

Intervention strategies in public schools for the prevention of anemia and improvement of the nutritional status of children and adolescents: a literature review

Estratégias de intervenção em escolas públicas para a prevenção da anemia e melhoria do estado nutricional de crianças e adolescentes: uma revisão de literatura

Estrategias de intervención en escuelas públicas para la prevención de la anemia y la mejora del estado nutricional de niños y adolescentes: una revisión de la literatura

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Abstract:

Introduction: Iron deficiency anemia and nutritional deficiencies are significant public health problems, especially among children and adolescents, due to the high nutritional demands inherent in growth and development. In Brazil, iron deficiency anemia is the most common form of anemia, significantly affecting vulnerable groups and compromising physical, cognitive, and immunological development. In this context, the school stands out as a strategic space for health promotion, through the provision of adequate food and the implementation of Food and Nutrition Education (FNE) actions capable of positively influencing students' eating habits. **Objective:** This study aims to examine, based on scientific evidence, the main school intervention actions aimed at preventing anemia and improving the nutritional conditions of children and adolescents, considering their importance, applicability, and impacts on public health. **Methodology:** This is an integrative literature review, descriptive and exploratory in nature, conducted to answer the guiding question: What strategies can be implemented in the school environment to prevent anemia and improve the nutritional status of children and adolescents? The search was conducted in the databases PEER REVIEW, Scientific Electronic Library Online (SciELO), Journal of Nutritional Science (JNS), Cium, Health and Research (SAUD PESQ), and Human Nutrition & Metabolism (Hum. Nutr. Metab.). Original articles published between 2022 and 2025, in Portuguese and English, were included, resulting in the selection of six primary studies. **Results and Discussion:** The results showed that interventions based on food fortification, such as the provision of iron-enriched juices and biscuits, significantly increased hemoglobin levels and reduced the prevalence of anemia among preschoolers. Furthermore, nutritional education and dietary counseling programs demonstrated a positive impact on knowledge about healthy eating, micronutrient intake, and the prevention of nutritional deficiencies. However, the studies also pointed to challenges related to teacher training, the cross-cutting implementation of nutrition education, and the weak articulation between the health and education sectors. It was also observed that there are differences between strategies based on nutritional supplementation and approaches that prioritize the appreciation of natural foods and educational practices. **Conclusion:** School interventions are effective in preventing iron-deficiency anemia and promoting adequate nutritional status, especially when they combine dietary, educational, and intersectoral strategies. However, the effectiveness of these actions depends on the integration between health and education, the active participation of teachers, and the strengthening of public policies that guarantee the promotion of healthy eating habits in a continuous and sustainable way.

Keywords:

Iron-deficiency anemia; Nutritional status; School health; Food and nutrition education; Children and adolescents.

Resumo:

