S.G. Makarova[1], [2]
[1] Scientific Center of Children's Health, Moscow, Russian Federation
[2] Sechenov First Moscow State Medical University, Moscow, Russian Federation

Practical Recommendations on Supplemental Feeding Introduction

Author affiliation:
Svetlana Gennadiyevna Makarova, PhD, head research fellow at the department of clinical pediatric studies of the Scientific Center of Children's Health, Professor at the department of allergology and clinical immunology of the Sechenov First Moscow State Medical University
Address: 2/1 Lomonosovskiy Av., Moscow 119991; **tel.:** +7 (495) 967-04-20; **e-mail:** sm27@yandex.ru

Article received: December 10, 2015. **Accepted for publication:** December 25, 2015.

Despite the availability of a national consensus document describing in detail modern approaches to feeding infants, pediatricians keep on giving most diverse recommendations on the time of supplemental feeding introduction. The article presents a brief historical review, as well the modern view on the issue of introduction of supplemental feeding to children. In the previous century, it was common both in Russia and most European countries to introduce supplemental feeding to children at the age of 2 or even 1.5 months. In 2002, the World Health Organization put forward an initiative in support of breastfeeding and recommended not to introduce supplemental feeding before the age of 6 months. A certain "golden mean" has apparently been achieved on the basis of results of studies and a long-term discussion among the specialists in feeding from different countries – all scientific communities and national recommendations of most countries define the optimal age for supplemental feeding introduction as "from 4 (completed) months to 6 (completed) months" with certain individual approach.
Keywords: *infancy, nutrition, supplemental feeding, food allergy, hypoallergenic supplemental feeding formulas.*

(***For citing:*** Makarova S.G. Practical Recommendations on Supplemental Feeding Introduction. *Pediatric pharmacology*. 2015;12(6):697−704. (In Russ). doi: 10.15690/pf.v12i6.1495.)

Introduction

Although there is a large number of papers on supplemental feeding as well as the national consensus paper, National Program for Optimization of Infant Feeding in the Russian Federation [1], pediatricians still make varying recommendations on when to introduce supplemental feeding, and some very archaic notions and concepts have "settled down" on popular websites and become the a common "property". However, the greatest concern is that even pediatric departments of universities are "armed" with a number of obsolete recommendations.
This paper is aimed at a retrospective review of how opinions in relation to supplemental feeding introduction have changed over time. The paper is also to characterize the today's recommendations so as to draw pediatricians' attention to this important topic once again.

A bit of "newest history" of supplemental feeding.

In 2002, after years-long debates, the World Health Organization (WHO) issued recommendations that infants should be breastfed for the first six months of life so as to ensure optimal growth, development, and health [2]. Many countries of Europe then supported this stance.

It should be noted that such strict WHO recommendations on when to introduce supplemental feeding were based on studies carried out in developing countries. The WHO also prioritized breastfeeding and thus

• Breast-milk can be substituted by formulas, resulting in decreased breast-milk production, thus posing a risk of insufficient intake of energy and nutrients;
• infants are exposed to pathogenic microbes present in foods and liquids that may be infected. This increases the risk of digestive diseases and malnutrition;
• digestive diseases and food allergy become even more threatening due to the immaturity of the intestines, which leads to a greater risk of malnutrition;
• mothers restore their fertility faster, as reduced breast sucking reduces the period of ovulation suppression.

As you can see from the above, these arguments are most valid for countries with low living standards and poor hygiene, where supplemental feeding is recommended first because of infection risk.

In 2005, the American Academy of Pediatrics also made a statement that exclusive breastfeeding is sufficient for optimal growth and development over approximately the first six months of life [4].

All these recommendations, the active promotion of breastfeeding and a series of support measures taken by the WHO did popularize breastfeeding of infants. In the United States alone, 33.6% of 3-month-olds were breastfed in 2006, up from 29.6% in 2003; for 6-month-olds, the figure rose from 10.3% in 2003 to 14.1% in 2006 [5]. In Europe, the breastfeeding figures improved from 2002 to 2007 as well [6]. In the United Kingdom, a comparison of national data for 2000 and 2005 shows that the changes of feeding and supplemental feeding policies led to a later introduction of supplemental feeding [7]. The share of children 4-month-olds to receive fell from 85% (a third of them started to receive supplemental feeding prior to reaching 17 weeks of age) to 51%; as for children to receive supplemental feeding prior to the age of 3 months, their share more than halved: 23% to 10% [7].

The recommendation of WHO experts for the European region is not that categorical; they say that for the first year of life, it is optimal to breastfeed the child until the age of six months, or at least for the first four months of life [3]. According to the same recommendations, some children may need supplemental feeding before the age of six months, but such feeding should not be introduced until the age of four months. Introduction of supplemental feeding is necessary if the child looks hungry after unrestricted breastfeeding or has insufficient weight gains in the absence of any disease. Such insufficiency can be determined based on two to three successive evaluations using recommended weight-height evaluation tables [3].

