группе сравнения их количество уменьшилось (ГВ: с 84,8 до 78,8 %; ИВ: с 69,3 до 62,3 %). В основной группе при отказе ребенка от определенного продукта мама продолжала настойчиво его предлагать — 61,5 % детей к концу исследования стали с удовольствием есть данное нелюбимое блюдо. В группе сравнения, где мама практически сразу меняла предлагаемый продукт, только 25 % детей стали положительно относиться к нелюбимому блюду. В основной группе диспептические нарушения были легкими у 4 %, а в группе сравнения преобладал диарейный синдром, обусловленный контаминацией детей патогенными формами *E. coli* — у 13 %. **Выводы.** Использование продуктов прикорма промышленного производства по оптимальной схеме с определенной настойчивостью со стороны матери обеспечивает «выравнивание» показателей упитанности, позволяет сформировать правильное пищевое поведение и снижает риск колонизации кишечника патогенными микроорганизмами.

Ключевые слова: дети; прикорм; нутриционный статус; пищевое поведение; диспептические нарушения.

BACKGROUND

The terms, order, and sequence of the introduction of qualitatively new food products (complementary foods) into a baby's diet have remained debatable until now among both pediatricians and parents. According to the definition, all products are complementary foods, except for human milk and infant milk formula, and they are used to supplement the diet with nutrients necessary to ensure the further growth and development of the child [1]. In addition to the nutritional component, the adequate and timely introduction of foods and complementary foods during critical periods of child growth stimulates certain segments of the brain responsible for the functions of taste, olfaction, and recognition; moreover, this introduction lays the foundations and habits of healthy nutrition for many years. The development of healthy eating habits helps prevent alimentary-dependent diseases, particularly obesity and metabolic syndrome, in adulthood [3, 5].

This *study aimed* to evaluate the influence of various schemes of the introduction of complementary foods on nutritional status and the formation of eating behaviors in children during the first year of life.

MATERIALS AND METHODS

This work was conducted at the St. Petersburg state healthcare institution City Polyclinic No. 35 in the Moscow district of St. Petersburg and utilized an open, prospective study design that enrolled practically healthy children aged 4–6 months. The children were followed up for an average of 3 months.

Children were enrolled in this study after the parents signed informed consent, and the ethical board at the St. Petersburg state healthcare institution City Polyclinic No. 35 of the Moscow district of St. Petersburg approved the design of the study with its decision No. 4 of January 10, 2014.

The study group consisted of 50 children (26 boys and 24 girls), 27 of whom were breastfed (BF) and 23 received artificial feeding (AF); their parents had signed an agreement to strictly follow the recommendations provided by the medical investigator. Only complementary foods of industrial production were introduced into the diet of the children in this group.

The comparison group included 46 children (26 boys and 20 girls), 33 of whom were BR and 13 received AF. Children of this group received both homemade (predominantly) and industrial production complementary foods.

Children in the surveyed groups were comparable by gender, age, and weight–height ratios.

The children's health was assessed according to a combination of physical examination and data from the "mother's diary."

The criteria for tolerability of the products introduced included a change in appetite, a refusal to take the product, the condition of the skin and visible mucous membranes, and the appearance or intensification of regurgitation, colic, flatulence, changes in defecation frequency, and stool consistency.

Additionally, a bacteriological study of all the children's feces was conducted at both the beginning and end of the study.

Six children from the study group discontinued participation of the study because of acute intercurrent diseases and non-fulfillment of the recommendations regarding the dates of the follow-up examinations to the medical investigator.

Statistical processing of the obtained results was performed using Statistica 7 for Windows. For the qualitative evaluation of the frequency of the sign in the groups studied, Pearson's chi-squared test was performed. Differences were considered significant at $p < 0.05$.

RESULTS

The introduction of the first complementary product in both groups occurred at the same time and did not depend on the type of feeding; in the study group, complementary food was first introduced at 153.68 ± 20.1 days, whereas it was first introduced at 151.65 ± 23.7 days in the comparison group. The products were introduced by considering the physiological and constitutional characteristics of the child

and individual tolerability and by observing all the rules of introducing complementary foods in accordance with existing recommendations.

