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REVIEW ARTICLE

The impact of vegetarianism on the growth and development of children between 0 and 2 years of age

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Abstract

This work is an integrative review of the literature seeking to investigate the impacts of a vegetarian diet on children from birth to two years of age. Vegetarianism is growing with each passing day, and health professionals are not prepared to meet the needs and demands of this pediatric population, given the lack of research carried out on the subject. In the last 10 years, vegetarianism has grown in Western societies, it is estimated that the number of vegans has grown by 350% in the last decade. However, scientific work and medical knowledge regarding the nutrition of the pediatric population with this eating habit are still scarce, and it is necessary to study the peculiarities of this diet so that we can provide better assistance to our patients. The research was based on the results found, carried out in November 2023, which showed that the adoption of a vegetarian dietary pattern can meet caloric and macronutrient needs even during periods of great importance for growth and development in childhood, even though the diet Vegetarian food, in general, offers nutrients in smaller quantities and bioavailability and continuous attention is recommended when planning your diet to avoid such nutritional deficits.

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INTRODUCTION

The adoption of vegetarianism is growing rapidly in Western societies. Estimates show that the number of vegans has increased by 350% in the past decade. However, scientific studies and medical understanding regarding the nutrition of pediatric populations following these dietary habits remain limited. Examining the specifics of these diets is essential to providing better care for our patients[1].

In this article, the terms vegetarianism, vegetarian, vegetarian diet, and vegetarian nutrition refer to individuals who do not eat meat or meat products. The term strict vegetarianism will be employed when discussing those who do not consume any food of animal origin (such as dairy products and eggs). Adherence to this movement is growing, and the reasons individuals choose to follow it are diverse. Therefore, this article aims to conduct a literature review, focusing on the impact of vegetarianism on the growth and development of children during early childhood, from birth to two years of age.

MATERIAL AND METHODS

A broad search was conducted in the medical literature, extracting information from national and international literature published between 2000 and 2023. The databases used for this systematic review included the Electronic Library Online (SciELO), Latin American and Caribbean Literature in Health Sciences (LILACS), PubMed, and Google Scholar. The descriptors utilized were "childhood vegetarianism." Data collection began with the preselection of articles based on the descriptors. The articles that focused on the topic of interest were selected. We excluded those that discussed pregnancy, adolescence, or adulthood or those that did not highlight the impacts of vegetarianism during childhood.

RESULTS AND DISCUSSION

The search produced 22 articles that were used to compile this literature review.

Vegetarianism is a dietary choice, and individuals who eat meat are not categorized as vegetarians[2].

A study conducted by the Economic and Social Research Institute (ESRI) in Ireland and published in 2010 estimates that 22% of the world's population is vegetarian. However, the authors indicate that, among these, 95% are considered vegetarians out of necessity due to low purchasing power, while only 5% are vegetarians by choice. The study reports that the proportion of vegetarians declines sharply when the average income reaches US$15,000 per person per year. This study was based on surveys of family budgets, expenses, and living standards in 29 countries. In the sample, the prevalence of vegetarians was 18%[3,4].

According to the Vegetarian Diet Guide for Adults from the Brazilian Vegetarian Society (SVB), "[...] a vegetarian is defined as someone who excludes all types of meat, poultry, fish, and their byproducts from their diet, and may or may not consume dairy products or eggs." The following classification, based on the consumption of animal byproducts, originates from this definition (Table 1):

- A lacto-ovo vegetarian includes eggs, milk, and dairy products in their diet but excludes all types of meat.
- A lacto-vegetarian does not eat eggs or meat but includes milk and dairy products.
- An ovo-vegetarian is a vegetarian who does not eat dairy products or meat but does consume eggs and egg-containing products.
- A strict vegetarian is a person who eats no foods of animal origin, not even honey[2,4,5].

The reasons reported by vegetarians and vegans for adopting this diet are varied, encompassing ethical, moral, religious, health, animal welfare, environmental concerns, economic factors, and world hunger, among others. In Brazil, according to IBOPE data published in April 2018, 14% of the population identifies as vegetarian, representing nearly 30 million people. The survey included 2,002 individuals over 16 from 142 Brazilian cities. In the metropolitan areas of São Paulo, Curitiba, Recife, and Rio de Janeiro, the prevalence of vegetarians increases to 16%. The 2018 survey indicates a 75% increase compared to the 2012 survey, which reported that the percentage of the Brazilian population in metropolitan regions identifying as vegetarian was 8%[1,6].

Pediatric nutrition during the early years of life, beginning at birth, has lasting impacts throughout an individual's life. The childhood period is particularly susceptible

Table 1. Variations of vegetarianism and their characteristics.