The consensus papers of the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition have always emphasized there is no sufficient reason not to introduce supplemental feeding at an age of four to six months while breastfeeding is maintained [8]. According to the ESPGHAN recommendations, supplemental feeding should not be added to the child's nutrition until 17 weeks of age; however, all the children should start to receive such feeding from the 26th week of age.

It is believed that if supplemental feeding is introduced too late, there is a risk of insufficient energy intake, stunted growth, and malnutrition, including insufficient intake of micronutrients, in particular iron and zinc. As a result of belated introduction of supplemental feeding, motor skills like chewing cannot develop in time; the same applies to the emotional component of nutrition, i.e. the child's positive reception of new taste and food structure [3].

Thus, despite the ongoing debates [7], the national recommendations of industrialized countries currently state the age of four to six months as optimal time for introducing supplemental feeding.

Age of Introduction and Physical Development and Health Parameters

The European Food Safety Authority has analyzed the available data and found out that sticking to exclusive breastfeeding until the age of six months is not associated with nutrient deficiency in the child only if the mother does not suffer from macronutrient and micronutrient deficiency, i.e. consumes enough vitamins, minerals, and long-chain polyunsaturated fatty acids, etc. [9] As for the age, it is noted that as long as supplemental feeding is introduced at an age of four to six months, the exact time of introduction does not affect the growth rate, i.e. the weight and the height of the body [9, 10]. However, if supplemental feeding is introduced when the child is older than six months, it can degrade the weight and growth parameters. On the contrary, if supplemental feeding is introduced when the child is 3- to 4-month-old, it may contribute to weight gain, which can have a long-term negative effect: higher risk of obesity, type 2 diabetes, or cardiovascular diseases in adulthood [9]. Too early introduction of supplemental feeding is also associated with excess body weight or obesity in 2-year-olds [11].
Below is a summary table of European recommendations on when to introduce supplemental feeding. The table shows that despite some discrepancies in national recommendations, all scientific communities and nutrition experts agree that supplemental feeding should be introduced when the child is four to six months old (Table 1).

Table 1. National Recommendations of European Countries on When to Introduce Supplemental Feeding (here is a summarized citation, see [9])

Country	When the Recommendations were issued*	Recommended Age for Introduction of Supplemental Feeding
Belgium	2006	4 to 6 months
Czech Republic	–	No general recommendations. Individual recommendations are bsed on the child's health, development and specific needs
Cyprus	–	About 6 months, but not earlier than 4 months
Denmark	2009	About 6 months Supplemental feeding can be introduced earlier, but no earlier than at the age of 4 months
Estonia	2006	6 months or later Can be introduced earlier on medical grounds
Finland	2004	Individually, but no later than the age of 6 months
Germany	–	Not before the beginning of the 5th month, not after the beginning of the 7th month
Greece	–	Not before the 4th month, not later than in the 6th months
Hungary	2009	About 6 months; if lactation is insufficient, supplemental feeding can be introduced earlier, but no earlier than the age of 4 months
Ireland	2008, 1999	Bottle-fed children should start receiving supplemental feeding neither before 17 weeks (about 4 months), nor later than 26 weeks (about 6 months)
Italy	2009	When to introduce supplemental feeding should be discussed with a pediatrician
Latvia	2003	6 months or later
Lithuania	2005	Six months or later
Malta	–	About 6 months
Netherlands	–	6 months or later

Norway	–	For breastfed children, 6 months; if necessary, supplemental feeding can be introduced earlier, but the child should be at least 4 months old. For bottle-fed children, age of introduction is 4 to 6 months
Romania	–	Supplemental feeding should be introduced when the child is ready for it; for most children, this time is between 4 and 6 months The most optimal period is 5.5 to 6 months
Slovakia	2008	About 6 months, but not earlier than 4 months
Slovenia	–	The child should be at least 17 weeks (119 days) old, but not older than 26 weeks (182 days)
Spain	–	From 4th-6th month of life
Sweden	2003	About 6 months
United Kingdom	2008	About 6 months

Note.* Lack of reference to year means the absence of a specific national document table at the time of publishing this article. The Table above then provides data from recommendations of national ministries, nutrition advisors and experts.

Recent studies on how the age of supplemental feeding introduction affects the development and health of children have not given any grounds for amending the current recommendations. The ESPGHAN experts confirm that their recommendations remain the same: the introduction of supplemental foods should not be before 17 weeks but should not be delayed beyond 26 weeks [12].

Recommendations on Limiting Sugar Intake

Apparently, the widespread use of simple sugars, i.e. monosaccharides and disaccharides, in the 20th century nutrition is a global mistake of humanity. According to the WHO, excessive intake of simple sugars is one of the most important factors degrading the human health [13]. In 2015, WHO experts proposed a number of measures to limit the intake of simple sugars, see Sugars Intake for Adults and Children. Guideline [14]. According to this document, it is recommendable to maintain a lower intake of simple sugars both as a child and as an adult: In both adults and children, the intake of free sugars should be reduced to less than 10% of total energy intake; further reduction to less than 5% provides further health benefits. The WHO is planning a number of measures, including marketing and advertising restrictions, to reduce children's consumption of foods rich in simple sugars [15].

