REVIEW

Effectiveness of food and nutritional education activities in children under the age of two: a systematic review

Aline Carare Candido [1]
https://orcid.org/0000-0002-6259-4786

Fabiana de Cássia Carvalho Oliveira [2]
https://orcid.org/0000-0002-6691-4038

[1] Nutrition and Health Department. Center for Biological Sciences. Universidade Federal de Viçosa. Av. Peter Henry Rolfs, s.n. University Campus. Viçosa, MG, Brazil. CEP: 36.570-000. E-mail: alinecarrare@gmail.com
[2] Pharmacy and Nutrition Department. Universidade Federal do Espírito Santo. Alegre, ES, Brazil.

Abstract

Objectives: to evaluate the effectiveness of food and nutritional education on children up to the age of two.

Methods: the systematic review was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses. The research was carried out in 2022 in the Virtual Health Library/Lilacs, Pubmed/Medline and Science Direct databases. The articles were selected independently using the Microsoft Excel® program. Articles that evaluated food and nutritional education applied on children up to the age of two were included. The risk of bias was assessed using the Joanna Briggs Institute tool.

Results: the research resulted in 1,523 studies and nine were included in the review. The articles presented a low risk of bias and good methodological quality. Food and nutritional education strategies were developed especially with the children's parents. Workshops, lectures, and teaching materials were developed. In most of the studies, the activities developed helped to improve children's health and eating patterns.

Conclusion: food and nutritional education activities have therefore been effective in building healthy eating habits at childhood. Prospero registration: CRD42022325608.

Key words *Food and nutritional education, Child health, Healthy eating, Child*

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Introduction

Food and nutritional education (FNE) aims to promote healthy eating habits and health protection through strategies that consider the affective, cultural and emotional aspects that involve feeding.[1] FNE should be continuous and intersectoral, with a multidisciplinary approach, incorporating popular knowledge and practices, contextualized into the reality of individuals and their families to enable the integration between theory and practice.[2]

In Brazil, FNE is acknowledged as a strategical action in achieving Food and Nutritional safety and assuring Human Rights in adequate feeding. Therefore, there is a guideline on National Food and Nutritional safety policy, which operates in different fields of action, either in the fields of feeding or in conjunction with other public policies. Thus, FNE occupies a strategical position in preventing and controling current food and nutritional problems and promoting adequate and healthy eating habits.[3]

The first thousand days of a child's life, from conception to the age of two, it is a period of intense physical, cognitive, emotional, and social development that can be influenced by environmental, nutritional, and metabolic factors that can impact on the individual's long-term metabolic programming, with effects that may persist throughout adult life.[4,5]

Thus, the FNE strategies can help promote a healthy lifestyle pattern, through activities that help parents with food introduction, in addition to instructing about the importance of food diversity to ensure adequate intake of macro and micronutrients.[6]

The teaching-learning process based on Nutrition and Nutritional Education actions encourages people to reflect and act in order to improve their health conditions. In this sense, the parents'roles stands out, especially in this early stage of life, since they will be responsible for food choices and offers.[7]

In this sense, it is essential to evaluate the effectiveness of the FNE activities used on children up to two years of age, to help formulate strategies that are more effective and assertive in infant feeding, since this is a gap in the literature. However, the objective of this review was to evaluate the effectiveness of FNE strategies directed to children up to two years of age.

Methods

This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) and was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the number of CRD42022325608.[8]

To define the guiding question, the Population, Exposure, Computer, Outcome and Study (PECOS) strategy was adopted, where the population (P) was children up to two years of age, the exposure (E) was the FNE strategies, without comparison (C). The outcome (O) was that the FNE strategies would be effective in improving health, nutritional and growth parameters. The study design (S) was randomized clinical trials and cohort studies. The guiding question was "What is the effect of nutrition education interventions on children's nutritional status and health parameters?"

