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Position paper on vegetarian diets in infants and children. Committee on Nutrition and Breastfeeding of the Spanish Paediatric Association☆

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KEYWORDS
Vegetarian diet;
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Abstract In the last few years, there are an increased number of families following a vegetarian diet, including their children. In order to guarantee child heath, paediatricians need to know the characteristics of this diet and the main foods that are used.

There are few data on the medium and long-term health outcomes when removing all animal foods from the child's diet, especially at younger ages. Nevertheless, new tools have recently become available to facilitate following a vegetarian diet and decreasing the risk of deficiencies.

In this document, the group of foods commonly used in vegetarian diets are reviewed, as well as recommendations for each age group. It also mentions the need to use B_{12} supplements at all ages, as well as other nutrients (iodine, iron, vitamin D_3, poly-unsaturated fatty acid n-3), when required.

A vegetarian or a vegan diet, as in any other kind of diet, needs to be carefully designed. After reviewing current evidence, even though following a vegetarian diet at any age does not necessarily mean it is unsafe, it is advisable for infant and young children to follow an omnivorous diet or, at least, an ovo-lacto-vegetarian diet.

PALABRAS CLAVE
Dieta vegetariana;
Vegano;
Vitamina B_{12};
Lactante;
Niño

Recomendaciones del Comité de Nutrición y Lactancia Materna de la Asociación Española de Pediatría sobre las dietas vegetarianas

Resumen En los últimos años ha aumentado el número de personas que optan por una dieta vegetariana y que incluyen a sus hijos en esta opción de alimentación. Esto obliga a los pediatras a conocer sus características principales y la composición de los alimentos usados más comúnmente, con el fin de garantizar la salud de los niños.

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[1] Appendix Alists the names of all the authors of the article.

Existe una escasez de datos sobre el impacto a medio y largo de eliminar los productos de origen animal en la dieta de los niños, en especial en la de los más pequeños. Sin embargo, en los últimos años se han publicado herramientas (tablas de intercambios de alimentos, recomendaciones de suplementación) que facilitan el cumplimiento de una dieta vegetariana disminuyendo el riesgo de deficiencias.

En este documento se revisan los grupos de alimentos que habitualmente forman parte de la dieta vegetariana, así como las recomendaciones para cada grupo de edad. Se señala también la necesidad de utilizar suplementos de vitamina B_{12} en todas las edades, y en aquellos otros nutrientes (yodo, hierro, vitamina D_3, ácidos grasos polinsaturados n-3) en riesgo de deficiencia.

Una alimentación vegetariana o vegana, como cualquier otro tipo de alimentación, debe estar bien planificada. A la luz de la evidencia disponible, a pesar de que seguir una dieta vegetariana en cualquier etapa de la infancia no signifique necesariamente que sea insegura, es preferible aconsejar que durante el periodo de lactante y en el niño de corta edad se siga una dieta omnívora o, al menos, ovo o lactovegetariana.

Introduction

Human beings are omnivores that take advantage of an abundance of resources to maintain a complete and balanced diet. In recent years, there has been an increase in the number of individuals that choose to follow a vegetarian diet and who include their children in this choice. The members of the Committee on Nutrition and Breastfeeding of the Asociación Española de Pediatría (Spanish Association of Pediatrics, AEP) considered that it would be useful to develop recommendations in case a vegetarian diet is chosen for or by individuals in the paediatric age group.

Definition of vegetarian diet and current perspective

Vegetarian diets are those that exclude meats and meat products (including fowl) and fish (including shellfish and their derivatives). There are different types of vegetarian diets, depending on whether they include eggs or dairy (ovo- or lacto-vegetarian diet) or exclude all animal-derived products, including honey (vegan diet).[1]

The estimated prevalence of vegetarian diets in Europe ranges from 1.2% to 1.5% of the population in Portugal and Spain to up to 7% in the United Kingdom and 10% in Germany, although the proportion of vegans is substantially lower (1–3%). Although there are no official data in Spain, in recent years there has been a growing number of families adopting vegetarian or vegan diets, and therefore of children and adolescents consuming these diets. As a consequence, health care providers need to be knowledgeable of the main characteristics of these diets and the foods most commonly consumed in them.[2]

The reasons why families choose to follow vegetarian diets are diverse; in most cases it is due to ethical or ecological reasons, and less frequently due to health reasons. In adolescents, it may be difficult to determine whether they are following such a diet for any of those reasons or with the aim of restricting their energy intake.[3]