That is why modern supplemental foods do not contain sugars, and we all – parents, pediatricians, and formula makers – should accustom the child to other tastes and avoid the common perception that food should be sweet to be tasty.

Fruit juices are a food that is naturally rich in sugar. DAISY, a trial involving 1835 children with genetic predisposition to type 1 diabetes, showed that an early (before 4 months) introduction of supplemental feeding, especially fruit juices, put children at a greater risk of diabetes, but so did an introduction delayed beyond 6 months [16].

Age of Introduction and Allergy Prevention

If you want to determine the optimal age for introducing supplemental feeding, the maturity of the child's intestinal barrier is an important factor. Insufficiency activity of digestive enzymes and high permeability of the intestinal wall to macromolecules contribute to the sensitization to alien proteins. This is why the determination of optimal age of introduction is largely based on multiple studies on how the use of different supplemental food introduction diagrams affects the further development of sensitization and allergies. It is shown that if supplemental feeding is

introduced before 4 months, it puts the child at a greater risk of atopic dermatitis regardless of whether he or she has allergic predisposition [17, 18]. In the recent past, it was recommended to delay such introduction in "children at allergy risk", i.e. children having one or more allergic close relatives (father, mother, or siblings). However, this approach has failed. In recent years, the results of multiple studies and meta-analyses made scientists reconsider the age of introducing supplemental feeding in "children at risk" [19]. In 2000, the American Academy of Pediatrics recommended delayed introduction of supplemental foods to such children, e.g. the recommended introduction age was 1 year for cow milk, 2 years for chicken eggs, 3 years for peanuts, tree nuts, or fish [20]. In 2008, the AAP published amendments to these recommendations [21], in which it was stated that allergenic foods should be introduced earlier.
Well-planned studies that met the principles of evidence-based medicine did not collect any evidence to prove the opinion that if the introduction of supplemental foods was delayed beyond 4-6 months, it would reduce the risk of allergic response [22–24]. This is why the experts of the world's leading societies for pediatrics and allergology have agreed that the most optimal time for introduction of supplemental feeding is the so-called "tolerance window", i.e. an age of 4 to 6 months [25]. This period is recommended both for children without a family history of allergy and for healthy children "at risk". It is important that such data were collected in respect of the most allergenic foods. That is why the latest EAACI recommendations on prevention of allergy state that regardless of atopic predisposition, it is recommendable to introduce supplemental feeding in the nutrition of every child after they reach the age of 4 months. Foods should be introduced in accordance with the ordinary practices of supplemental feeding introduction as well as the national recommendations on nutrition. That is why it is recommended not to avoid "allergenic foods" like milk, eggs, or peanuts; however, they should not be consumed excessively [26]. Russian recommendations for treatment and prevention of allergy in children state the same [27].

From the "Brief History of Supplemental Feeding" in Russia

In Russia, the views on when to introduce supplemental feeding have a history of their own. Papers by G.N. Speranskiy and N.F. Filatov attach great importance to the organization of breastfeeding [28, 29]. Recommendations on the introduction of different foods in the child's nutrition vary. N.F. Filatov's "Brief Tutorial on Childhood Diseases" says that in the 7th month of a breastfed child's life, you can introduce broth and then whole milk. In the 3rd week after "weaning", you can add soft-boiled eggs and porridge to the child's nutrition. At the time the book was written, bottle-fed children were fed with formulae based on cow milk and cereal concoctions. G.N. Speranskiy recommends introducing juices (2 to 3 teaspoons) in the 6th month of life; porridges, according to him, should be introduced at the age of 6 months [28]. N.K. Ignatov's guidelines to children's nutrition state: "Carbohydrate foods (porridges) should be introduced as supplemental foods not before the child is 6 months old; only in some extreme cases could it be introduced at the age of 4 months."[30] However, it is proposed the child should consume a teaspoon of juice a day starting from the age of 3 months; a bit of whole cow milk should become a part of the child's diet after reaching the age of 4.5 months [30].
It was not so long ago that the USSR experts though that even breastfed children needed some "small portions of dietary supplements" from very early age. The additives included juices, decoction, fruit puree, and yolk. Fundamentals of Balanced Nutrition for Children recommend introducing juices at the age of 3 weeks, fruit puree at the age of 1.5 to 2 months, although the main types of supplemental foods (porridge and vegetable mash), according to the same Fundamentals, should be introduced at the age of 4-4.5 months. It was suggested that yolk could be introduced at the age of 3–3.5 months, whilst cottage cheese could be introduced not before 4 months [31]. The main goal of such early introduction was to "enrich" the child's nutrition with a number of additional nutrients. It should be noted that at that time, these recommendations