The research was conducted in January 2022, independently by two researchers, in English, without restriction on the publication period. The electronic databases consulted were: Virtual Health Library (VHL)/LILACS, Pubmed/MEDLINE and Science Direct. The descriptors were selected from the Descriptors in Health Sciences (DeCS) and Medical Subject Headings (MeSH), and combined by means of the Boolean operator AND, composing the following search strategy: (Infant) AND (Food and Nutrition Education) AND (Effectiveness) AND (Infant Health). Finally, we complemented the database researches with additional searches on journal websites and by cross-referencing lists of published articles.

The selection of studies was performed by two researchers with the help of Microsoft Excel® program in an independent and standardized manner. First the titles were read, then the abstracts, and finally the full articles. The studies that evaluated the effect of nutritional education interventions in children under the age of two were included. Guidelines, reviews, experimental studies, articles on other subjects, and articles on children of other ages were not included.

The primary endpoint was the effectiveness of FNEs applied on children up to the age of two. The secondary endpoint was the improvement of feeding, health, and growth parameters.

For the qualitative synthesis, the following information was extracted from the studies: authors, year of publication, study design, population characteristics, information on the developed FNE, main results and conclusions.

In the included studies, different food and nutritional education (FNE) activities were carried out with the aim of protecting and promoting children's health and food and nutritional safety. To this end, activities, workshops and lectures were carried out and various materials were used, including playful tools. To assess whether the strategy was effective, we analyzed whether there was any positive impact on the children's diet, nutritional status, development and growth.

The risk of bias was assessed by the critical appraisal tool recommended by the Joanna Briggs Institute (JBI). The methodological quality assessment was performed independently, using randomized clinical trials and cohort studies' checklist. The tool used for randomized clinical trials has 13 questions and for cohort studies, 11. The

questions were answered with "yes", "no", "unclear" or "not applicable". When the answer was positive, the risk of bias was low, and when it was negative, a high risk of bias was expected.[9,10]

The cutoff point suggested by Costa *et al*.[11] was adopted to classify the risk of bias, where the percentage of affirmative ('yes') responses ≥70% is considered low risk of bias, between 50 to 69% is moderate, and ≤49% is high. However, these ratings were not used as exclusion criteria.

Results

Study Selection

The database search resulted in 1,523 studies and the reverse search did not result in any articles. A total of 577 duplicates were identified and removed. After reading the titles, 846 articles were excluded as they were considered irrelevant to the topic of interest. After reading the abstracts, 100 articles were excluded, mainly because they referred to other subjects and the children were older than two years. After reading 40 full articles, nine were included according to Figure 1.

The studies included in this review were conducted between the years 2004[12] and 2018.[20] Of the nine studies, only one was a cohort,[13] the rest were randomized clinical trials.[12,14-20] The information from the studies is summarized in Table 1.

Main Results

Bhandari *et al*.[12] developed food and nutritional education (FNE) strategies on complementary feeding for parents, in home visits that took place every three months until the child reached the age of 18 months and in monthly meetings, in eight rural communities in Haryana, India. Of these eight, four received a specific feeding intervention and the other four did not. The authors observed that in the intervention group, growth was greater, especially in boys, as for energy intake, more meals were eaten, with greater consumption of fruit and dairy products.

Roy *et al*.[14] conducted a study with children who had adequate and mildly malnourished nutritional status in 121 Community Nutrition Centers in the Bangladesh Integrated Nutrition Project (BINP). To improve nutritional status, workshops were held for six months to prepare local food rich in energy, protein and micronutrients. The authors observed better weight gain among the children and consequently a lower risk of malnutrition.

Shi *et al*.[15] developed FNE activities for Chinese children from two to four months old, until they were one year old. They were allocated into two groups: intervention (n=294) and control (n=305). The FNE activities carried out were: preparation of recipes using locally available, affordable and nutrient-rich food; booklets with guidance on infant feeding and preparation methods for the recommended recipes; and quarterly home visits to identify possible feeding problems and individualized counseling. The authors observed that the children had eaten more meals and had improved their hygiene practices in the intervention group. In addition, there was an improvement in nutritional status, demonstrating the effectiveness of FNE strategies developed.