Safety of vegetarian diets

Some nutrition societies have published recommendations or guidelines for the consumption of vegetarian diets, although no paediatric societies have published such documents to guide their consumption by children, probably due to the scarcity of evidence on the impact of eliminating animal products from their diet, especially in very young children.[4]

The European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) specifies that it is necessary to guarantee adequate nutrient intake in case of a vegetarian or vegan diet, especially as restrictions in the diet increase. The consequences of not receiving the necessary supplementation can be dire.[5] In recent years, there have been several reports of infants or young children that followed a vegetarian diet after weaning being hospitalised due to nutrient deficiencies, which has sparked considerable public controversy both in Europe and in the United States.

The Academy of Nutrition and Dietetics of the United States considers that as long as they are properly planned, these diets can be adequate for all age groups, including children and adolescents.[1] Studies in children and adolescents consuming these diets have shown that their growth and development are within the normal range,[6] although there is a tendency toward a lower body mass index.[7] A poorly planned vegetarian diet, as is the case of any imbalanced diet, can have a deleterious impact on health and growth.[8]

Vegetarian diets are rich in fibre, magnesium, ferric iron, folic acid, vitamin C and vitamin D, omega-6 polyunsaturated fatty acids, carotenoids, flavonoids and other phytochemicals and antioxidants. They are lower in total fat, omega-3 polyunsaturated fatty acids, cholesterol, iodine, zinc, ferrous iron and vitamins B_{12} and D.[9] The mean

Table 1 Nutrients that vegetarian and vegan diets may be deficient in.

Diet	Vitamin A	Vitamin B_2	Vitamin B_{12}	Vitamin D	Iron	Zinc	Calcium	ω-3 (DHA)
Vegetarian								×
Ovo-vegetarian			×	×	×	×	×	×
Lacto-vegetarian				×	×	×		×
Ovo-lacto-vegetarian				×	×	×		×
Vegan	×	×	×	×	×	×	×	×

DHA, docosahexaenoic acid.

energy and protein intake in these diets meet recommendations, with adequate proportions of macronutrients and fibre.[10,11] The risk of deficiencies is greater in more restrictive diets, especially the vegan diet (Table 1).

Vegetarian children tend to consume more fruits and vegetables and fewer sweets and salty snacks, overall fat and saturated fat, but they are at risk of consuming excessive amounts of certain foods with low nutrient densities. Some studies have found that consumption of a balanced vegetarian diet in the early years of life can contribute to the establishment of healthy dietary habits for life.[12]

The recent publication of food exchange tables detailing the macronutrient and micronutrient contents of commonly consumed foods can help vegetarian families develop adequate meal plans.[2,13–15] In addition, all vegetarian and vegan individuals should regularly consume reliable sources of vitamin B_{12}, either in the form of fortified foods or supplements, and in many instances, of vitamin D as well.[16]

Characteristics of the vegetarian diet

Protein

Protein requirements may be met if the diet includes a wide variety of foods from plant sources and the energy requirements are met. There is a wide variety of plant-based sources of protein, which are of different quality. Overall, the quality of protein from plant sources is inferior compared to protein from animal sources (especially milk and eggs), and therefore it is recommended that vegetarian individuals consume protein-rich foods every day (especially legumes, nuts and seeds), combining different sources of protein. Consumption of soy and its derivatives (tofu, tempeh, meat analogues) and of pseudograins such as quinoa and amaranth may contribute to achieving an adequate and balanced intake of amino acids.

A high fibre content and the presence of some antinutrients reduces the digestibility of protein in plant-based foods compared to protein from animal sources, and therefore it is important to be particularly cautious in periods of life when protein requirements increase.[2]

Iron and zinc

Although the iron content of some plant-based foods may be high, its bioavailability is lower due to the high phytate content of plants and because iron is found in the non-heme form. The situation is similar when it comes to zinc. Some authors have reported decreased levels of ferritin and zinc in the vegetarian population, although the frequency of iron deficiency anaemia is low.[17] The prevalence of iron deficiency varies widely, ranging from 4% to nearly 50%, depending on the population under study and the biomarker used to assess iron status.[18] Previous studies have not reported differences in serum zinc levels between vegetarian and omnivorous children, although lower concentrations have been found in vegetarian adolescents.[19–21] Consumption of foods rich in vitamin C in every meal is recommended to facilitate iron absorption.[22]

Iodine

Iodised salt, marine vegetables and some cereal-based foods are the best source of iodine for vegan individuals. Dairy products and egg yolks are also good sources of iodine.