Introduction of complementary starter products

The first complementary feeding product was chosen by considering the functional characteristics of the gastrointestinal tract and the nutritional status of the child. Children with a low body mass index, single regurgitation, episodic colic and flatulence, and who were absolutely healthy were first introduced grain complementary food (porridge): the study group received dairy-free buckwheat porridge, and the comparison group received dairy-free and milk porridge of industrial production and homemade porridge with equal frequency. In children with increased body mass indexes or difficult bowel movements, a mono-component vegetable puree (squash, broccoli, and cauliflower) was suggested as a starting product for complementary foods.

Subsequent introduction of complementary foods

In the study group, meat puree was given to all children at the age of 6–6.5 months, and it was generally the third complementary product introduced (67%). Fruit puree and pumpkin were given last, after the introduction of porridge, vegetable, and meat puree, at the age of 7.5–8 months. During the observation period, 6 to 12 mono-component complementary foods of industrial production were introduced into the diet. The variation in the number of products introduced was due to the individual intolerance in a child of any of the products.

In the comparison group, meat puree was given to children much later, at the age of 6.5 to 8 months. In most cases (68%), before the inclusion of meat puree, parents independently started to give homemade fruit and berry puree to the children.

All children received three to four daily meals of complementary foods (by the time of study completion), which amounted to 400–450 g. These foods included porridge (180–200.0 g/day), vegetable puree (150–180.0 g/day), meat puree (40–60.0 g/day), and fruit puree (60–80.0 g/day). The total daily volume of food did not exceed 1000 mL (breast milk or adapted milk formula and complementary foods).

Formation of eating behavior

Observations over 10.65 ± 3.65 weeks showed that the period of adaptation to complementary foods in most children proceeded without abnormalities. In several cases, when the baby was acquainted with new flavors, most often with the introduction of vegetable puree (squash and broccoli) and dairy-free buckwheat porridge, the mother recorded in the diary any observations of refusal or unwillingness of the child to eat the proposed product.

In the study group, when the child refused (reluctant) to eat the proposed product, the mother continued to insistently offer the complementary meal; consequently, by the end of the study, 8 (61.5%) of 13 children ate with pleasure a dish that previously was unloved. In the comparison group, when the child refused to eat the proposed product, the mother almost immediately changed the proposed product to another; consequently, only one (25%) of the four children began to take a positive attitude toward the previously unloved dish.

Assessment of nutritional status

To objectively assess nutritional status, the Quetelet index II (body mass index) was calculated. The results obtained were interpreted by considering the age, gender, and type of feeding in accordance with the median (*M*). Deviation from the median in the range of 90%–110% was regarded as a normal nutritional state, a deviation of 111%–120% was regarded as an increased level, and a deviation of 85%–89% was regarded as a lowered level. The severity of protein–caloric insufficiency (PCI) without disturbing protein metabolism was determined; the severity was classified on the basis of the following body mass index deviations from the median: grade I, 80%–84%; grade II, 75%–79%; and grade III, ≤74% of the median.

Data on the dynamics of the nutritional status in children with the introduction of complementary foods are presented in Table 1.

The nutritional status assessment in the observation groups showed that most of the children, regardless of the type of feeding, had a normal nutritional state both before the introduction of complementary foods and after their introduction. When complementary foods were introduced in the study group, there was an increase in the number of children with a normal nutritional state (for BF, from 66.8% to 74.1%, and for AF, from 82.7% to 88.4%) with a decrease in the number of children with high and insufficient nutritional states (lowered level and PCI grade I).

In the comparison group, opposite data were noted. The number of children with a normal nutritional status decreased (for BF, from 84.8% to 78.8%, and for AF, from 69.3% to 62.3%), whereas the number of children with an excessive nutritional state increased almost twofold, particularly among children who had been BF (from 9% to 15.2%). The proportion of children with insufficient nutritional states (reduced level, PCI grade I) was practically unchanged.

