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ORIGINAL ARTICLE

Complementary feeding: what do we know?

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Pediatrics,
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Abstract

Introduction: Complementary feeding (CF) is defined as the set of foods that are offered to the infant, from the 6th month of life, in addition to breastfeeding or infant formulas. One of the roles of the pediatrician is to guide the introduction of CF. **Methods:** Descriptive cross-sectional study through self-administered questionnaire with pediatricians and pediatrics residents on demographic information, knowledge of feeding practices, nutrition and supplementation in the first two years of life. There were analyzed associations between time since medical degree and degree of formation with the variables supplementation of iron and vitamin D. **Results:** The final sample consisted of 109 questionnaires; 63% of the participants considered the presence of topics on infant feeding insufficient. A total of 66,9% and 38.53% of the participants follow the current recommendations regarding the age of supplementation of iron and vitamin D, respectively. **Discussion:** We observed divergent practices of current scientific evidence by pediatricians and pediatric residents. There was a relationship between training time and a higher proportion of inadequate practice regarding iron supplementation. **Conclusion:** A more emphatic approach to the topic of infant feeding should be considered both in pediatric training and in the context of professional update.

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INTRODUCTION

Complementary feeding (CF) is defined as the set of foods that are offered to the infant, after 6 months of life, in addition to breastfeeding and/or infant formulas¹.

Nutritional and metabolic factors in the early stages of human development have long-term effects on adult health. The period between birth and two years of life is particularly important for physical, health and behavioral development. A significant example is the relationship between poor eating in the first years of life and the future development of obesity^{2,3}. Inadequate food introduction is mainly due to the lack of information and incorrect beliefs on the subject by family members and caregivers, as well as healthcare professionals^{4,5}.

In Brazil, most children within the age group of CF introduction have inadequate eating habits. Therefore, this fact requires special attention from healthcare professionals. A survey carried out in Basic Health Units in municipalities across the country with the parents of 38,566 children, between 6 and 23 months of age showed that only 14% of those children consumed iron-rich foods the day before the appointment with a pediatrician, while 56% of them, had some type of ultra-processed food to eat⁶.

An adequate process of introducing CF relies directly on the knowledge of family members concerning this subject, with an emphasis on the maternal role in this matter. In a study regarding mothers' knowledge about CF, only 34% of them knew how to identify the appropriate food groups that make up the menu of a 6-month-old child, while 72% didn't know how to identify the best way to offer food⁷.

Although in recent years the promotion of breastfeeding has seen relevant advances, we have not seen the same advances in the promotion of CF. New knowledge about infant feeding has made many recommendations that have been part of pediatric practice for a long time become outdated^{2,8}.

Silva & Gubert analyzed the information contained in healthcare professionals' websites concerning instructions for CF introduction; they noticed that these recommendations were in dissent with the current guidelines of the Health Department⁹.

Part of a pediatrician's responsibility, together with nutritionists and other healthcare professionals, is to advise on CF introduction, highlighting the significance of adequate nutrients for the best body composition and evaluating the quality of the food consumed by the family¹⁰.

Regarding the epidemic of child obesity and hidden hunger, it is important to accurately measure the knowledge of pediatricians on these topics.

METHODS

This is a descriptive cross-sectional study. The instrument used was a non-validated and self-applied questionnaire. We prepared a set of multiple-choice questions about demographic information, knowledge on dietary practices, nutrition and

supplementation during the first two years of life (supplementary information). The questionnaire was applied to pediatricians and pediatric residents using convenience sampling, by spontaneous and anonymous collaboration, using Google Forms. We invited pediatricians and residents linked to a tertiary referral hospital and also doctors from a group interested in nutrition to participate. The participants received an informative text alerting them that, when answering the questionnaire, they were agreeing to participate in the survey. The project was approved by the institution's Ethics Committee under the number 170427.

We noticed associations between time since graduation and educational status with the different answers about the prescription of iron and vitamin D supplementation. In the study of associations, we used the chi-square test, with statistical significance of 5% ($p < 0.05$), using the SPSS® v20 software.

RESULTS

The final sample consisted of 109 questionnaires, of which 51 (46.7%) were answered by pediatric residents and 58 (53.3%) by pediatricians. Table 1 depicts data on specialization, time since graduation and how these doctors obtained continuing education in child nutrition.

Table 1. Demographic analysis (n=109).