were not really different from those of other countries, where it was recommended to introduce supplemental feeding at the age of 3 months, and juices at the age of 1 months [32–34].
Further studies (including research by Institute of Nutrition [35]) proved there was no real reason for such early introduction of juices, which is why it was then recommended to delay their introduction. Until recently, the Russian Federation used the supplemental food introduction diagram developed by Institute of Nutrition of the Academy of Medical Sciences. The diagram was approved by the Ministry of Health of the Russian Federation in 1999 and cited in the Guidelines no. 225 On Modern Principles and Techniques of Infant Feeding [36]. These recommendations offered different supplemental feeding introduction diagrams for breastfed and bottle-fed children. In case of sufficient maternal lactation, the main supplemental foods (vegetable mash, porridge, etc.) were to be introduced at an age of 4 to 6 months. However, it was recommended to add to the child's nutrition fruit juices and purees, then referred to as additional nutritional factors or dietary supplements, before introducing the main supplemental foods. Thus, the first food to introduce in addition to breast-milk was fruit juice, and they recommended to add it to the child's nutrition not before 3 months of age. If the child tolerated fruit juices well, it was recommended to introduce fruit purees two weeks later.
In accordance with the above-mentioned document, "you can add denser food, that is referred to as supplemental in Russia, at an age of 4.5 to 5.5 months". Vegetable mash is the most preferable supplemental food [36]. For bottle-fed children, the recommendations proposed a similar introduction diagram; however, it was considered acceptable that some supplemental foods could be introduced earlier "where appropriate": "In particular, fruit juices and purees can be introduced earlier than the age of 3 and 3.5 months, i.e. at the age of 1.5 and 2 months, based on individual indications." It was due to the fact that "bottle-fed children take in a significant amount of "alien" nutrients, resulting in the child's adaptation to "alien" foods." It was recommended to introduce kefir and other whole non-adapted dairy products at the age of 6–7 months. Further research, including studies by Institute of Nutrition [37, 38], and accumulated experience resulted in a re-consideration of Russian views on when to introduce supplemental feeding.

Adoption of the National Document

In 2011, after years-long discussion, Russian nutrition experts have drawn up a consensus paper, National Program for Optimization of Infant Feeding in the Russian Federation, which was signed by V.A. Tutelyanov, the Director of Institute of Nutrition of the Russian Academy of Medical Sciences, the Chairman of the National Association for Nutrition and Dietetics, an academician of the RAMS. The other signee was A.A. Baranov, the Director of the Scientific Center of Children's Health of the RAMS and the Chairman of the Executive Committee of the Union of Pediatricians of Russia. The document was adopted at the 16th Congress of Pediatricians of Russia in February 2009 [1].
Since its adoption, the paper is deemed the nation's primary guideline to infant feeding. As the pediatric community adopted the document more than 5 years ago, it is quite surprising that, as noted above, some pediatricians are not aware of its contents. When it comes to supplemental feeding, the paper makes it clear: "When introducing supplemental foods, the child should be aged 4 to 6 months." However, the obsolete ideas that juices should be introduced earlier are deeply rooted in pediatricians' minds; one can still encounter those ideas in doctoral recommendations.
The new supplemental feeding introduction diagram states a later introduction of juices and fruit purees (Table 2). The document also recommends later (not before 6 months) introduction of cottage cheese so as to avoid excessive intake of proteins, because according to the today's concepts of nutritional programming, it is excessive intake of proteins as an infant that puts the child at risk of obesity and diabetes [39].

According to the National Program, the age of supplemental feeding introduction may vary, as one has to take into account the developmental peculiarities of the digestive system and the eliminative organs as well as the child's psychomotor development in terms of readiness to new foods. These recommendations no longer offer different introduction diagrams for bottle-fed and breastfed children, as modern adapted formulae contain a large number of various micronutrients. Thus, if the idea of early juice introduction was based on the necessity of vitamin and mineral intake adjustments, that is no longer the case, and supplemental feeding recommendations are now the same for both children groups [37]. In case of underweight or diarrheal events, it makes sense to prescribe the consumption of porridges; the preferable options are industrially-produced foods rich in iron, calcium, zinc, and iodine. Overweight children or children with a disposition to constipations should first receive vegetable mash as a supplemental food.

It is possible to use home-made foods, however, "for children nutrition, you'd better use industrially made foods supplemental foods that are produced of high-quality products, meet the strictest hygiene and safety requirements, are guaranteed to have a specified chemical composition, including vitamin composition, regardless of the season, and are available in a variety of grinding degrees." [1, 40]. If supplemental foods are enriched with prebiotics and probiotics, they become more valuable biologically and gain the quality of "functional nutrition". [41]

Results of studies, including those carried out in Russia [37] show that changing the order of introduction of various supplemental foods does not affect the child's development parameters, which is why it is possible to make individual diagrams that in general meet the existing recommendations. Where there is a more or less clear target in choosing the supplemental feeding introduction age whereas a good evidence bas is available, it is recognized that the set and range of foods are individual for this or that child [42]. Due to their osmolarity and organic acid content, juices have an intense irritating effect on the child's gastrointestinal tract, which is why it is preferable to introduce juices later if the child has functional gastrointestinal disorders or food intolerance. Approximate amount of juice to be consumed by the infant is calculated as 10 ml per kg of body weight [43].