Table 1 (Таблица 1)

Dynamics of nutritional status in children on the background of the introduction complementary foods
Динамика нутриционного статуса у детей на фоне введения продуктов прикорма

Index / Показатель	Main research group / Основная группа				Comparison group in the study / Группа сравнения			
	Before the introduction first complementary product / До введения первого продукта прикорма		On the background introduction of complementary foods (in 10.65 ± 3.65 weeks) / На фоне введения продуктов прикорма (через 10,65 ± 3,65 нед.)		Before the introduction first complementary product / До введения первого продукта прикорма		On the background introduction of complementary foods (in 10.65 ± 3.65 weeks) / На фоне введения продуктов прикорма (через 10,65 ± 3,65 нед.)	
	BF *n* = 27	MF *n* = 23	BF *n* = 25	MF *n* = 19	BF *n* = 33	MF *n* = 13	BF *n* = 33	MF *n* = 13
Increased nutritional status / Повышенная упитанность, %	18.6*	4.3*	17.3	–	9*	23*	15.2	30
Normal nutritional status / Нормальный уровень упитанности, %	66.8	82.7	74.1	88.4	84.8	69.3	78.8	62.3
Reduced nutritional status / Пониженная упитанность, %	3.7	8.7	4.3	5.8	6.2	–	3	–
Protein-caloric insufficiency I degrees / Белково-калорийная недостаточность I степени, %	10.9	4.3	4.3	5.8	–	7.7	3	7.7

* the reliability of differences within the group between children on BF and MF before the introduction of complementary foods ($p < 0.05$). BF – breast-feeding, MF – children on milk formulas;
* достоверность различий внутри группы между детьми на грудном и искусственном вскармливании до введения продуктов прикорма ($p < 0,05$). BF — грудное вскармливание, MF — искусственное вскармливание

On the basis of the data presented, the use of balanced foods for complementary products of industrial production, and the optimal algorithm for introducing products, ensures the "equalization" of nutritional state rates. This effect can be considered protective in terms of the development of obesity and metabolic syndrome.

Functional digestive disorders in children in the observation groups

The children examined mostly had a combination of two and rarely three syndromes of moderately severe functional disorders of digestion (63% in the study group and 70% in the comparison group, $p > 0.05$). The regurgitation syndrome was noted most often in children in both groups, both before the introduction of complementary foods (28% in the BF group and 21.7% in the AF group) and after their introduction (12.5% in the BF group and 13.8% in the AF group).

The dynamics of the frequency of functional digestion disorders in children after complementary food was introduced is presented in Table 2.

As shown in the table, by the end of the third month of consuming complementary foods, virtually all the syndromes of functional disorders of the digestive organs were eliminated, except for regurgitation syndrome. However, the introduction of complementary foods of industrial production more than halved the incidence of regurgitation syndrome ($p < 0.05$). Notably, the mothers of children of the study group adhered to the recommendations on the choice and sequence of the introduction of complementary foods,

Table 2 (Таблица 2)

Dynamics of the frequency of functional disorders of digestion in children against the background of the introduction of complementary foods

Динамика частоты функциональных нарушений пищеварения у детей на фоне введения продуктов прикорма

Syndrome / Синдром	Main research group / Основная группа				Comparison group in the study / Группа сравнения			
	Before the introduction first complementary product / До введения первого продукта прикорма		On the background introduction of complementary foods (in 10.65 ± 3.65 weeks) / На фоне введения продуктов прикорма (через 10,65 ± 3,65 нед.)		Before the introduction first complementary product / До введения первого продукта прикорма		On the background introduction of complementary foods (in 10.65 ± 3.65 weeks) / На фоне введения продуктов прикорма (через 10,65 ± 3,65 нед.)	
	n = 50	%	*n* = 44	%	*n* = 46	%	*n* = 46	%
Regurgitations / Срыгивания	14	28*	5	11.4*	10	21.7	6	13.8
Colic / Колики	7	13	0	–	4	7.7	0	–
Flatulence / Метеоризм	4	8	0	–	3	6.8	0	–
Infant dishezia / Младенческая дисхезия	6	12	1	2.3	5	12.2	1	3

* $p < 0.05$ – the reliability of differences between the children of the main group before the introduction of complementary foods and the introduction of complementary foods;

* $p < 0,05$ — достоверность различия между детьми основной группы до введения продуктов прикорма и на фоне введения продуктов прикорма

which contributed to a faster elimination of syndromes of functional disorders in their children.