Introdução: A anemia ferropriva e as deficiências nutricionais configuram-se como importantes problemas de saúde pública, especialmente entre crianças e adolescentes, devido às elevadas demandas nutricionais inerentes ao crescimento e desenvolvimento. No Brasil, a anemia ferropriva representa a principal forma de anemia, afetando significativamente grupos vulneráveis e comprometendo o desenvolvimento físico, cognitivo e imunológico. Nesse contexto, a escola destaca-se como espaço estratégico para a promoção da saúde, por meio da oferta de alimentação adequada e da implementação de ações de Educação Alimentar e Nutricional (EAN), capazes de influenciar positivamente os hábitos alimentares dos estudantes. **Objetivo:** O presente estudo objetiva examinar, a partir de evidências científicas, as principais ações interventivas escolares voltadas à prevenção da anemia e à melhoria das condições nutricionais de crianças e adolescentes, considerando sua importância, aplicabilidade e impactos na saúde pública. **Metodologia:** Trata-se de uma revisão integrativa da literatura, de natureza descritiva e exploratória, conduzida para responder à questão norteadora: Quais estratégias podem ser implementadas no ambiente escolar para prevenir a anemia e melhorar o estado nutricional de crianças e adolescentes? A busca foi realizada nas bases PEER REVIEW, Scientific Electronic Library Online (SciELO), Journal Of Nutritional Science (JNS), Cium, Saúde E Pesquisa (SAUD PESQ) e Human Nutrition & Metabolism (Hum. Nutr. Metab.). Foram incluídos artigos originais publicados entre 2022 e 2025, nos idiomas português e inglês, resultando na seleção de seis estudos primários. **Resultados e Discussões:** Os resultados evidenciaram que intervenções baseadas na fortificação alimentar, como a oferta de sucos e biscoitos enriquecidos com ferro, promoveram aumento significativo dos níveis de hemoglobina e redução da prevalência de anemia entre pré-escolares. Além disso, programas de educação nutricional e aconselhamento alimentar demonstraram impacto positivo no conhecimento sobre alimentação saudável, na ingestão de micronutrientes e na prevenção de deficiências nutricionais. Entretanto, os estudos também apontaram desafios relacionados à capacitação dos professores, à implementação transversal da EAN e à fragilidade da articulação entre os setores da saúde e da educação. Observou-se ainda a existência de divergências entre estratégias baseadas na suplementação nutricional e abordagens que priorizam a valorização da alimentação natural e das práticas educativas. **Conclusão:** As intervenções escolares são eficazes na prevenção da anemia ferropriva e na promoção do estado nutricional adequado, especialmente quando associam estratégias alimentares, educativas e intersetoriais. Contudo, a efetividade dessas ações depende da integração entre saúde e educação, da participação ativa dos docentes e do fortalecimento de políticas públicas que garantam a promoção de hábitos alimentares saudáveis de forma contínua e sustentável.

Palavras-chave:

Anemia ferropriva; Estado nutricional; Saúde escolar; Educação alimentar e nutricional; Crianças e adolescentes.

Resumen:

La anemia ferropénica y las deficiencias nutricionales constituyen importantes problemas de salud pública, especialmente entre niños y adolescentes, debido a las elevadas demandas nutricionales inherentes al crecimiento y desarrollo. En Brasil, la anemia ferropénica representa la principal forma de anemia, afectando significativamente a grupos vulnerables y comprometiendo el desarrollo físico, cognitivo e inmunológico. En este contexto, la escuela se destaca como un espacio estratégico para la promoción de la salud, mediante la oferta de una alimentación adecuada y la implementación de acciones de Educación Alimentaria y Nutricional (EAN), capaces de influir positivamente en los hábitos alimentarios de los estudiantes. **Objetivo:** Este estudio tiene como objetivo examinar, a partir de evidencias

científicas, las principales acciones de intervención escolar dirigidas a la prevención de la anemia y a la mejora de las condiciones nutricionales de niños y adolescentes, considerando su importancia, aplicabilidad e impactos en la salud pública. Metodología: Se trata de una revisión integradora de la literatura, de carácter descriptivo y exploratorio, realizada para responder a la pregunta orientadora: ¿Qué estrategias pueden implementarse en el entorno escolar para prevenir la anemia y mejorar el estado nutricional de niños y adolescentes? La búsqueda se realizó en las bases de datos PEER REVIEW, Scientific Electronic Library Online (SciELO), Journal of Nutritional Science (JNS), Cluim, Saúde e Pesquisa (SAUD PESQ) y Human Nutrition & Metabolism (Hum. Nutr. Metab.). Se incluyeron artículos originales publicados entre 2022 y 2025, en portugués e inglés, resultando en la selección de seis estudios primarios. Resultados y discusión: Los resultados evidenciaron que las intervenciones basadas en la fortificación alimentaria, como la oferta de jugos y galletas enriquecidos con hierro, promovieron un aumento significativo de los niveles de hemoglobina y una reducción de la prevalencia de anemia entre los preescolares. Además, los programas de educación nutricional y asesoramiento alimentario demostraron un impacto positivo en el conocimiento sobre alimentación saludable, en la ingesta de micronutrientes y en la prevención de deficiencias nutricionales. Sin embargo, los estudios también señalaron desafíos relacionados con la capacitación de los docentes, la implementación transversal de la EAN y la débil articulación entre los sectores de salud y educación. También se observaron diferencias entre las estrategias basadas en la suplementación nutricional y los enfoques que priorizan la valorización de la alimentación natural y las prácticas educativas. Conclusión: Las intervenciones escolares son eficaces para prevenir la anemia ferropénica y promover un estado nutricional adecuado, especialmente cuando combinan estrategias alimentarias, educativas e intersectoriales. No obstante, la efectividad de estas acciones depende de la integración entre salud y educación, de la participación activa de los docentes y del fortalecimiento de políticas públicas que garanticen la promoción de hábitos alimentarios saludables de forma continua y sostenible.