Table 2. Introducing Supplemental Feeding to the Nutrition of Infants [1]

Name of food (g, ml)	Age in months			
	4–6	7	8	9–12
Vegetable mash	10–150	170	180	200
Milk porridge	10–150	150	180	200
Fruit puree	5–60	70	80	90–100
Fruit juice	5–60	70	80	90–100
Cottage cheese*	10–40	40	40	50
Yolk, (pcs)	–	0.25	0.5	0.5
Meat mash*	5–30	30	50	60–70
Fish mash	–	–	5–30	30–60
Kefir and other sour milk drinks	–	–	200	200
Rusks and cookies	–	3–5	5	10–15
Wheat bread	–	–	5	10
Vegetable oil	1–3	5	5	6
Butter	1–4	4	5	6

Note.* Not before 5.5 months.

Some Psychomotor Aspects of Supplemental Feeding Introduction

It is obvious that a child has to develop some psychomotor skills before supplemental foods can be introduced. This stage of development can be considered a physiological milestone of

individual development, similar to walking or speech [8]. At the early stage of supplemental feeding introduction, the child should get accustomed to spoonfeeding. First, give the child just a small amount of food (1 or 2 teaspoons). Food should be placed on the very tip of a clean teaspoon, because it will take time for the infant to learn how to take food from the spoon with their lips and then use the tongue to move food to the back of the oral cavity to swallow it. Some portions of food can flow down the chin or be spit out. The parents should be ready for such reaction and understand that it does not mean the child dislikes the food. In this period, i.e. early post-introduction period, breastfeeding or formula feeding should be continued. The child should still receive as much breast-milk as they did when breastfed exclusively. Breast-milk or formula should still be the main source of energy, nutrients, and fluids.

As the child gets accustomed to spoonfeeding, the parent(s) should add new tastes and try to give the child denser foods so as to diversify the nutrition and boos the motor skills of the child. Whereas the "spoon ejection reflex" should be suppressed for the infant to eat semi-fluid foods, consumption of more dense foods require the infant to stay in the seated position and hold the head steadily; it requires coordination of eyes, mouth and hand motions so that the child can look at the food, take it and put in the mouth; besides, the child should be capable of swallowing solid foods. When these skills develop depends on the child; this time varies in a rather wide range, and only a few infants can develop them in full to the sixth month of life [44]. That is why solid foods or foods with solid pieces should only be offered to the child when he or she is ready to take it. If the child rejects the food you offer, try later.

New foods should be added to the child's nutrition gradually. It takes 1 to 2 weeks for the child to adapt to a new food; do not introduce any other foods in this period. Foods introduced earlier remain in the child's diet, making it more diverse. At the first stage of supplemental food introduction, single-component foods are preferable. When a new food is introduced to the child's nutrition, its amount should not exceed 5 ml/g. It should be added to the child's morning meal so that you could see during the day if the child tolerates it well, i.e. if any cutaneous rashes appear or become more plentiful, if stool changes, etc. If there are no adverse events, the amount of new food is increased by 10 to 30 g every day and reaches the age-appropriate values over 5 to 7 days [19].

It is believed that a more diverse diet improves the child's appetite. Every child has specific taste preference, and when offered various foods, the child chooses a certain set of foods including their favorites. The child's preferences are influenced by a number of organoleptic properties such as taste, smell, appearance, and structure.

It is suggested that sweet taste it human's only inborn preference, and even neonates prefer sweet. This can lead to a steady preference for sweet taste, as it has been proven that children develop food preferences based on how frequently they sense this or that taste. Further rejection of any but sweet foods makes the child's diet less diverse and limits the intake of nutrients [45], thus forming an "unhealthy" nutrition stereotype [13, 14].

It is very important that the child develops a positive perception of foods when supplemental foods are introduced. Force feeding should never be the case. It is believed that one should try to offer a new food at least 8 to 10 times. It is shown that after taking a new food for the 12th to 15th time, the child's perception of this food becomes a lot better [3, 45]. That is why parents should be instructed that rejection of food is normal. Foods should be offered multiple times; experience has shown that initially rejected foods are often well-accepted later on. On the contrary, if the child's rejection of food is interpreted as something you cannot change, it deprives the child of the opportunity to expand their sensation of taste.

It is interesting that the child's temperament and activity do affect the way the parents choose when to introduce supplemental foods, recent studies have shown. It is very important that the child learns to enjoy new foods when supplemental foods are introduced. It is believed that breastfed children are quicker to develop a positive perception of new foods as compared to bottle-fed children, as they get accustomed to the varying taste and smell of maternal milk [3].