Bortolini and Vitolo[16] developed FNE strategies focused on reducing the occurrence of anemia and iron deficiency among children aged zero to 12 months. The children were divided into the control group and the intervention group, which consisted of dietary guidelines referring to the Ten Steps to Healthy Eating for Children Under Two, provided to mothers during ten home visits carried out in the first ten days after birth, monthly until six months and then at eight, ten and 12 months. Although the FNE activities had no effect on the occurrence of anemia, improvements were identified in relation to dietary diversity, where there was greater consumption of meat and diets with higher iron bioavailability.

Daniels *et al*.[17] conducted a study in Australia with the aim of describing the infant feeding behavior reported by parents. To this end, activities on feeding responsive to hunger and satiety signals and guidance on "feeding is parenting" and positive parenting (encouraging autonomy and self-efficacy) were conducted. The authors concluded that guidance on eating practices has an impact on "obesogenic" eating behavior, where healthy food started to be included in the children's eating routine, with significant improvement in diet quality.

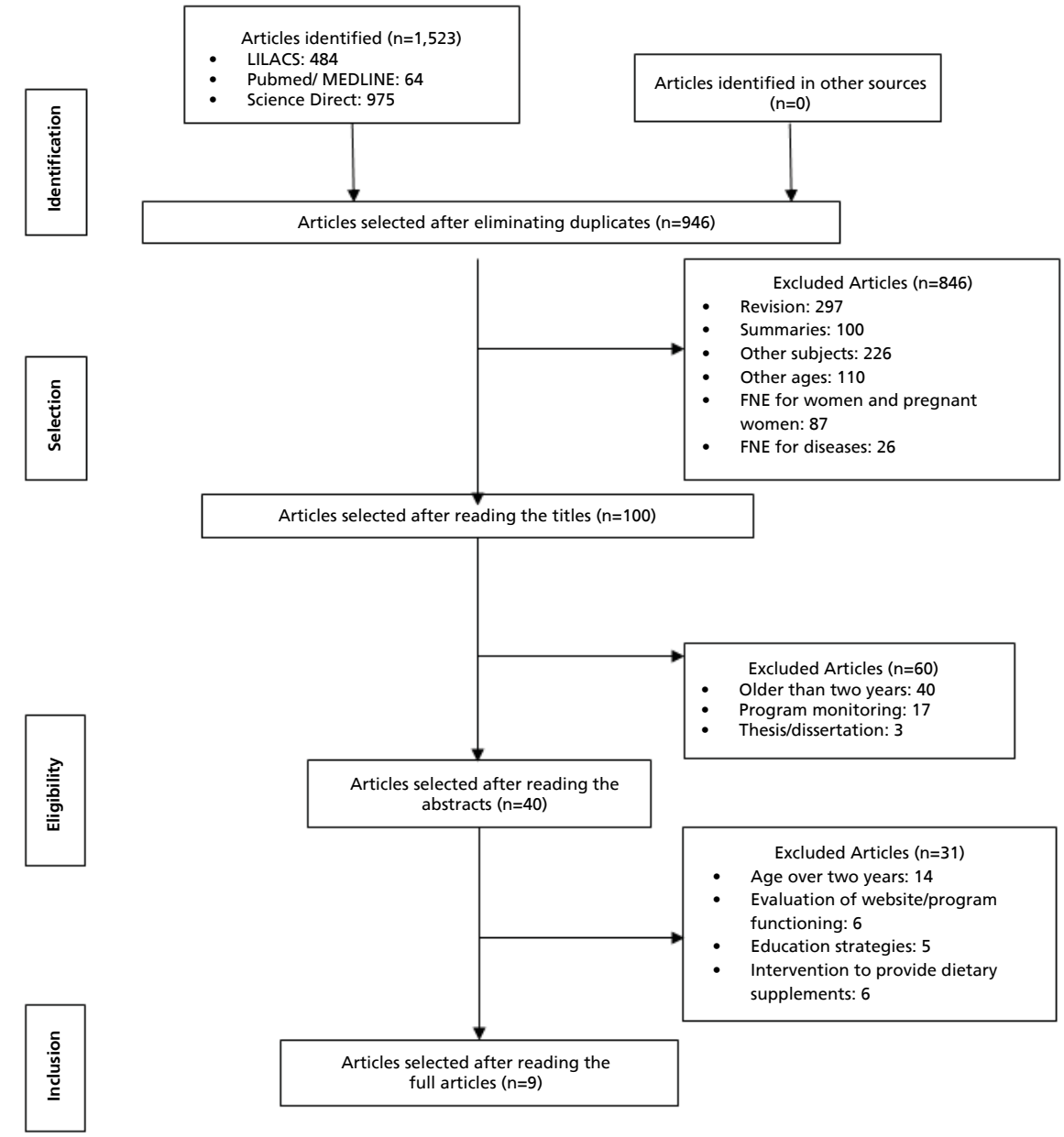
Fangupo *et al*.[18] conducted a study with children in New Zealand that included seven to eight contacts with breastfeeding and feeding activities, in which questionnaires were also administered to assess parental feeding behaviors and practices at 18 and 24 months of age. The authors observed minimal changes in the children's feeding behavior and therefore suggested that FNE approaches other than the ones they used, needed to be developed in future interventions.