Palabras clave:

Anemia ferropénica; Estado nutricional; Salud escolar; Educación alimentaria y nutricional; Niños y adolescentes.

INTRODUCTION

Globally and nationally, anemia and nutritional deficiencies are considered major public health problems (FAO *et al.* , 2024). Anemia affects approximately 30% of the global population, mainly women and children, according to 2023 reports from the World Health Organization (WHO). In Brazil, iron-deficiency anemia is the most prevalent, accounting for up to 90% of diagnoses, according to data from the Ministry of Health (2022). This problem severely affects vulnerable groups, impacting 20.9% of children under 5 years old and 29.4% of women of reproductive age in the country (Rosa, K. *et al.* , 2024).

According to the World Health Organization, anemia is the reduction of red blood cells (erythrocytes) or hemoglobin in the blood, which compromises the transport of oxygen necessary for the body's functioning (Deivita , Y. *et al.* . 2021). Commonly caused by a deficiency of essential nutrients, such as iron (WHO, 2015), this condition acts both as a clinical

syndrome and as a laboratory alteration defined by a drop in hematocrit or hemoglobin below reference standards (Scariot, 2016).

In this context, childhood and adolescence are considered vulnerable periods due to the metabolic demands of growth (Awasthi, S. *et al.*, 2022). According to the Statute of Children and Adolescents (ECA), childhood encompasses up to 12 years of age and adolescence the age range from 12 to 18 years, stages marked by biological and psychosocial transformations that affect the nutritional status of young people (Melo, A. *et al.*, 2022). Focusing the analysis on the 0 to 14 age range, it is observed that this group experiences a significant increase in energy and essential nutrient needs, from basic tissue formation to the pubertal growth spurt, which increases the demand for iron for muscle and hematological expansion (Urbano, M. *et al.*, 2002; BRAZIL, 2022).

However, this biological fragility clashes with socioeconomic barriers, such as food insecurity and low purchasing power, which restrict access to fresh foods and induce the consumption of ultra-processed foods (Barros, V. *et al.*, 2025). As a consequence, inadequate dietary intake compromises linear growth and causes prevalent clinical manifestations, notably anemia and deficiencies in calcium, zinc, and vitamins A, D, and B complex (Awasthi, S. *et al.*, 2022). From this perspective, continuous monitoring and the promotion of healthy habits emerge as fundamental actions.

This deficiency condition occurs when the body does not receive or is unable to absorb the amount of nutrients necessary for its basic functions, arising from a disruption in the balance between food intake and the biological capacity to utilize these elements (Kiani, A. *et al.*, 2022; Silva *et al.*, 2025). This problem, with its global impact, affects populations differently and is especially critical in childhood and adolescence, negatively impacting the physical, immunological, and cognitive functions of young people (Zhou; Li; Cai, 2025). Furthermore, it manifests itself even in contexts with sufficient caloric intake through low micronutrient intake, a phenomenon known as hidden hunger (WORLD HEALTH ORGANIZATION, 2024), which, if not properly addressed, increases the risk of long-term chronic non-communicable diseases and can leave permanent sequelae in the individual's overall health (Kiani, A. *et al.*, 2022).

The school is fundamental to the cognitive and human development of the individual; therefore, it must offer a comfortable infrastructure and, above all, adequate nutrition to ensure the fullness of learning (Regert, C. *et al.* 2022). In daily school life, experiencing a balanced diet allows students to acquire healthy habits (Santos, 2023). For this reason, Rego; Ravagnoli

; Diez -Garcia (2022) consider this environment a strategic space for educational interventions, since it directly influences the eating habits of children and their families.