Introducing Supplemental Foods for Food-Allergic Children

If the child has a food allergy, introduction of supplemental foods becomes a peculiar process. If there is an allergy to cow milk proteins (CMP), the child's diet should be milk-free, i.e. any CMP-containing supplemental foods, including milk porridges, sour milk products, and cottage cheese, should not be introduced as long as the child is on an elimination diet. The child's nutrition should also contain no foods made of goat or sheep milk as well as no beef (veal), because these foods trigger cross-allergic reactions in CMP-allergic patients; such foods are also allergenic on their own and may cause severe reactions in patients that are tolerant to cow milk [26, 27, 28].

As modern medicinal formulae based on highly hydrolyzed milk protein and amino acids allow making a full ration for a CMP-allergic child, there is no need for earlier introduction of supplemental foods as was done earlier, as the current recommendations stipulate the same age of introduction for both healthy and allergic children [27]. But, of course, when to introduce supplemental foods should be decided individually on the basis of the child's physiology, clinical picture, and disease phase [19]. The first supplemental food to introduce is either vegetable mash or milk-free porridge. Either is chosen on the basis of the child's nutritional status and stool quality [19]. Accordingly, this should be single-component purees made of light-colored vegetables like zucchini, squash, cauliflower, white cabbage, Brussels sprouts, broccoli, light-colored pumpkin. In case of underweight, the recommended first supplemental food to introduce is milk-free gluten-free porridge (buckwheat, corn, rice). After its introduction is complete, add vegetables for the next dietary stage. Meat mash should be added to the child's nutrition at the age of 5.5-6 months; the preferable options are canned horsemeat, rabbit meat, turkey, or pork (made for children). One can also use broth-free homemade mash.

The first fruit-based supplemental food to introduce in an allergic child's nutrition is pure of light-colored apples or pears [19]. One should not forget, however, that even very young children can have allergic reactions to apples as the first manifestations of sensitization to tree pollen. As fruit juices have an irritating effect on the gastrointestinal tract, introduction of such juices is usually delayed if the child is allergic, especially when there are gastrointestinal manifestations of allergy.

Foods proven hypoallergenic are recommended to both allergic children and children "at risk" so as to avoid non-specific reactions to food. The Scientific Center of Children's Health, Moscow, has tested the safety of 13 variants of single- and multi-component supplemental foods (FrutoNyanya by OOO Progress, Russia). We tested apple, pear, and apple-pear juices, apple, pear, and prune purees, cauliflower and broccoli mashes, milk-free dry buckwheat and rice porridges as well as turkey mash and rabbit meat mash [49]. These foods were introduced as supplemental foods to the nutrition of 40 children with mild atopic manifestations or "at risk of atopy". In this study, clinical and immunological methods (general and specific IgE determination by means of ImmunoCAP) helped find out the children tolerated these foods very well.

No child had cutaneous rashes or intense gastrointestinal dysfunctions. No children had increased concentrations of specific IgE to proteins of cauliflower, broccoli, pumpkin, buckwheat, prunes, rice, apple, pear, rabbit meat, or turkey, although the supplemental foods we used did contain these proteins. Absence of reaction prove the low immunogenicity of these products. The results of our trials allow labeling these foods as hypoallergenic and drawing the conclusion that they can be used as a part of medical diets of allergic children or children at risk of atopy [49].

Conclusion

The basic principle of healing is do no harm, so it is the doctor's duty and responsibility to keep track of modern scientific advancement and use it for betterment of their own practices. When making decisions on introduction of supplemental foods, a pediatrician should stick to the national recommendations on infant feeding, as these recommendations have a sufficient evidential basis and have been adopted at a professional pediatric congress. Doctors should also raise public awareness of these recommendations.

Funding source

Publication of this paper was supported by PROGRESS, LLC.

Conflict of interest

The author of this article has declared absence of reportable conflict of interest.