Individual tolerance of complementary foods

Food intolerance reactions occurred with almost the same frequency in children of both groups: in the study group, 15 (30%) of 50 children experienced intolerance, and in the comparison group, 13 (28.3%) of 46 children experienced intolerance. In the 15 children of the study group who experienced food intolerance, skin manifestations were recorded in nine children, whereas intestinal manifestations were observed in six. Of the nine children (18%) with a skin reaction due to food intolerance (the appearance of minor hyperemia of the skin and punctate rash), three had burdened allergological anamnesis, three had manifestations of atopic dermatitis in the form of insignificant dryness of the skin and scaling in the cheeks, and three children had mild symptoms of atopic dermatitis in the anamnesis, which were absent at the time the children were enrolled in the study. With the occurrence or increased manifestations of atopic dermatitis, the cause-significant product was withdrawn. With fading (decrement of the allergic process) of the rash, a full substitution was selected from food products of industrial production.

We noted the reactions of food intolerance to the following complementary products of industrial production: buckwheat porridge with omega 3 fatty acids ($n = 4$), cauliflower ($n = 2$), pumpkin ($n = 2$), and squash ($n = 1$).

Dyspeptic disorders in children of this group were characterized by a short-term change in defecation (difficulty or increase of frequency) and minimal clinical manifestations. Thus, when a vegetable puree from squash was the first product of complementary foods introduced with an increase in volume of 20–30 g, the mother recorded the absence of an independent

defecation in her child for 1 to 2 days. This situation was noted in 4 (8%) of 50 children. The frequency of defecation in all children was restored 2 to 3 days after the withdrawal of this product.

An increase in defecation frequency (by one to three defecations) and stool softening was recorded in 2 (4%) of 50 children. In one case, this increase was due to the introduction of prunes and, in another case, the introduction of pumpkin.

After analyzing each specific situation in children with intestinal disorders, we assumed that a change in the frequency of defecation was not only a reaction to the product itself but also a reaction to the fillers included in this complementary meal. Because of its high fiber content, squash usually causes stool softening. The presence of cornmeal in the vegetable mash with squash as a form-maker, even in a small volume, could lead to a reduction in the frequency of defecation.

In one child of this group with mild diarrheal syndrome without intoxication, the enterocolitis was caused by enteropathogenic *Escherichia coli* (*E. coli* O-6) that was isolated during the final bacteriological study. All these dispeptic abnormalities occurred in children in the BF group. In this regard, it is possible that in some cases, a violation of the diet by the mother herself led to the above symptoms.

In the comparison group, 13 (28.3%) of the 46 children had a negative reaction to complementary foods. Manifestations of food hypersensitivity in the form of a finely spotted pink or morbilliform rash with localization on the face, chest, or lower legs were found in 7 (15.2%) of the 46 children. Eruptions were more often observed with the introduction of milk porridge, jelly, fruit (apricot and peach), or berry puree (garden strawberries, strawberries, raspberries, and black currants), which were homemade. Dyspeptic disorders (stool softening and increase of frequency) were noted in 6 (13%) of the 46 children.

Results of the bacteriological study

A bacteriological study of feces was performed for all children in both groups twice – before the introduction of complementary foods and immediately after the period of complementary food introduction.