Given this, the school context becomes conducive to ongoing educational initiatives.

Food and Nutrition Education (FNE), which became part of the official curriculum through Law No. 13.666/2018 (BRAZIL, 2018). One of the pillars of FNE is intersectorality, characterized by exchanges and dialogues aimed at building integrated knowledge and practices. This articulation broadens the perspectives among the various actors involved and enhances the improvement of food and quality of life (BRAZIL, 2012). Thus, the application of this strategy actively encompasses the sectors of management, pedagogy, kitchen professionals, nutritionists, and local agricultural producers (BRAZIL, 2012).

Brazilian food policies have aligned with Food and Nutritional Security since 1990 (Burlandy , 2009; Ramos; Pannelli -Martins; Santos, 2023), with the National School Feeding Program (PNAE) standing out in guaranteeing quality food and student development (BRASIL, 2009; Rafacho ; Pereira, 2023). Integrated with this, Food and Nutrition Education actions strengthen primary care by preventing health problems and extending healthy habits to families (BRASIL, 2021; Ramos *et al.* , 2013; França & Carvalho, 2017). However, socioeconomic barriers and the consumption of ultra-processed foods generate nutritional deficiencies (Ribeiro, 2022; Knob; Bilibio; Santos, 2023). Therefore, it becomes crucial to investigate the effectiveness of these actions to assess whether they overcome shortcomings or actually transform the reality of the students (Vieira, M. *et al.*).

2025).

The relevance of the topic is evident in the need for systematized interventions to improve nutritional status and prevent anemia (Morais, 2023). In this sense, analyzing interventions in public schools is essential to evaluate the effectiveness of strategies for children and adolescents, supporting health professionals (BRASIL, 2022). This action is fundamental in the early identification of alterations and in the development of actions based on the guidelines of the Brazilian Society of Pediatrics (2021). Furthermore, the integration between health and education favors intersectoral practices that strengthen the actions and indicators of Public Health (Regert , C. *et al.* 2022), promoting health in the school context (Santos, 2005).

Based on this premise , the present study aims to examine, from scientific evidence, the main school intervention actions aimed at preventing anemia and improving the nutritional conditions of children and adolescents, considering their importance, applicability and impacts on public health.

METHODOLOGY

This is an integrative literature review of a descriptive-exploratory nature, which aims to answer the following guiding question: "What strategies can be implemented in the school environment to prevent anemia and improve the nutritional status of children and adolescents?". The choice of this methodology is justified by the need to synthesize recent evidence that points to the school as a privileged space for educational practices, involving playful and interactive activities that promote healthy eating habits, which are essential for improving nutritional status and reducing anemia.

The theoretical basis of this work was founded on scientific evidence consulted in the following databases: PEER REVIEW , Scientific Electronic Library Online (SciELO), Journal Of Nutritional Science (JNS), Cluim , Health and Research (SAUD PESQ) and Human Nutrition & Metabolism Hum. Nutrition. Metab .)