References

1. *Natsional'naya programma po optimizatsii vskarmlivaniya deteĭ pervogo goda zhizni v Rossiĭskoĭ Federatsii*. Moscow: Soyuz pediatrov Rossii; 2011. 68 p.
2. *Global Strategy for Infant and Young Child Feeding*. Geneva: WHO; 2002. 32 p.
3. Michaelsen KF, Weaver L, Branca F, Robertson A. Kormlenie i pitanie grudnykh deteĭ i deteĭ rannego vozrasta. *WHO. European edition*. 2003;87:368.
4. American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. *Pediatrics*. 2005; 115:496–506.
5. *National Center for Chronic Disease Prevention and Health Promotion. Breastfeeding among U. S. Children Born 1999-2006, CDC National Immunization Survey*. CDC: Atlanta; 2010.
6. Cattaneo A, Burmaz T, Arendt M, Nilsson I, Mikiel-Kostyra K, Kondrate I. Communal MJ, Massart C, Chapin E, Fallon M. Protection, promotion and support of breast feeding in Europe: progress from 2002 to 2007. *Public Health Nutrition*. 2010;13:751–759.
7. Cattaneo A, Williams C, Pallas-Alonso CR, Hernandez-Aguilar MT, Lasarte-Velillas JJ, Landa-Rivera L, Rouw E, Pina M, Volta A, Oudesluys-Murphy AM. ESPGHAN's 2008 recommendation for early introduction of complementary foods: how good is the evidence? *Matern Child Nutr*. 2011;7(4):335–343.
8. Agostoni C, Decsi T, Fewtrell M, Goulet O, Kolacek S, Koletzko B, Michaelsen KF, Moreno L, Puntis J, Rigo J, Shamir R, Szajewska H, Turck D, van Goudoever J. Complementary feeding: a commentary by the ESPGHAN Committee on Nutrition. ESPGHAN Committee on Nutrition. *J Pediatr Gastroenterol Nutr*. 2008;46(1):99–110.
9. EFSA Panel on Dietetic Products Nutrition and Allergies. Scientific opinion on the appropriate age for introduction of complementary feeding of infants. *EFSA J*. 2009;7:1–38.
10. Klag EA, McNamara K, Geraghty SR, Keim SA. Associations Between Breast Milk Feeding, Introduction of Solid Foods, and Weight Gain in the First 12 Months of Life. *Clin Pediatr (Phil.)*. 2015;54(11):1059–1067.
11. Wen LM, Baur LA, Rissel C, Xu H, Simpson JM. Correlates of body mass index and overweight and obesity of children aged 2 years: findings from the healthy beginnings trial. *Obesity (Silver Spring)*. 2014;22(7):1723–1730.
12. Heinrich J, Koletzko B, Koletzko S. Timing and diversity of complementary food introduction for prevention of allergic diseases. How early and how much? *Expert Rev Clin Immunol*. 2014;10(6):701–704.
13. *Global'naya strategiya VOZ v oblasti ratsiona i rezhima pitaniya, fizicheskoĭ aktivnosti i zdorov'ya: konsul'tativnaya vstrecha stran Evropeĭskogo regiona. Otchet o konsul'tativnoĭ vstreche*. Kopengagen, Daniya. 2003. 526 p.
14. *Sugars intake for adult and children. Guideline*. Geneva: WHO; 2015. 49 p.

15. *Marketing pishchevykh produktov s vysokim soderzhaniem zhira, soli i sakhara, orientirovannyĭ na deteĭ - obnovlennaya informatsiya za 2012–2013 gg*. Kopengagen: WHO; 2014. 35 p.
16. Frederiksen B, Kroehl M, Lamb MM, Seifert J, Barriga K, Eisenbarth GS, Rewers M, Norris JM. Infant exposures and development of type 1 diabetes mellitus: The Diabetes Autoimmunity Study in the Young (DAISY). *JAMA Pediatr*. 2013;167(9):808–815.
17. Fergusson DM, Horwood LJ, Shannon FT. Early solid feeding and recurrent childhood eczema: a 10 year longitudinal study. *Pediatrics*. 1990;86:541–546.
18. Fergusson DM, Horwood LJ, Beautrais AL, Shannon FT, Taylor B. Eczema and infant diet. *Clin Allergy*. 1981;11:325–331.
19. Makarova SG, Vishnëva EA, Alekseeva AA. Rekomendatsii po vvedeniyu prikorma patsientam s pishchevoĭ allergieĭ i detyam iz gruppy riska: chto i kogda? *Pediatric pharmacology*. 2014;11(5):45–51.
20. American Academy of Pediatrics Committee on Nutrition. Hypoallergenic infant formulas. *Pediatrics*. 2000;106(2):346–349.
21. Jennifer S. Feeding the Infant With Possible Food Allergy: What's Best? *Medscape*. 2014;21–27.
22. Zutavern A, von Mutius E, Harris J, Mills P, Moffatt S, White C, Cullinan P. The introduction of solids in relation to asthma and eczema. *Arch Dis Child*. 2004;89:303–308.
23. Zutavern A, Brockow I, Schaaf B, von Berg A, Diez U, Borte M, Kraemer U, Herbarth O, Behrendt H, Wichmann HE, Heinrich J. Timing of solid food introduction in relation to eczema, asthma, allergic rhinitis, and food and inhalant sensitization at the age of 6 years: results from the prospective birth cohort study LISA. *Pediatrics*. 2008;121:44–52.
24. Tromp II, Kiefte de Jong JC, Lebon A, et al. The introduction of allergenic foods and the development of reported wheezing and eczema in childhood: the Generation R study. *Arch Pediatr Adolesc Med*. 2011;165:933–938.
25. de Silva D, Geromi M, Halken S, et al. Primary prevention of food allergy in children and adults: systematic review. *Allergy*. 2014;69:581–589.
26. Muraro A, Werfel T, Hoffmann-Sommergruber K, et al. EAACI Food Allergy and Anaphylaxis Guidelines. Diagnosis and management of food allergy. *Allergy*. 2014;69:1008–1025.
27. Baranov AA, Namazova-Baranova LS, Borovik TE, et al. *Pishchevaya allergiya. Seriya: Bolezni detskogo vozrasta ot A do Ya*. Moscow; 2013.
28. Speranskiĭ GN. *Ukhod za rebenkom rannego vozrasta*. Moscow: Izdanie M. i. S. Sabashnikovykh; 1922. 119 p.
29. Filatov NF. *Kratkiĭ uchebnik detskikh bolezneĭ dlya studentov poslednikh semestrov*. Izd. 10-e. Moscow: Sklad izdaniya u A. A. Kartseva; 1911. 270 p.
30. Ignatov NK. *Pitanie deteĭ vsekh vozrastov*. Moscow - Leningrad: Medgiz; 1931. 264 p.
31. *Osnovy ratsional'nogo pitaniya deteĭ*. Ed by K.S. Ladodo, V.D. Ott, E.M; Fateeva. Kiev: Zdorov'ya; 1987. 248 p.
32. Fomon SJ. Reflections of infant feeding in the 1970s and 1980s. *Am J Clin Nutr*. 1987;46:171–182.
33. Hendriks KM. Weaning recommendations: the scientific basis. *Nutr Rev*. 1992;50:125–133.
34. Clark BJ, Laing SC. Infant feeding: a review of weaning. *J Hum Nutr Dietetics*. 1990;3:11–18.
35. Sorvachëva TN. *Metabolicheskie osnovy optimizatsii iskusstvennogo vskarmlivaniya deteĭ grudnogo vozrasta*. [dissertation abstract] Moscow; 1995. 40 p.
36. *Sovremennye printsipy i metody vskarmlivaniya deteĭ pervogo goda zhizni. Metodicheskie ukazaniya No 99/225*. Moscow; 1999. 52 p.
37. Kon' IYa, Gmoshinskaya MV, Abramova TV, Safronova AI, Pustograev NN, Toboleva MA, Kurkova EV, Makarova EV, Kalenov SE. Kliniko-fiziologicheskoe obosnovanie novoĭ skhemy vvedeniya prikorma. *Voprosy detskoĭ dietologii*. 2011;9(3):23–28.