Roche *et al*.[19] developed a study in Ecuador with the aim of carrying out an intervention using local food to improve the infants and children's nutrition. Eighty mothers and their children in six communities made up the intervention group and 184 mothers and children in nine communities made up the control group. Mothers were instructed to add nutritious and locally consumed food to their meals, and were instructed on the proper consistency of the food to be offered to the child, and proper hygiene for food preparation. The FNE activities increased energy and nutrient intake, helping to reduce the incidence of low weight in children.

Candido *et al*.[20] carried out a study in the Brazilian nurseries with the aim of investigating the effectiveness

Figure 1

Flowchart on article selection.



Source: PRISMA.

of different nutritional interventions in complementary feeding practices. The activities were developed with parents/guardians (n=169), professionals (n=90) and children. The authors observed that FNE strategies had a positive impact on children's diets.

Fahmida *et al*.[13] conducted a study in Indonesia and used FNE activities from gestation to 18 months of the child's life. The authors observed that the intervention was effective in improving feeding practices, although it did not show significant improvement in linear growth of children at 18 months of age.

Risk of Bias Assessment

The studies included in this review showed low risk of bias, with positive responses higher than 70%, indicating optimal methodological quality. According to the evaluation of the randomized clinical design articles, one study did not perform the allocation of treatment groups in a hidden manner and one article was not clear enough; in three studies it was unclear if the follow-up was concluded and; in five studies it was not clear if the study design was appropriate. Regarding to the cohort study, it was unclear whether confounding factors were identified and strategies to deal with these factors were indicated (Figure 2 and 3).

Table 1

Main results of the studies selected for the systematic review.