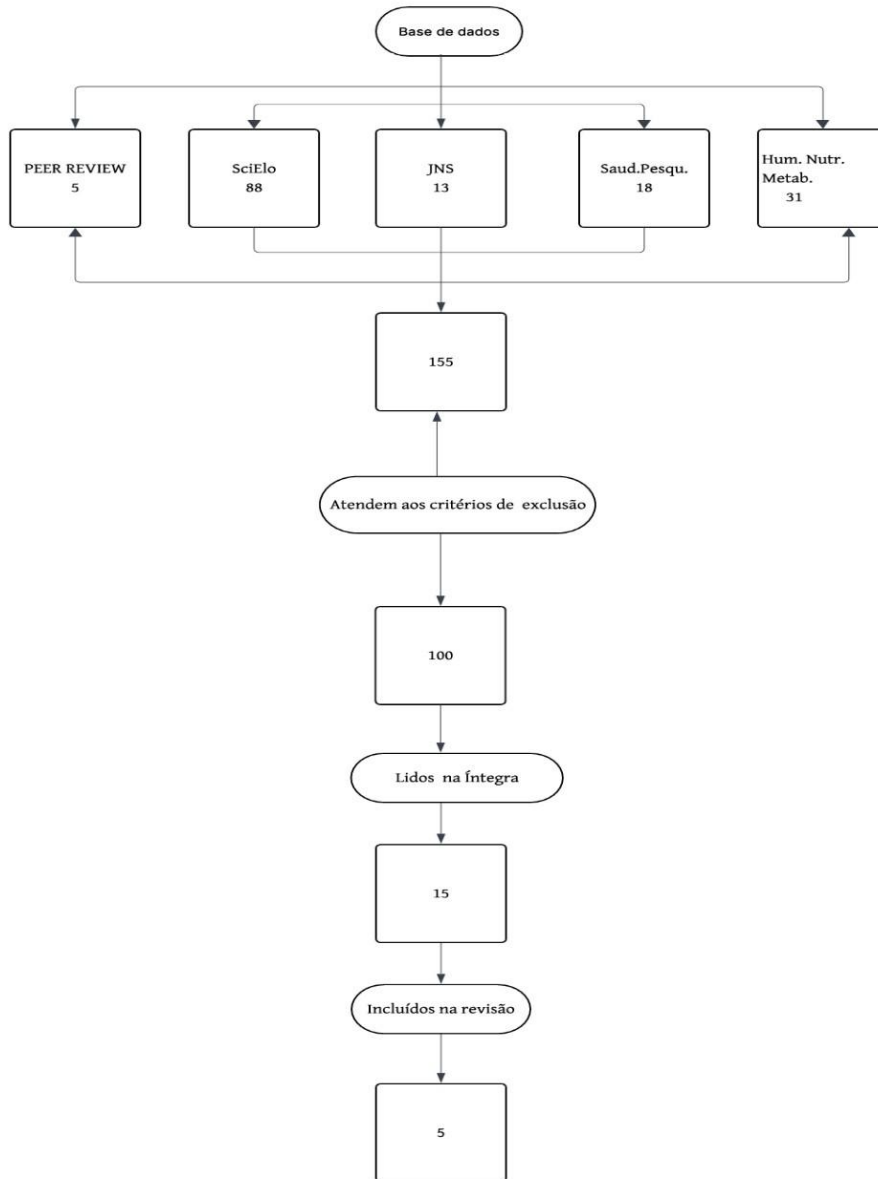
DeCS and MeSH were used : Anemia, Nutritional Status, School Health, Nutrition Education and Intervention Studies . In order to broaden the search for studies in the databases, the keywords used were in English. The search strategy was structured by combining these terms with the Boolean operators AND and OR.

Original articles with full text available, published between 2022 and 2025 in Portuguese and English, were selected. The selection focused on studies that directly addressed nutritional intervention strategies in public school settings, with a specific focus on the prevention of iron-deficiency anemia and the assessment of the nutritional status of children and adolescents. Exclusion criteria included literature reviews, abstracts, theses, and opinion pieces. Additionally, duplicate publications across databases and studies that did not establish a direct relationship with interventions for anemia prevention in the context of public schools were excluded .

Data collection was conducted in consecutive stages. Initially, a search was performed in databases using specific descriptors (anemia, children, adolescents, nutritional intervention). The initial screening consisted of reading titles and abstracts, selecting studies that met the inclusion criteria. Subsequently, the selected articles were read in full, allowing for critical analysis and identification of evidence on nutritional interventions in the school setting and the role of the nutritionist in the prevention of iron deficiency anemia.

Figure 1. Flowchart of the research selected for the literature review related to this article.

ESTRATÉGIAS DE INTERVENÇÃO EM ESCOLAS PÚBLICAS PARA A PREVENÇÃO DA ANEMIA E MELHORIA DO ESTADO NUTRICIONAL DE CRIANÇAS E ADOLESCENTES: UMA REVISÃO DE LITERATURA



Source: Prepared by the authors based on research data, 2026.