38. Kon' IYa, Safronova AI, Vorob'ëva LSh, Shilina NM. Otsenka vliyaniya kefira i «posleduyushcheĭ» molochnoĭ smesi na razvitie diapedeznykh krovotecheniĭ u deteĭ vtorogo polugodiya zhizni. *Pediatriya*. 2002;3:55–59.
39. Netrebenko OK. Belok v pitanii grudnykh deteĭ: normy potrebleniya i sovremennye rekomendatsii. *Current pediatrics*. 2003;1(1):44–47.
40. Skvortsova VA, Borovik TE, Netrebenko OK, et al. Nauchnoe obosnovanie skhemy vvedeniya prikorma, izlozhennoĭ v «Natsional'noĭ programme optimizatsii vskarmlivaniya deteĭ pervogo goda zhizni v Rossiĭskoĭ Federatsii». Chast' 1. *Current pediatrics*. 2011;10(6):128–136.
41. Borovik TE, Netrebenko OK, Semënova NN, Makarova SG, Skvortsova VA, Sergeeva SN, Zvonkova NG. Innovatsionnye podkhody k organizatsii prikorma detyam s pishchevoĭ allergieĭ i iz gruppy vysokogo riska po razvitiyu atopii. *Pediatriya*. 2011;90(3):91–99.
42. Sorvachëva TN, Gordeeva EA, Anikieva EN. Prikorm. Ot reglamentov k individual'nomu podkhodu. *Current pediatrics*. 2011;10(5):45–48.
43. American Academy of Pediatrics: committee on nutrition: The use and misuse of fruit juice in pediatrics. *Pediatrics*. 2001;107(5):1210–1213.
44. Carruth BR, Skinner JD. Feeding behaviors and other motor development in healthy children (2-24 months). *Journal of the American College of Nutrition*. 2002;21:88–96.
45. Birch L. Development of food acceptance patterns in the first years of life. *Proceedings of the Nutrition Society*. 1998;57:617–624.
46. Doub AE, Moding KJ, Stifter CA. Infant and maternal predictors of early life feeding decisions. The timing of solid food introduction. *Appetite*. 2015;92:261–268.
47. Kronborg H, Foverskov E, Vaeth M. Predictors for early introduction of solid food among Danish mothers and infants: an observational study. *BMC Pediatr*. 2014;14:243.
48. Koletzko S, Niggemann B, Arato A, Dias JA, Heuschkel R, Husby S, Mearin ML, Papadopoulou A, Ruemmele FM, Staiano A, Schappi MG and Vandenplas Y. Diagnostic Approach and Management of Cow's Milk Protein Allergy in Infants and Children: ESPGHAN GI Committee Practical Guidelines. *JPGN*. 2012;55:221–229. doi: 10.1097/MPG.0b013e31825c9482.
49. Turti TV, Makarova SG, Zimina EP, Davydova IV, Snovskaya MA. Profilaktika allergii u deteĭ v period vvedeniya produktov prikorma (v pomoshch' prakticheskomu vrachu). *Current pediatrics*. 2014;13(6):512–556.