Variations of vegetarianism	Permitted animal-origin products	Banned animal-origin products
Ovo-lacto vegetarian	Eggs, milk, and their byproducts	Meat
Lacto-vegetarian	Milk and dairy products	Meat and eggs
Ovo-vegetarian	Eggs	Mewat, eggs, and their byproducts
Strict vegetarian/vegan	None	Meat, eggs, milk, and their byproducts

Source: Adapted from the Brazilian Vegetarian Society (2021).

to changes in nutritional status, which can have adverse short- and long-term effects on health. Preventing these changes through careful dietary planning that ensures an appropriate supply of macronutrients and micronutrients for each age group is the best approach to maintaining good nutritional status and health throughout life. Therefore, when following a diet that includes restrictions, it is always wise to stay attentive[1,2].

From birth to six months of age

Breast milk is considered a complete food and the best source of infant nutrition, providing all the necessary nutrients during the first months of life. Its unique composition meets the requirements to promote healthy growth and development in children, as long as the mother maintains an adequate nutritional status and a varied diet. The WHO and the Brazilian Ministry of Health recommend exclusive breastfeeding for six months, followed by complementary breastfeeding until two years or beyond. They emphasize that breastfeeding is much more than simply nourishing the child; it involves a deep interaction between mother and child, affecting the child's nutritional status, immunity against infections, physiology, and cognitive and emotional development. It also has implications for the mother's physical and mental health[5,7,8].

Breastfeeding should always be encouraged, as there are no significant differences in the composition of milk produced by vegetarian and non-vegetarian mothers. Their milk's caloric and protein content is similar, with slight variations due to the individual factors mentioned earlier. The primary nutrients that can be affected by the mother's diet, whether she is vegetarian or not, are vitamins A, D, E, K, C, and the B complex[4,9].

Vitamin D levels are linked to maternal nutrient intake and sun exposure. However, since there is no consensus on the risks and benefits of sun exposure, the Brazilian Society of Pediatrics and the American Academy of Pediatrics recommend vitamin D supplementation from birth for all children, regardless of their vegetarian status, as previously discussed. Currently, the only vitamin D supplements available for infants contain cholecalciferol (vitamin D3), derived from sheep's wool lanolin, and are not a strict vegetarian product, though it is acceptable for vegetarians. Suppose a family chooses not to administer vitamin D3 in drops. Studies indicate that the mother should be supplemented with high-dose ergocalciferol (vitamin D) from fungal sources: approximately 2,000 IU daily or 60,000 IU monthly for three months. Calcium, iron, and zinc levels are adequate in human milk and do not vary with the mother's diet. Supplementation is only recommended for iron starting at the third month of life due to the high incidence of deficiency of this nutrient. For premature infants, supplementation with vitamins A, C, and D is advised starting at 10 days of life, iron from 30 days, and zinc from 36 weeks of corrected age. If exclusive breastfeeding is not feasible, or if there are contraindications to breastfeeding, commercial infant formulas should be used [9,10,11,12].

According to the Brazilian Society of Pediatrics and the guide from the Brazilian Vegetarian Society titled "Food for Vegetarian Babies and Children: Up to Two Years of Age," the recommendations for infants who cannot be breastfed or whose parents wish to provide a non-dairy formula include solutions based on hydrolyzed rice protein or isolated soy protein for children over six months of age. The Food Guide for Brazilian children under 2 years old, issued by the Brazilian Ministry of Health, does not offer recommendations for vegetarian parents who cannot breastfeed their child, with the general suggestion being to use the available infant formulas on the market[10,11,13].

Growth is a dynamic and continuous process from conception to the end of life, characterized by increased body size and the replacement and regeneration of tissues and organs. It is regarded as one of the best indicators of a child's health due to its association with intrinsic (genetic) and extrinsic (environmental) factors, including diet, incidence of diseases, general care, and hygiene. Thus, monitoring weight gain enables identifying children at a higher risk of mortality through early warning signs of malnutrition, helping to prevent growth deviations that could jeopardize their current health and future quality of life. The concept of development is broad and refers to a complex, continuous, dynamic, and progressive change encompassing growth, maturation, learning, and psychological and social aspects. The characteristics of the individual, such as their ways of acting, thinking, feeling, and values, depend on their interactions with the social environment in which they live[14,15,16].