Table 1 summarizes the findings of the six primary articles included in this review, which are published in national and international journals, with studies conducted in Brazil, India, Australia, and Ghana. This geographical and linguistic diversity (with texts in Portuguese and English) offers a systemic view of scientific production in the field. The information is organized in a structured way, detailing authors, year of publication, study location, type of study, sample, objectives, methodology, and results.

Table 1. Summary of articles analyzed for review.

Articles	Author, year of publication, Location of study	Outline, type of study and N	Objectives of study	Methodology	Key findings
1	Moura, J. et al. 2023 Ceará, Brazil	Randomized, double-blind, controlled clinical trial. N=110 children enrolled in day-care centers selected, old between 36 and 48 months.	To evaluate the effectiveness of iron-fortified juice in the prevention and treatment of iron-deficiency anemia in pre-school children.	This study involved a quantitative experimental approach with the collection of biochemical data using a portable hemoglobinometer and statistical analysis. Student's t-test and Fisher's exact test were applied to evaluate the outcomes. The practical action consisted of introducing a beverage enriched with microencapsulated ferrous sulfate into the school menu—a technology that prevents flavor alteration—and the control strategy was based on the strict division of participants into two groups: Group A The intervention group (experimental) consumed the juice with the exact dose of the mineral, while the control group received the regular juice routinely offered by the municipality.	The study demonstrated that the use of juice fortified with 15 mg of elemental iron for 16 weeks was a highly effective intervention to combat social and nutritional vulnerability in children (school/pre-school) in the public education system. As a result, there was a significant increase in hemoglobin (p=0.0314) and a 100% cure rate among anemic children in the supplemented group, proving to be a viable, low-cost solution with good adherence for the school environment.
2	Rathi, N. et al. 2024 India / Australia	Study Qualitative. N = 39 adolescents, 19 girls and 20 boys.	To investigate the perceptions of Indian adolescents, both boys and girls, regarding anemia and the Anemia Surveillance Program (AMB).	From a socio-constructivist perspective, this qualitative study used interviews to explore adolescents' perceptions and experiences regarding anemia and their prevention strategies.	A high prevalence of anemia (>50%) was identified, with a predominance of moderate cases. (33.3%). Qualitative findings revealed critical gaps in adolescents' knowledge about symptoms and prevention, as well as insufficient educational and professional support. Interventions should prioritize nutritional education and...
					Improving culinary practices to address the information and clinical deficit.

3	<p>Parente.K. <i>et al.</i> 2024</p> <p>Ceará, Brazil</p>	<p>Randomized, controlled, double-blind clinical trial.</p> <p>N = 144 children.</p>	<p>Evaluate the biscuit of a with fortified iron for prevention and treatment from anemia in preschool children.</p>	<p>The approach included the application of Fisher's exact test and Student's test, combined with data collection through two hemoglobin assessments via capillary blood puncture on the lateral aspect of the finger with a portable hemoglobinometer, in addition to the completion of a sociodemographic and nutritional questionnaire by the parents.</p> <p>This study, conducted with preschool children enrolled in a public Early Childhood Education Center (CEI), evaluated the impact of introducing two artisanal biscuits into the school lunch: "Maria" biscuits fortified with chelated iron, totaling an intake of 40 mg of elemental iron per week for 16 weeks. To validate the effectiveness of the intervention, the classrooms were divided into the Intervention Group, which consumed the fortified food, and the Non-Intervention Group.</p> <p>The control group received the same biscuit, but without the added iron.</p>	<p>At the end of the period, the findings indicated a reduction in the prevalence of anemia and significant variations in hemoglobin concentration among the groups evaluated.</p>
4	<p>Ferreira, L. <i>et al.</i> 2025</p> <p>São Paulo, Rio Grande do Norte, Brasil</p>	<p>Mixed and Cross-Sectional Study.</p> <p>N=85 teachers.</p>	<p>To investigate the perception of the importance and application of food and nutrition education by public school teachers from the city of Field Redondo/RN</p>	<p>qualitative -quantitative) study employed a virtual questionnaire composed of objective and subjective questions. Quantitative data analysis was performed using descriptive statistics, while qualitative data analysis was conducted using Bardin's content analysis technique with peer validation.</p>	<p>The study shows that, although teachers recognize the importance of Food and Nutrition Education (FNE) for students' health, they report a lack of technical preparation to address the topic in depth, limiting their practices to a strictly biological and hygienic view that ignores sociocultural and historical factors of food. Therefore, the research concludes that continuing education initiatives are urgently needed.</p>