	Frequency (%)
Educational Status (Pediatrics)	
1st Year Resident	17
2nd Year Resident	16
3rd Year Resident	13
Practice Area Resident	7
Pediatrician	16
Pediatrician in the Practice Area	30
Time since graduation in medicine (years)	
<1 - 5	52
5 - 10	5
10 - 20	7
20 - 30	15
> 30	20
How they obtained Continuing Education in Child Nutrition	
Specific courses	27
Pediatrics conference	50
Clinical practice	44
Health Department guidebooks	43
Brazilian Pediatric Society	76
Internet	36
Scientific papers	61
Books	36
Attending's orientation	1

When we asked if they had sufficiently addressed breastfeeding in their training, 76 (69.7%) participants considered it to be very sufficient or sufficient; 28 (25.7%), had little enough and 5, (4.6%) insufficient. As for the presence of topics on infant feeding, 69 (63%) considered it little enough or insufficient and 40 (37%), sufficient or very sufficient.

Regarding the introduction of CF, 78 (71.6%) professionals considered that fruits should be the first food offered; 20 (18.3%), vegetable and meat porridge; 6 (5.5%), juices and 3 (2.8%), a full porridge with vegetables. Regarding the consistency of the food offered at the beginning of CF, 104 (95.4%) participants considered that food should be offered in the form of porridge, mashed with a fork.

Concerning the age at which a whole egg can be offered (white and yolk), 76 (66.1%) suggested that it can be offered as early as 6 months of age; 21 (19.3%), after 1 year of age; 15 (13.8%), after 9 months and 1 (0.9%), after 4 months.

Only 1 (0.9%) participant advised on the introduction of honey in the diet plan of a 6-month-old baby, while the remaining 108 (99.1%) advised it only after 1 year of age.

Seventy-three (67%) participants advised on the introduction of fish to the infant's diet from 6 months of age, 18 (16.5%) from 1 year of age, 17 (15.6%) from 9 months and 1 (0.9%) as early as 4 months.

When asked what should be the average interval between each meal, 95 participants (87.2%) answered 3 hours; 9 (8.3%), 4 hours; and 5 (4.6%), 2 hours.

The limit time to eat a porridge was 30 minutes for 62 professionals (56.9%), 45 minutes for 31 professionals (28.4%); 60 minutes for 14 participants (12.8%) and 90 minutes for 2 participants (1.8%).

When asked about when juices can be offered for the first time, 49 participants (44.9%) answered to be from one year of age; 36 (33%), from 6 months; and 2 (1.8%), from 9 months. As for the recommendation of the highest volume of juice that could be offered per day, 55 (50%) advised 100mL; 30 (27.5%), 200mL and only 2 participants (2%), 300 or 400mL. The opinion of 22 participants was not considered because they answered more than one option in these items.

Regarding iron supplementation, 73 participants (67%) answered correctly when compared to the guidelines recommended for such period. The answers relating to the beginning of iron supplementation with 6 months of age or also with the beginning of CF, both ending at 2 years of age, were correct. Concerning vitamin D supplementation, 42 participants (38.5%) answered correctly to the recommendations of such period, while 51 (46.8%) didn't. We considered as the correct answer to start vitamin D supplementation at 7 days of life and end it at 2 years of age. The answers of 4 and 16 participants were excluded, respectively, for having answered more than one option in these questions.

When we correlate the variables of time since graduation and educational status vs. iron supplementation, there was a statistical association between the more recently

graduated doctors (<1 to 5 years) and the professional status (current pediatric resident) with adequate guidance in relation to iron supplementation in childhood (table 2).

It was not possible to establish a correlation between the vitamin D supplementation and time since graduation or educational status due to the number of invalid answers.

DISCUSSION

Until the 6th month of life, infants being breastfed or fed with milk formula, don't need other types of food in their diet plan to meet their nutritional needs. Upon the sixth month, food should be introduced gradually, with special attention to hygiene during the preparation and to the presence of micronutrients, ultra-processed food shouldn't be used².

The benefits of appropriate CF in the first two years of life are incontestable^{4,11,12}. While parents or caregivers are responsible for preparing and offering the CF, pediatricians should guide feeding practices based on scientific evidence^{1,3,10,11}.

More than half of the professionals participating in our study did not consider the lessons about infant feeding in their training adequate, that can probably have an impact on their future practice. In opposition to the large amount of literature on breastfeeding, less attention is given to the period of food introduction and its influence on the health and development of children, a fact that seems to be correlated to the different instructions given by doctors regarding CF¹¹. The training of healthcare professionals concerning CF is essential to improve caregivers' practices¹³.