Seaweed (wakame, kombu, kelp, nori, etc), which plays a prominent role in these diets, can be an important source of iodine. However, since the iodine content of seaweed varies widely, as does the arsenic content,[23,24] seaweed should be given with caution to infants and young children.

Calcium

Consumption of foods fortified with calcium and vitamin D combined with regular physical activity of appropriate intensity is important in children with either vegetarian or omnivorous diets. The bioavailability of calcium in plant-based foods is influenced by their oxalate content: the higher the oxalate content, the lower the bioavailability of calcium. Thus, spinach contains high amounts of calcium, but due to the presence of oxalates, the former is consumed in the form of calcium oxalates that have low solubility and therefore are poorly absorbed,[25] whereas the bioavailability of calcium is higher in other vegetables, including those in the cabbage family (green cabbage, broccoli rabe, Tuscan cabbage, Chinese cabbage), broccoli and bitter salad greens such as arugula or watercress.[26]

Few studies in the literature have assessed bone mass in children with vegetarian diets. Some have found an increased risk of facture in the vegan population associated with a low calcium intake.[27,28]

Vitamin D

Vitamin D deficiency is frequent in Spain in vegetarian and non-vegetarian individuals alike and depends mainly on the exposure to sunlight and the consumption of supplements and fortified foods.[29] Some cereals and dairy products are

Table 2 Vitamin B_{12} supplementation recommended for different age groups.

	Single daily dose	Weekly dose
Pregnant and lactating women	50 μg	1000 μg, twice a week
Infants and young children (≤3 years)	5 μg	250 μg, twice a week
Children aged 4–10 years	25 μg	500 μg, twice a week
Age > 10 years	50 μg	1000 μg, twice a week

fortified. However, if consumption of such fortified foods does not guarantee an optimal intake, supplementation should be considered, as it is in the general population.[30]

Omega-3 fatty acids

Consumption of monounsaturated and polyunsaturated fats containing omega-3 fatty acids, found in fish, olive oil and sunflower oil (especially the high oleic variety), soy beans and some nuts and seeds, must predominate over consumption of unsaturated fats containing omega-6 fatty acids (mid-oleic or linoleic sunflower, corn, avocado, grapeseed or cottonseed oils). Supplementation with long-chain polyunsaturated omega-3 fatty acids (docosahexaenoic acid [DHA] and eicosapentaenoic acid [EPA]) should be considered in pregnant women and breastfed infants, infants aged less than 6 months that are not breastfed and infants aged more than 6 months obtaining less than 50% of calories from breast milk. There is evidence of a lower intake of DHA and EPA in vegetarian individuals compared to the non-vegetarian population,[31,32] although the long-term effects of this difference have yet to be determined.

Vitamin B_{12}

Vitamin B_{12} is not found in plant-based foods.[1] Fermented foods or marine plants are not reliable sources of vitamin B_{12}.[33] Oral vitamin B_{12} supplementation is essential in any individual following a vegetarian or vegan diet. Even in individuals following ovo-lacto-vegetarian diets or those that habitually consume fortified foods, a weekly supplemental dose is the optimal strategy to ensure optimal vitamin B_{12} levels (Table 2).[2]

Recommendations for vegetarian or vegan diets based on age

Pregnancy and lactation

Vegetarian and vegan individuals are at higher risk of suffering nutrient deficiencies compared to omnivore individuals, but if a sufficient intake of all nutrients is ensured, pregnancy outcomes (birth weight, preterm birth) are similar in both populations. Given the increased requirements in pregnancy, nutritional management, even before conception, is particularly relevant.[34] Due to their impact on psychomotor development, it is essential to guarantee an adequate intake of vitamin B_{12} and omega-3 fatty acids, usually by means of supplementation.[35,36]

Infancy

Human milk is the ideal food for vegetarian and vegan infants. It is important to ensure that mothers consume vitamin B_{12} supplements regularly and, depending on their particular diet, also iodine and omega-3 fatty acid supplements.[35–37]

When breastfeeding is not an option, vegan families can use soy protein-based formula. The use of plant-based milks that are not formulated for infants, sometimes mixed with fruit or vegetable juices, has in some cases resulted in severe malnutrition, neurologic sequelae and even death.[38]

Complementary feeding

The age of introduction of complementary foods should be the same as in children following non-vegetarian diets. Introduction of legumes is recommended starting at age 6 months, as they are the natural substitute of meat in vegetarian diets. If the infant consumes pureed foods, some options include purees made with legumes or tofu. In ovo-lacto-vegetarian infants, eggs can occasionally substitute legumes. If the family would rather introduce solids directly, one option is to offer the infant chickpea hummus (or other legume spreads), crumbled cooked tofu, peas, lentils mixed with rice, unsweetened peanut butter spread on bits of banana or bread, or omelette. From age 6 months, infants may also sometimes be offered unsweetened soy yogurt for breakfast or as a snack, with or without fruit. It is important to choose brands fortified with calcium.