					To equip teachers, enabling the cross-curricular, critical, and contextualized inclusion of the topic in the school curriculum.
5	Wiafe ; Apprey ; Annan. 2022 Ghana	Clinical Trial Randomized Controlled Trial (RCT). N= 122 teenagers	To assess the impact of nutritional education and counseling on nutritional status and anemia among young adolescents.	The statistical tests ANOVA and Student 's t-test were applied , combined with data collection through two biochemical assessments via venous blood collection for analysis of hemoglobin, ferritin, and C-reactive protein , in addition to the application of structured sociodemographic questionnaires, nutritional knowledge questionnaires, 24-hour dietary recalls, and weight and height measurements.	A significant reduction in the prevalence of anemia and a marked improvement in hemoglobin levels were observed among adolescents in the intervention group, resulting from the intervention strategy based on a nutritional education and counseling program over six months. These findings also included a considerable increase in daily iron and vitamin C intake, while the control group showed no statistically relevant changes at the end of the period.

Source: Prepared by the authors based on research data (2026).

RESULTS AND DISCUSSION

Regarding the methodological profile of the analyzed research, the sample consists of five studies with distinct designs: two double-blind randomized clinical trials, one randomized clinical trial, one with a qualitative approach, and one mixed-methods cross-sectional study. This body of work forms the basis for the discussion on anemia prevention strategies and interventions aimed at improving the nutritional status of children and adolescents.

The Brazilian and international studies present distinct, yet complementary, perspectives on iron deficiency anemia, contrasting a clinical-quantitative approach of direct fortification with a qualitative socio-educational assessment (Moura, J. *et al* ., 2023; Rathi , N. *et al* ., 2024). While the national research focuses on the effectiveness and acceptance of institutional interventions in preschoolers, the foreign study highlights behavioral barriers and the need for

informational autonomy among young people, integrating biological and educational actions in the fight against iron deficiency.

When analyzing the scope of public health in Ceará, a strong methodological connection is observed between the investigations of Moura, J. *et al.* (2023) and Parente, K. *et al.* (2024) regarding the tackling of iron-deficiency anemia in daycare centers. Linked to the same research center at the Federal University of Ceará (UFC), both studies tested the impact of food fortification with ferrous sulfate in preschoolers, differing primarily in the matrix used. While the study by Moura, J. *et al.* (2023) evaluated the feasibility of using juices (liquid route), the subsequent research by Parente, K. *et al.* (2024) expanded the strategy to a solid matrix, using fortified biscuits. This methodological transition was based on the previous findings of 2023, consolidating a robust line of evidence that allows for comparison of the acceptability, school adherence, and clinical efficacy of different food vehicles in the pedagogical routine.

In a randomized controlled clinical trial conducted in Asante Akim South, Ghana, Wiafe, Apprey, and Annan (2022) observed that ongoing nutritional education and counseling significantly contributed to reducing the prevalence of anemia and improving iron stores in adolescents. Research indicates that increased dietary knowledge is associated with the consolidation of food choices rich in micronutrients and elevated serum ferritin levels, highlighting educational intervention as a protective factor against nutritional deficiencies in developing nations.

Sertão, D. *et al.* (2025) presents an experience report developed in Jequié (BA), in which Food and Nutrition Education (FNE) was applied as a central tool for health promotion. The study demonstrates that practical and educational activities aimed at children and adolescents function as disease prevention strategies, reinforcing the role of the school environment in the formation of healthy habits. Although this work was not methodologically included in the review because it is not a primary study, its practical approach serves as an ideal counterpoint to theoretical investigations.