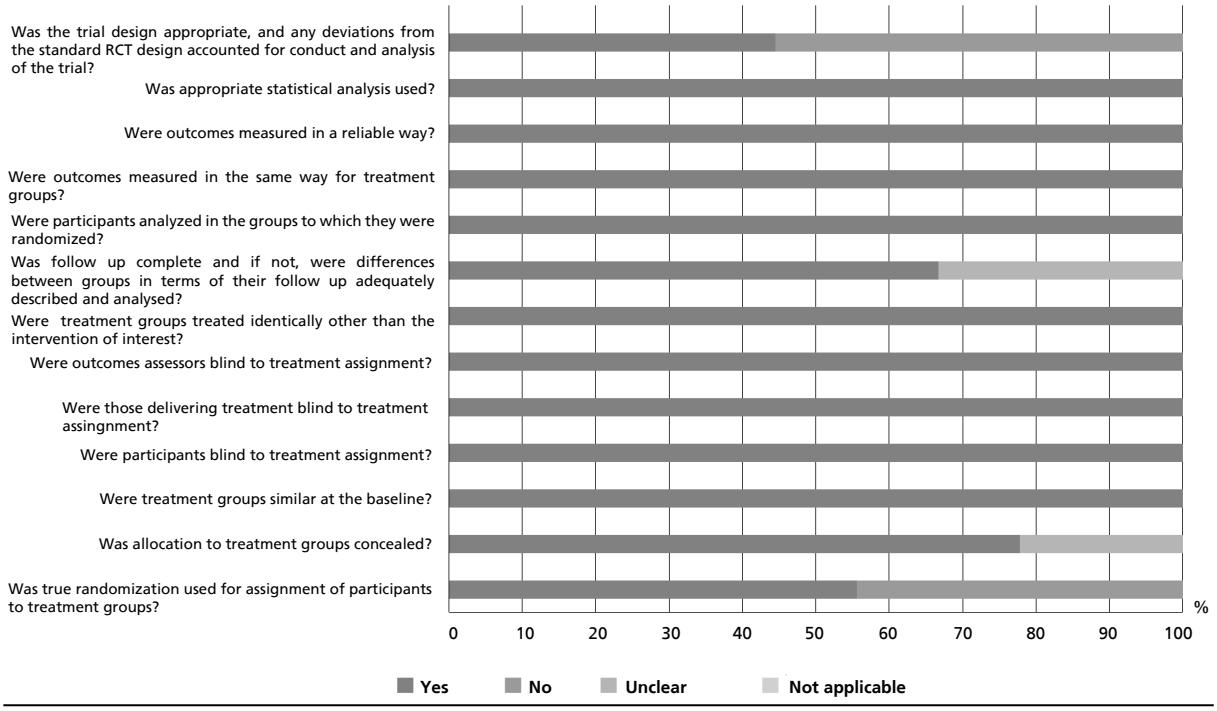
Authors/Year	Location/ Design	Population	FNE Strategy	Intervention duration	Main outcomes	Conclusions
Bhandari *et al.*,[12] 2004	India/ Randomized Clinical	1,025 children aged 6 to 18 months Intervention: 552 Control: 473	Home visits, cooking workshops, debates about complementary feeding, street plays, posters, flipbooks, and folders with guidelines about feeding.	The children were followed up every 3 months until the age of 18 months.	The boys in the intervention group showed greater length at 12 months (p=0.035) and a greater increment in length between 6 and 12 months of age (p=0.035). Better eating habits were also observed in this group.	Although FNE strategies improved feeding practices, the effect on physical growth varied. Therefore, interventions need to take into account gender differences.
Fahmida *et al.*,[13] 2020	Indonesia/ Randomized cohort	691 children from 0 to 18 months Intervention: 346 Control: 345	Media campaigns and activities were carried out on nutrition during pregnancy, breastfeeding, complementary feeding and hand washing.	The pregnant women were followed up during the third trimester until 18 months postpartum.	Among breastfed children, the percentage of children who achieved the minimum DDS and MAD was higher for the intervention group. The odds ratios were 3.49 and 2.79 for DDS and 3.49 and 2.74 for MAD in the 9 -11 month and 16 -18 month groups, respectively.	The intervention was effective in improving children's eating practices, but not in improving their linear growth.
Roy *et al.*,[14] 2007	Bangladesh/ Randomized Clinical	576 children aged 6 to 9 months Intervention: 294 Control: 282	FNE activities based on the UNICEF nutritional triangle concept.	Once a week for the first 3 months and once every 2 weeks for the other 3 months.	83.8% of the mothers started to offer the food at least three times a day to their children, compared to 19.4% in the control group (p<001). Weight gain was greater in the intervention group, with improved nutritional status (1.81 *vs.* 1.39 kg, p<0.001).	FNE strategies, when appropriate to the regions and based on the nutritional triangle model, prevent stunting and malnutrition among children.
Shi *et al.*,[15] 2010	China/ Randomized Clinical	599 children aged 2 to 12 months Intervention: 294 Control: 305	Workshops were held to teach healthy recipes and food hygiene, booklets on infant feeding were prepared, and home visits were made.	1 year. The visits occurred at 6, 9, and 12 months of age of the children.	Dietary diversity, meal frequency and hygiene practices improved in the intervention group. Infants in the intervention group gained 0.22 kg more (p=0.047) and gained 0.66 cm more (p=0.04) than in the controls.	FNE strategies provided by local health professionals can lead to behavioral changes in caregivers and improve child growth.
Bortolini and Vitolo,[16] 2012	Brazil/ Randomized clinical	397 children between 0 and 12 months Intervention: 163 Control: 234	Dietary Guidelines for the Ten Steps to Healthy Eating for Children Under two years of age.	10 home visits conducted in the first 10 days after birth, monthly until 6 months and at 8, 10 and 12 months.	In the intervention group there was improved eating pattern, higher consumption of meat, lower consumption of cow's milk than the children in the control group.	The intervention did not result in a reduction in the prevalence of anemia and iron deficiency. But dietary changes were observed in the intervention group.
Daniels *et al.*,[17] 2014	Australia/ Randomized Clinical	397 children aged 0-12 months Intervention: 163 Control: 234	Exposure activities to unfamiliar and unhealthy foods, feeding responsive to hunger and satiety signals, and activities to encourage autonomy.	The intervention started with children aged 4-7 months. The second module started 6 months after the completion of the first with children aged 13-16 months.	Children in the intervention group were rated with higher scores for satiety responsiveness (p=0.03) and lower scores for emotional excess (p=0.009) and restlessness (p=0.01). The children also liked fruit more (p=0.008) and were exposed to a greater variety of vegetables (p=0.008).	The application of FNE on eating practices impacts aspects of the child's "obesogenic" eating behavior, food preferences, and diet quality.