As mentioned above, in the study group, the pathogenic flora inoculation (*E. coli* O-6) was registered in one child at the final examination. Another finding was revealed in the bacteriological examination of the comparison group. In the final bacteriological study of feces from children in this group, pathogenic flora was found in nine cases (19.5%). This was due to the inoculation of enteropathogenic ***E. coli*** O-6 and ***E. coli*** O-75**.**

Of the nine children who were inoculated with this pathogenic flora, six had clinical symptoms of mild enterocolitis (diarrhea syndrome without manifestations of intoxication), whereas no clinical manifestations of intestinal infection were recorded in three children, which enables us to regard this situation as an asymptomatic contamination by causative agents of colibacillosis.

Thus, in the study group, dyspeptic disorders in children were mild and unstable (decrease/increase in defecation and stool softening), and in the comparison group, diarrhea syndrome caused by the contamination of children with pathogenic forms of *E. coli* prevailed.

The contamination of children in the comparison group likely occurred through complementary homemade foods.

DISCUSSION

Studies conducted in recent years indicate that the nutrition status of a child at any period of life affects not only growth and development but also the health status as a whole. The antenatal and "breastfeeding" periods of life are fundamental. The nutrition of a pregnant woman, a lactating mother, and a child during the first year of life "programs" the metabolism in such a way that some of its disorders can increase the risk of developing several diseases, particularly obesity and metabolic syndrome [4, 7–10, 13]. Clinical studies of large groups of children have revealed that not only low birth weight but also high growth rate and excessive weight gain in the first year of life with a high degree of reliability are accompanied by a higher accumulation of fat with a decrease in the protein component of body weight, a violation of the sensitivity of cells to insulin, and a decrease in bone density, which are prerequisites for the development of arterial hypertension, obesity, diabetes, and osteoporosis in the adult period of life [16, 17].

When analyzing the data obtained during our study, it was revealed that the introduction of complementary foods of industrial production during the first year of a child's life should have a balanced composition of both major and minor nutrients. Additionally, the selection of these products should consider the individual characteristics of the child; moreover, the mother's patience in the organization of complementary food provides an "equalization" of nutritional state rates, the normalization of the functions of the gastrointestinal tract, and the generation of proper eating behaviors. The revealed positive effects of complementary foods of this category include preventing the development of obesity and metabolic syndrome in the future [6].

The intestinal microbiota plays an important role in the formation of immunity in the postnatal period since it is the primary stimulus for the activation of congenital immunity and the development of acquired immunity. Any violations in the formation of microbiocenosis, particularly during the introduction of complementary foods, will contribute to an increase in food hypersensitivity, including food sensitization. There is evidence that the composition of complementary foods, the timing and sequence of their introduction, and the balance of the diet affect the formation of the intestinal microbiome [11, 14, 15, 17].

In our study, the introduction of complementary foods was accompanied by the development of minor dyspeptic disorders, which could indirectly indicate both individual food hypersensitivities and dynamic changes in the composition of the intestinal microbiocenosis [2]. Absolute confirmation of the development of intestinal contamination with pathogenic microorganisms was demonstrated by the inoculation of enteropathogenic *E. coli* in every fifth child from the group of children receiving complementary homemade foods.

A balanced composition and enrichment of industrial products with biologically active nutrients (vitamins, trace elements, PUFAs, prebiotics and probiotics) imparts children with functional food products that have a proven positive effect on the body [12].

CONCLUSIONS

The use of complementary foods of industrial production during the first year of a child's life in accordance with the optimal scheme, combined with the mother's persistence to introduce "unloved" products, ensures "equalization" of nutritional state rates, normalizes the functions of the gastrointestinal tract, generates correct eating behaviors, and significantly reduces the risk of pathogenic microorganisms colonizing the child's intestines.