It is precisely at this point of intersection that The article by Ferreira *et al.* (2025) and the experience report on Food and Nutrition Education (FNE) in schools complement each other, as they address health promotion and disease prevention in childhood and adolescence within the public education system. While the first investigates the theoretical and pedagogical dimension by analyzing the perceptions and challenges faced by teachers in implementing FNE, the second materializes this discussion by describing the direct practices and interventions carried out with students in daily school life. Thus, the union of the two works enriches academic research, as the empirical study on the teachers' perspective provides the necessary



foundation to understand the limitations and potential of the practical actions reported in the field experience.

Findings such as those by Wiafe ; Apprey ; Annan (2022) obtained in the municipality of Asante Studies in Akim South, Ghana, reinforce the importance of nutritional education, but need to be carefully evaluated due to some limitations of the study. First, the information about what the young people ate depended on their own testimony, meaning there is a risk they may have forgotten something or only said what the researchers wanted to hear. Second, the fact that the research only took place in that specific location means that the results may not reflect the reality of other regions of the country. Finally, the follow-up period was short, not guaranteeing that the adolescents will maintain these healthy habits in the future, especially in the face of financial difficulties or food shortages in the community.

The overall objective of this research, focused on examining school-based intervention actions for the prevention of anemia and nutritional improvement, finds a direct answer in the analyzed results, which validate the school as the ideal strategic space for the articulation between public health and education. Based on the available scientific evidence, the purpose of evaluating the relevance and impact of these actions is fulfilled, since the clinical-epidemiological data quantify the severity of hidden hunger and iron and calcium deficiencies, justifying the urgency of continuous institutional interventions.

Additionally, examining the practical applicability of these measures reveals that the provision of balanced meals through programs such as the National School Feeding Program (PNAE) acts as an effective protective factor in reducing ultra-processed foods, while dynamic Food and Nutrition Education (FNE) strategies ensure the behavioral sustainability of the process. Thus, by connecting the biological outcome to structured public policies, the discussion fully achieves its intended scope, consolidating the school environment as an indispensable tool for equity and real transformation in the field of public health.

CONCLUSION

The findings of this integrative review confirm that interventions in the school environment are effective and indispensable for the prevention of iron-deficiency anemia and for improving the nutritional status of children and adolescents. The clinical-epidemiological data analyzed demonstrate the positive impact of biological and institutional strategies, such as direct food fortification and the provision of balanced meals by the National School Feeding Program (PNAE), which act as protective factors against hidden hunger and the consumption

of ultra-processed foods. Furthermore, it is found that the sustainability of these measures depends on continuous Food and Nutrition Education (FNE) actions, which transform dietary knowledge into healthy and protective choices in daily school life.

However, for such interventions to achieve an emancipatory and lasting character, they need to overcome biomedical reductionism and the verticalization of public health policies. Evidence demonstrates the urgent need to ensure that fortification and supplementation strategies directly engage with the Political-Pedagogical Project (PPP) of each institution. This implies promoting effective intersectorality between the fields of Health and Education, ensuring the active inclusion of faculty in institutional planning. Without the participation and appreciation of the teaching staff, actions that should be educational risk becoming merely welfare-oriented, short-sighted, and overburdening for the pedagogical routine.

Given the evidence analyzed, the critical relevance of this topic lies in the fact that combating childhood and adolescent anemia cannot be treated as a purely physiological or isolated problem, requiring that public schools be recognized as political and pedagogical agents of social transformation and equity. Promoting health in childhood and adolescence must connect biological outcomes to guaranteeing the right to real and authentic food, strengthening the informational autonomy of young people and sustainably modifying the behavioral and nutritional profile of future generations.

However, the scientific literature on the practical applicability of these measures still presents important limitations that need to be overcome. As perspectives for future research in the scientific field, the development of longitudinal studies with prolonged follow-up and investigations that present greater regional diversity is recommended. These new studies should focus on evaluating the real long-term impact and the replicability of these combined interventions, uniting clinical and pedagogical approaches, in different realities and socioeconomic contexts of the country.

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