The diet must include foods rich in vitamin C in the main meals to facilitate iron absorption. Regular consumption of vegetables rich in vitamin A is also recommended (sweet potato, broccoli, carrot, squash). One easy way to do this is to substitute sweet potato for potatoes in pureed vegetable soups.

Gluten should be introduced as the same age recommended in infants without special diets.[5] Use of whole grains should predominate: whole grain bread, brown rice, whole wheat pasta, couscous, millet, corn polenta or quinoa. Once the child tolerates these foods well, nuts and seeds should be introduced next, either ground or in butter form (parents should be reminded of the dangers of offering whole nuts): 1) ground almonds, hazelnuts or walnuts could be added to fruit purees or cereal porridge or to cooked rice, pasta or vegetables; 2) tahini (a ground sesame butter) can be introduced from age 6 months, either as an ingredient in chickpea hummus or by adding it to vegetable purees occasionally as a substitute of legumes; 3) almond, hazelnut or other nut butters could be added to pureed foods or smoothies or spread directly on bread.

Plant-based milks fortified with calcium may be used occasionally to prepare some dishes, but should never be used as the main liquid food of the child, at least until age 2–3 years.

Until age 1 year, spinach, chard, borage, beets, arugula and other leafy greens should be avoided due to their high nitrate content; honey and syrups (agave syrup, rice syrup, wheat glucose syrup) due to the risk of contamination with botulism spores; seaweed due to its high iodine content; and also foods with a laxative effect, such as flax or chia seeds.

Children aged 2 years and older

From this age, children ought to follow the same diet as the rest of the family, with an emphasis on offering fresh foods rather than processed foods or fruit juices with added sugars. The main problem in this population is the lack of longitudinal data from cohorts of children and adolescents following a vegetarian diet that would allow drawing conclusions on the potential advantages or disadvantages of their consumption.[39]

Adolescents

Requirements for many nutrients increase during adolescence, especially of protein, iron, zinc and calcium. It is important to ensure that vegetarian and vegan adolescents consume legumes and their derivatives daily, as they are the food group that contributes most to the dietary intake of these four nutrients. To optimise iron absorption, we must encourage consumption of foods rich in vitamin C in the main meals while at once excluding consumption of coffee or tea during meals. The best way to ensure an adequate intake of calcium is to include the following foods in the diet: 1) 2 servings per day of milk, dairy or plant-based milks fortified with calcium; 2) at least 3–4 servings per week of greens rich in calcium with a low oxalate content; 3) 2–3 servings per week of calcium-set tofu; 4) 1 serving per day of fruit, dried fruit or seeds rich in calcium (almonds, sesame seeds, figs, chia seeds, dates, oranges...).

Conclusions

The duty of paediatricians is to guarantee the good health of their patients. Adequate growth and development are evident signs of good health. When it comes to nutrition, health is promoted by encouraging breastfeeding and facilitating the eventual transition to the family diet. The more varied the diet, the more likely it is to ensure adequate nutrition. Furthermore, the management of paediatric patients must be mindful of the sociocultural identity of the parents as long as it does not pose a risk to the health of their offspring. Restrictive diets—such as the vegan diet—require additional effort in developing dietary strategies that guarantee adequate nutrition and adequate use of dietary supplements. Vegetarian and vegan diets, like any other diet, need to be properly planned. Therefore, based on the evidence currently available, and although following a vegetarian diet is not necessarily unsafe at any point during childhood or adolescence, it is preferable to recommend an omnivorous diet or, at least, an ovo-lacto-vegetarian diet during infancy and early childhood. The paediatric followup of children that consume vegetarian diets need not be different from the followup of all other healthy children as long as the diet is balanced and the child exhibits normal grow and development.

Conflicts of interest

The authors have no conflicts of interest to declare.

Appendix A. Authors

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