Monitoring child development in primary care aims to promote, protect, and identify early changes that can be modified and may impact their future lives. This primarily takes place through educational initiatives and comprehensive health assessments. Children must progress through each stage in a regular sequence, reflecting sequential cognitive development stages that indicate the maturation of the central nervous system. However, providing environmental stimuli that elicit responses and allow children to acquire and enhance functional skills is essential. These stimuli are crucial for adequately nurturing the child's potential[16,17].

From six months to two years of age

Every child starts life as a vegetarian because, during the first six months, their diet consists of breast milk or adapted formulas when exclusive breastfeeding is not feasible. After this initial period, complementary foods are introduced to meet the child's energy and nutritional needs while transitioning from exclusive breastfeeding to family nutrition. Consequently, meat is introduced during the second six months

of life. The appropriateness of a vegetarian diet for children has been debated, even though it offers health benefits for adults. When well-planned, these dietary styles are suitable for every stage of life[17].

Research indicates that a plant-based diet reduces the risk of mental illnesses, such as depression, hypertension, and diabetes. When transitioning to a vegetarian diet and encouraging your child to adopt this eating habit, seeking guidance from a nutritionist is crucial to prevent nutritional deficiencies. Choosing healthy foods and considering certain supplements may be advisable, depending on each child's needs. During childhood, eating habits are developing and are strongly influenced by food choices, especially those made by the family. Caregivers need to provide a healthy diet for the child, as consuming an inadequate diet during this stage can increase the risk of chronic degenerative diseases later in adulthood[2,18].

The supplementation offered to vegetarian children is similar to that provided to non-vegetarians, except for vitamin B12. The success of children's nutrition lies in dietary diversification. A well-planned vegetarian diet can suit the child from birth. Special attention should be paid to a family history of food allergies so that foods with potential allergens can be introduced at the correct time[19,20].

The American Academy of Nutrition and Dietetics believes that introducing a vegetarian diet can benefit children. In contrast, the American Academy of Pediatrics does not recommend a vegetarian diet during childhood. Their main concern revolves around potential nutritional deficiencies that children following this diet may experience, such as low energy due to lower caloric intake, reduced nutrient absorption caused by typically high fiber intake, which can hinder absorption, and deficiencies in cyanocobalamin and vitamin B12, which can directly impact the nervous system. However, there are recommendations to address possible deficiencies from a vegetarian diet, which can be remedied with a balanced diet and supplementation of vitamins and minerals[19,20,21,22].

In evaluating nutritional aspects, it was observed that a balanced vegetarian diet can support adequate growth and development. However, certain elements require special attention, such as vitamin B12, omega-3 fatty acids, and ferritin levels. Other nutrients, including calcium and vitamin D, are also essential, but their intake and replacement recommendations are similar to those for the general population. Regarding anthropometry, vegetarians demonstrate adequate growth, despite a tendency for lower weight and height, all within reference values. Equally important, we assessed the specific needs of vegetarian infants concerning breastfeeding, formula use, and the introduction of solid foods. Health professionals must be prepared and qualified to guide and support families choosing this dietary option. Therefore, increasing research and investing in training on this topic in universities and medical residency programs is crucial[1,22,23].

An important aspect to monitor is BMI, which may show lower values in vegetarian children despite staying within the normal range. Additionally, there are reports of caloric intake falling below the recommended level in cases of limited diversification and poor dietary execution. This underscores the urgent need to plan and oversee the diets of vegan and vegetarian children to avoid nutritional deficiencies and growth delays. Because of these concerns, anthropometric data should be monitored periodically for early intervention in case of deviations from normality[23].

FINAL CONSIDERATIONS

A vegetarian diet can adequately meet the recommended calorie and macronutrient intake requirements for children in a high-quality manner. Vitamin B12 supplementation is essential for strict vegetarians and should be regularly assessed in all vegetarians. While vegetarians demonstrate proper growth, they tend to have lower weight and height. Several critical parameters must be evaluated in vegetarian infants, including breastfeeding, formula use, and the introduction of solid foods. Health professionals must be prepared and trained to guide and support families who choose vegetarianism. Further research and courses at universities and medical residency programs are crucial. We should ensure child development through educational actions and comprehensive monitoring of health. Environmental stimuli are necessary to elicit children's responses and help them acquire and enhance functional skills. These stimuli are vital for the appropriate development of their potential. Therefore, developing a nutrition monitoring plan and relying on the support of health professionals and caregivers is essential to prevent dietary deficiencies and minimize adverse effects on nutrient metabolism. Additionally, promoting the consumption of fortified foods and elements that aid in absorbing other nutrients, such as vitamin C, which helps absorb iron from plant sources, is vital to ensure that children raised in vegetarian families do not experience developmental or growth issues.

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