REFERENCES

1. Баранов А.А., Тутельян В.А., Чумакова О.В., и др. Национальная программа оптимизации вскармливания детей первого года жизни в РФ. – М., 2009. [Baranov AA, Tutel'yan VA, Chumakova OV, et al. Natsional'naya programma optimizatsii vskarmlivaniya detey pervogo goda zhizni v RF. Moscow; 2009. (In Russ.)]
2. Булатова Е.М., Бойцова Е.А., Шабалов А.М. Распространенность пищевой непереносимости и пищевой аллергии у детей Санкт-Петербурга // Педиатрия. Журнал им. Г.Н. Сперанского. – 2014. – Т. 93. – № 3. – С. 14–20. [Bulatova EM, Boytsova EA, Shabalov AM. Rasprostranennost' pishchevoy neperenosimosti i pishchevoy allergii u detey Sankt-Peterburga. *Pediatria. Journal named after G.N. Speransky*. 2014;93(3):14-20. (In Russ.)]
3. Воронцов И.М. Диетология развития — важнейший компонент профилактической педиатрии и валеологии детства // Педиатрия. Журнал им. Г.Н. Сперанского. – 1997. – Т. 76. – № 3. – С. 57–61. [Vorontsov IM. Dietologiya razvitiya — vazhneyshiy komponent profilakticheskoy pediatrii i valeologii detstva. *Pediatria. Journal named after G.N. Speransky*. 1997;76(3):57-61. (In Russ.)]
4. Галактионова М.Ю., Машина Н.С., Будаева Ю.А., Заброда К.В. Особенности вскармливания детей первого года жизни, страдающих гастроинтестинальными расстройствами // Педиатр. – 2010. – Т. 1. – № 1. – С. М23. [Galaktionova MYu, Mashina NS, Budaeva YuA, Zabroda KV. Osobennosti vskarmlivaniya detey pervogo goda zhizni, stradayushchikh gastrointestinal'nymi. *Pediatr*. 2010;1(1):M23. (In Russ.)]
5. Мазурин А.В., Воронцов И.М. Пропедевтика детских болезней. – 2-е изд. – СПб., 1999. [Mazurin AV, Vorontsov IM. Propedevtika detskikh bolezney. 2nd ed. Saint Petersburg; 1999. (In Russ.)]
6. Мычка В.Б., Верткин А.Л., Вардаев Л.И., и др. Проект Рекомендаций экспертов российского кардиологического общества по диагностике и лечению метаболического синдрома. Третий пересмотр. – М., 2013. [Mychka VB, Vertkin AL, Vardaev LI, et al. Proekt Rekomendatsiy ekspertov rossiyskogo kardiologicheskogo obshchestva po diagnostike i lecheniyu metabolicheskogo sindroma. Moscow; 2013. (In Russ.)]
7. Armitage JA, Taylor PD, Poston L. Experimental models of developmental programming: consequences of exposure to an energy rich diet during development. *J Physiol*. 2005;565(Pt 1):3-8. Epub 2005 Feb 3.
8. Barker D, Osmond C. Diet and coronary heart disease in England and Wales during and after the Second World war. *J Epidemiol Community Health*. 1986;40(1):37-44. doi: 10.1136/jech.40.1.37.
9. Barker D, Osmond C. Infant mortality, childhood nutrition, and ischaemic heart disease in England and Wales. *Lancet*. 1986;1(8489):1077-81. doi: 10.1016/S0140-6736(86)91340-1.
10. Barker DJ, Martyn CN, Osmond C, et al. Growth in utero and serum cholesterol concentrations in adult life. *BMJ*. 1993;307(6918):1524-7. doi: 10.1136/bmj.307.6918.1524.
11. Bergström A, Skov TH, Bahl MI, et al. Establishment of intestinal microbiota during early life: a longitudinal, explorative study of a large cohort of Danish infants. *Appl Environ Microbiol*. 2014;80(9):2889-900. doi: 10.1128/AEM.00342-14.
12. Contor L, Asp NG. Process for the assessment of Scientific Support for claims on foods (PASSCLAIM) phase two: moving forward. *Eur J Nutr*. 2004;43 Suppl2: II3-II6.