Fangupo *et al.*,[18] 2015	New Zealand/ Randomized Clinical	666 children aged 0 to 18 months Intervention: 325 Control: 341	Interactive workshops with healthy snacks and drink ideas, healthy food shopping, and label reading.	Home visits at 4, 7, 13 and 18 months of age.	The children in the intervention group had more control over their eating and less pressure to eat at 18 months, as well as more encouragement to consume healthy food at 24 months.	Interventions that focus on education and feeding support do not seem to be sufficient to change the parents and children's diet.
Roche *et al.*,[19] 2016	Ecuador/ Randomized Clinical	264 children aged 0 to 24 months Intervention: 80 Control: 184	Workshops on healthy recipes using local food, food hygiene, responsive eating, and organization.	Home visit every 2 weeks for 4 months. And FNE activities for 12 days.	In the intervention, children consumed more iron, zinc, vitamin A, protein and energy (p<0.05). The prevalence of low weight decreased from 30.4% to 23.7% and the prevalence of very low weight decreased from 10.0% to 1.3%.	The FNE strategies helped mothers to improve nutritional practices and reduced the incidence of low weight in children.
Cândido *et al.*,[20] 2018	Brazil/ Randomized clinical	169 children from 4 to 24 months Intervention: 72 Control: 97	Activities on consistency of baby food, offering rejected food, healthy eating, and food to be avoided.	For the children, the average time of the interventions was 50 minutes, for the professionals there were 4 meetings of 8 hours, and for the parents and guardians there were meetings with a total duration of 5 hours.	The consistency of food offered to infants evolved from 'pureed' to 'like the rest of the family' after the 8-month interval. There were improvements among parents regarding beliefs (soups and broths do not nourish my child: p=0.012), and intentions (not offering soups and broths: p=0.003; offering vegetables: p=0.018; offering meat: p<0.001).	The intervention using FNE strategies impacted on the parameters evaluated, denoting the importance of its application in child care to improve the introduction of food.