The Health Department recommends that after six months of age the child should receive two porridges of fruit and a main porridge (lunch or dinner) a day, initially these have to be mashed with a fork. The full porridge should contain foods from the following groups: cereals/tubers, vegetables, meats or eggs and beans. The meat group includes several animal origin-foods, including fish¹⁴. In our study, most part of the participants advised on the introduction of food in the right consistency. However, approximately one third of them recommends introducing fish to the diet only after 9 months of age.

Although different guidelines still exist regarding the introduction of the whole egg to the children's diet, a meta-analysis by Lerodiakonou and collaborators showed that the

Table 2. Guidance on iron supplementation (n=105) .

	Right Answers (%)	Wrong Answers (%)	Errada <i>p</i>
<i>Educational Status</i>			
Pediatrics Resident	41 (39)	8 (7.6)	0.003
Pediatrician	32 (30.5)	24 (22.9)	
<i>Time since graduation (years)</i>			
< 1 - 5	46 (43.8)	9 (8.6)	0.001
> 5	27 (25.7)	23 (21.9)	

risk of allergy is reduced when the egg is introduced between 4-6 months of age.¹⁵ The Health Department advises that the whole boiled egg should be offered to the breastfed infant at 6 months of age¹⁴. In our study, 43% of the participants advised introducing the whole egg into the children's diet during a period that is in dissent with the current scientific evidence.

As for the interval between meals and the time required for eating porridge, the American Academy of Pediatrics suggests an interval of 2 to 3 hours between each meal.¹⁶ This guideline is already adopted by the majority of participants in our study.

We found different instructions regarding the introduction of juice in CF, perhaps because this recommendation is recent. Previously, juice was recommended by pediatricians as a source of vitamins and hydration¹⁷. In 2017, the American Academy of Pediatrics recommended not to offer juice to children until they reach 1 year of age. After that consumption should be limited to 100mL/day until 3 years of age. We should encourage the consumption of the whole fruit, because juice by itself does not offer nutritional benefit to a healthy and balanced diet¹⁷.

The introduction period of CF, starting at 6 months of age, is of high risk for the development of micronutrient deficiency, especially iron. 60% of anemia cases are associated with iron deficiency¹⁸. In addition to the instruction of offering a varied diet that includes animal inputs, fruits, vegetables, avoiding beverages with low nutritional value and that reduce iron absorption, and food enhancement, iron supplementation is part of the anemia prevention program for this age group¹⁹.

The World Health Organization recommends iron supplementation as a public health measure to prevent iron deficiency and anemia in children aged from 6 to 23 months, in places where the prevalence of anemia is greater than or equal to 40%¹⁹. In Brazil, the reported prevalence of anemia in children varies between 40 and 50%¹⁸. The Health Department, through the National Iron Supplementation Program, advises that children between 6 and 24 months of age should have their iron intake supplemented with 1mg/kg/day with prophylactic ferrous sulfate²⁰. We noticed that 70% of the participants in our study recommended supplementation with ferrous sulfate from 6 months of age or from the time CF is introduced up to 2 years. Recently, the Brazilian Pediatric Society¹⁸ suggested a review on the prophylactic supplementation criteria currently adopted, recommending the beginning of it from the 3rd month of life for full-term newborns of adequate weight for gestational age, regardless of whether they are on exclusive breastfeeding or not.

Vitamin D is a prohormone that is involved in bone metabolism and in the regulation of calcium and phosphorus plasma levels. Recent research demonstrate that its deficiency seems to be related not only to bone changes, but also to the development of different autoimmune, cardiovascular and oncological diseases^{21,22}. Only a small amount of vitamin D comes from the diet, most of it is synthesized in the skin

through exposure to ultraviolet rays. The amount of vitamin D in breast milk is insufficient to provide the recommended intake – there is 40 IU of vitamin D in 1 liter of breast milk²³. The Brazilian Pediatric Society recommends prophylactic supplementation of 400 IU/day from the first week of life up to 12 months - for full term children, including those on exclusive breastfeeding - and of 600 IU/day from 12 to 24 months, regardless the region of the country²⁴. Despite being well established, the 2014 recommendation seems to be little incorporated into medical practice, as we can see with only 45% of correct answers.

There is an inverse correlation between the time since graduation and the professional's training concerning the prescription of iron supplements in accordance to the current evidence, suggesting that the topic of child nutrition needs a more emphatic approach within the topics of professional continuing education. We emphasize that even though pediatricians specialized in nutrition have been more appreciated in recent years, this still is a young specialty.

As for the restrictions of this study, we state that is impossible to establish a cause-effect relationship between the variables, inherent to any cross-sectional study. In addition, there is a possibility of sample selection bias since we used convenience sampling. There was a significant loss of answers in some questions that may be due to the questionnaire being self-applied, although an application test was performed in a pilot sample.