13. Gali Ramamoorthy T, Begum G, Harno E, White A. Developmental programming of hypothalamic neuronal circuits: impact on energy balance control. *Front Neurosci*. 2015;9:126. doi: 10.3389/fnins.2015.00126.
14. Krebs NF, Sherlock LG, Westcott J, et al. Effects of different complementary feeding regimens on iron status and enteric microbiota in breastfed infants. *J Pediar*. 2013;163(2):416-23. doi: 10.1016/j.jpeds.2013.01.024.
15. Law M, Morris JK, Wald N, et al. Changes in atopy over a quarter of a century, based on cross sectional data at three time periods. *BMJ*. 2005;330(7501):1187-8. doi: 10.1136/bmj.38435.582975.AE.
16. Stocks T, Renders CM, Bulk-Bunschoten AM, et al. Body size and growth in 0- to 4-year-old children and the relation to body size in primary school age. *Obes Rev*. 2011;12(8):637-52. doi: 10.1111/j.1467-789X.2011.00869.x.
17. Toschke AM, Grote V, Koletzko B, von Kries R. Identifying children at high risk for overweight at school entry by weight gain during the first 2 years. *Arch Pediatr Adolesc Med*. 2004;158(5):449-52. doi: 10.1001/archpedi.158.5.449.

◆ Information about the authors

Elena M. Bulatova — Professor, MD, PhD, Head of Department of Propaedeutics of Children's Diseases, St. Petersburg State Pediatric Medical University, Saint Petersburg, Russia; Main Freelance Pediatrician of Ministry of Health in North-Western Federal Region. Main Specialist in Children Nutrition of Committee of Healthcare of Government of Saint Petersburg and NWFR, Saint Petersburg, Russia.
E-mail: bulatova2008@gmail.com.

Natalia M. Bogdanova — MD, PhD, Department of Propaedeutics of Children's Diseases. St. Petersburg State Pediatric Medical University, Saint Petersburg, Russia. E-mail: natasha.bogdanov@mail.ru.

Alexandr M. Shabalov — MD, PhD, Department of Propaedeutics of Children's Diseases. St. Petersburg State Pediatric Medical University, Saint Petersburg, Russia.
E-mail: Aleks-Shabalov2007@yandex.ru.

Valentina A. Razheva — Pediatrician. Maternity Hospital No 2, Saint Petersburg, Russia. E-mail: valentina.razhewa@yandex.ru.

Irina A. Gavrina — District Pediatrician, City Polyclinic No 4, CPD 1. Saint Petersburg, Russia.
E-mail: iro4ka2507@mail.ru.

◆ Информация об авторах

Елена Марковна Булатова — д-р мед. наук, профессор, зав. кафедрой пропедевтики детских болезней с курсом общего ухода за детьми, ФГБОУ ВО «Санкт-Петербургский государственный педиатрический медицинский университет» Минздрава России, Санкт-Петербург; главный внештатный педиатр Минздрава России в Северо-Западном федеральном округе, главный специалист по питанию детей Комитета по здравоохранению Правительства Санкт-Петербурга и СЗФО, Санкт-Петербург.
E-mail: bulatova2008@gmail.com.

Наталья Михайловна Богданова — канд. мед. наук, доцент кафедры пропедевтики детских болезней с курсом общего ухода за детьми. ФГБОУ ВО «Санкт-Петербургский государственный педиатрический медицинский университет» Минздрава России, Санкт-Петербург. E-mail: natasha.bogdanov@mail.ru.

Александр Михайлович Шабалов — канд. мед. наук, доцент кафедры пропедевтики детских болезней с курсом общего ухода за детьми. ФГБОУ ВО «Санкт-Петербургский государственный педиатрический медицинский университет» Минздрава России, Санкт-Петербург.
E-mail: Aleks-Shabalov2007@yandex.ru.

Валентина Андреевна Ражева — врач-педиатр. ЛПУ «Родильный дом № 2», Санкт-Петербург. E-mail: valentina.razhewa@yandex.ru.

Ирина Андреевна Гаврина — участковый врач-педиатр. СПбГБУЗ «Городская поликлиника № 4», ДПО 1, Санкт-Петербург. E-mail: iro4ka2507@mail.ru.