FNE = Feeding and nutritional education; DDS = Dietary diversity score; MAD = minimum acceptable diet; UNICEF=United Nations Children's Fund.

Figure 2

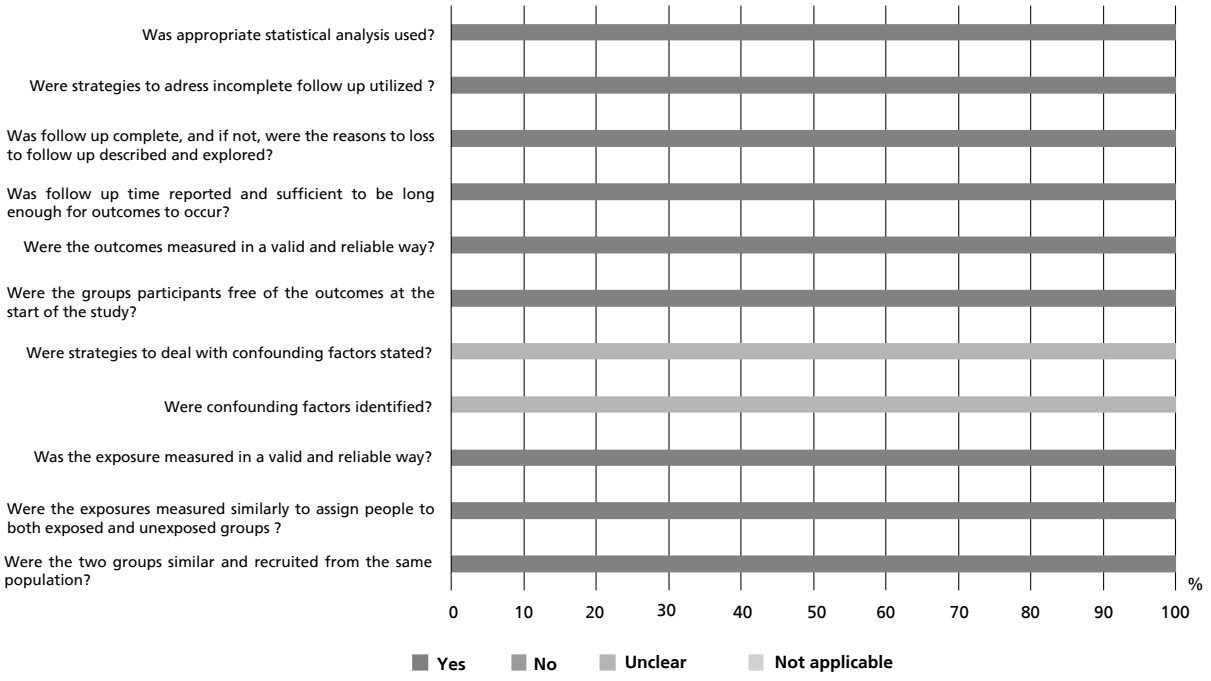
Risk of bias assessment by JBI's Critical Appraisal Tools for randomized clinical trials (n = 8).



Source: JBI (Joanna Briggs Institute); RCT= randomised controlled trial.

Figure 3

Risk of bias assessment by JBI's Critical Appraisal Tools for cohort studies (n =1).



Source: JBI (Joanna Briggs Institute).