CONCLUSION

Considering the importance of pediatricians in CF introduction and the influence of childhood eating practices in the development of lifetime habits, it is essential that the guidelines for feeding and supplementation are in agreement with the current recommendations. We must consider a more emphatic approach to infant feeding, both in pediatric training and within the context of professional continuing education.

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APPENDIX I

QUESTIONNAIRE USED WITH THE PEDIATRICIANS AND PEDIATRIC RESIDENTS

Hello!

This is an invitation to participate in a research on Complementary Feeding Introduction in Pediatrics. The project was approved by the ethics committee under the number 170427. This survey consists of a questionnaire with multiple-choice questions and it takes approximately 15 minutes to answer. To participate you just need to answer the questions through Google Forms, the answers are completely anonymous. By answering the questionnaire, you are consenting to participate in the survey.

To answer the questionnaire and participate in the survey, click on the link below "Fill in Form" Thank you very much for participating.

1. What is your educational status?

- ☐ First year resident
- ☐ Second year resident
- ☐ General Pediatrician
- ☐ Practice Area Resident
- ☐ Pediatrician in the Practice Area

2. For how long have you had a medical degree?

- ☐ 0-5 years
- ☐ 5-10 years
- ☐ 10-20 years
- ☐ 20-30 years
- ☐ over 30 years

3. Do you consider the presence of topics on breastfeeding in your pediatric training:

- ☐ Insufficient
- ☐ Little Enough
- ☐ Sufficient
- ☐ Very Sufficient

4. Do you consider the presence of topics on complementary feeding in your pediatric training:

- ☐ Insufficient
- ☐ Little Enough
- ☐ Sufficient
- ☐ Very Sufficient

5. How do you get continuous education on Child Nutrition?

- ☐ Specific courses
- ☐ Pediatrics Conferences
- ☐ Clinical Practice
- ☐ Health Department/BPS guidebooks

6. From what age children can have tea:

- ☐ 1 month
- ☐ 2 months
- ☐ 4 months
- ☐ 6 months

7. When starting complementary feeding, which foods should be offered first?

- ☐ juices
- ☐ fruits

- ☐ full porridge with vegetables
- ☐ full porridge with vegetables and meat

8. In the beginning, the child's food should be given:

- ☐ In small pieces
- ☐ Sifted
- ☐ Crushed
- ☐ In the form of porridge smashed with a fork

9. From what age can the child be offered a whole egg (white + yolk)?

- ☐ 4 months
- ☐ 6 months
- ☐ 9 months
- ☐ 1 year

10. From what age can Honey be introduced to a child's diet:

- ☐ 6 months
- ☐ 8 months
- ☐ 10 months
- ☐ 1 year

11. Brown sugar can be inserted into the child's diet as of:

- ☐ 6 months
- ☐ 8 months
- ☐ 10 months
- ☐ 1 year

12. When can juices be offered to the child for the first time and how much should consumption be limited to?

- | From: | Limit: |
|-----------------------------------|---------------------------------|
| ☐ 4 months | ☐ 100ml |
| ☐ 6 months | ☐ 200ml |
| ☐ 9 months | ☐ 300ml |
| ☐ 1 year | ☐ 400 ml |

13. At what age can children be offered fish?

- ☐ 4 months
- ☐ 6 months
- ☐ 9 months
- ☐ 1 year

14. For full-term infants with an appropriate weight for gestational age, ferrous sulphate supplementation should be:

- | From: | Until: |
|--|---|
| ☐ 30 days of life | ☐ 1 year |
| ☐ 4 months | ☐ 1 year and 6 months |
| ☐ 6 months | ☐ 2 years |
| ☐ 1 year | ☐ 2 years and 6 months |

15. For full-term infants with an appropriate weight for gestational age, vitamin D supplementation should be:

- | From: | Until: |
|--|---|
| ☐ 7 days of life | ☐ 1 year |
| ☐ 30 days of life | ☐ 1 year and 6 months |
| ☐ 6 months | ☐ 2 years |
| ☐ 1 year | ☐ 2 years and 6 months |

16. What should be the average interval between each meal (main porridge, fruit and/or infant formula/breast milk)?

- ☐ 1 hour
- ☐ 2 hours
- ☐ 3 hours
- ☐ 4 hours

17. What is the ideal time limit for eating a porridge?

- ☐ 30 minutes
- ☐ 45 minutes
- ☐ 60 minutes
- ☐ 90 minutes