Discussion

The studies included in this review used different FNE activities, demonstrating that there were not any good. Thus, the positive impact of interventions depends on the goal to be achieved, the adherence and acceptability of the target population, environmental factors, and local reality, because this would influence the demand and food availability.[21]

Therefore, it is important that nutritional education should be carried out from infancy, especially in the first two years of life, as this is a critical period characterized by intense growth and development. In addition, it is at this stage that children begin to form their eating habits, defining their preferences, which should ideally be healthy choices, based on food with nutritional quality. However, food choices are made by adults, so the best strategy in this case is activities that involve the whole family.[22]

In early childhood, especially in nutrition, the main activities carried out are playful ones, workshops for children to explore the texture, taste and smell of food and actions such as theater and lectures with colloquial language adapted to the child's understanding. The interesting thing is that these activities can be carried out at school, together with the teachers, and also at home, to explore the environment and the possibilities, encouraging the improvement of the child's eating behavior.[23]

The duration of the intervention is very variable, as it depends on the objective, material, human and financial resources to carry out the activities. The impact of FNE strategies is observed in short and long terms, through adherence to healthy eating habits in current and future life, which helps to maintain quality of life and prevent diseases.[24]

In order to FNE intervention becomes successful, the activities is needed to be carried out over a longer period of time so that the results can be sustained. It should also be considered that the activities carried out are not only intended to instruct, but also to offer a meaningful experience that prepares the child for life and provides quality of life, enabling the family and the child to be independent and agents of their own choices.[25]

The interventions carried out with children up to 24 months of age are generally directed at complementary feeding, because in this phase growth deficits, micronutrient deficiencies, or even dietary excesses may occur due to nutritional transition and the increase in ultra-processed food consumption.[26]

This phase demands special attention due to the difficulty in reversing nutritional problems, such as malnutrition or obesity, caused by malnutrition in the first years of life, hence the importance of effective FNE actions.[27]

The activities carried out in the studies were mostly directed to parents and caregivers, such as**,** workshops to prepare healthy recipes, lectures, and debates. It is noted that little attention was given to children, who should have been the main targets of the interventions. Thus, considering their young age, more playful activities could have been developed to encourage them to learn about food, its smells, textures, colors, and to learn to differentiate them, so that healthy eating becomes a desire and a moment of joy and encouragement for children.[28]

In this way, FNE activities that value local food culture can mobilize people with different histories and contexts, creating an environment of exchange, (re)knowledge, sharing of knowledge and strengthening bonds.[29]

According to the Marco Referência de Educação Alimentar e Nutricional para Políticas Públicas (Food and Nutrition Education Framework for Public Policies) document, adequate and healthy food is a basic human right that involves permanent and regular access to healthy food in sufficient quantity and quality, appropriate for the individuals' income, biological and social aspects respecting culture and gender, being based on adequate and sustainable production practices.[29]

The effectiveness of the FNE actions depends on numerous factors, such as dedication and quality of the activities, adequacy to the population, respecting the culture, religion, education level, and local reality.[28] Therefore, games, activities, and lectures may sometimes not be enough, and other strategies such as micronutrient supplementation and food supply should be used to improve the nutritional status.[30]

The strength of this review is the inclusion of studies with excellent methodological quality and good sample and global representativeness, which would be crucial to guide future strategies on FNE. The main limitation of the included studies is that the FNE activities were mostly aimed for the parents, leaving aside the children who should have been the main focus of these activities.

Conclusion

As final considerations, the developed FNE activities were effective in raising parents' awareness about the importance of healthy eating in children's early years, improving their eating habits and children's health and growth conditions. These strategies, when implemented early, can cause deep and lasting changes, not only in the current and future quality of life of the children, but also of their families.

This study highlights the importance of implementing systematic strategies for Nutrition and Nutritional Education in programs and public health policies, especially focusing on the childrens first thousand days, in order to expand its benefits to the entire population.

Authors' contribution

Candido AC: design, analysis, interpretation of the data, writing of the article, and all aspects of the work to ensure accuracy and completeness. Oliveira FCC: analysis and interpretation of the data, critically reviewing the paper. The authors approved the final version of the article and declare no conflicts of the interest.

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