

## Caring for Infants and Children Following Alternative Dietary Patterns

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The number of people that refrain from eating meat has apparently increased. This is due to a variety of factors other than economic constraints or religious concerns, which have long been reasons for such dietetic conduct. Several reasons for adopting diets excluding meat include improved health, concerns regarding animal welfare, the use of antibiotics and hormones in livestock, and the excessive exploitation of environmental resource. Consequently, the number of children whose parents decide to follow alternative diets, such as vegetarian, vegan, macrobiotic, or fruitarian, is also growing.

Clinical research regarding adults adopting such diets has expanded, and their nutritional impact is now well documented. However, data on children following dietetic regimens excluding meat and the impact on their health are limited. We would like to raise the awareness among pediatricians regarding advising parents during pregnancy and for regularly caring for infants and children who grow up in families consuming atypical dietetic regimes, such as vegetarian and vegan diets.

### People Following Vegetarian and Vegan Diets

Vegetarianism is defined by the practice of abstaining from the consumption of the flesh of any animal, which means that meat and fish are excluded from the diet.<sup>1</sup> The most common is lacto-ovo-vegetarianism, which excludes meat and fish but includes consumption of milk, cheese, and eggs. Vegan diets exclude all animal food sources including dairy products or eggs<sup>2</sup> (Table I; available at [www.jpeds.com](http://www.jpeds.com)).

A recent update on vegetarianism, reported in the Gallup's Consumption Habits survey, revealed that 5% of the American adult population was vegetarian and 2% of the same population considered themselves to be vegans.<sup>3</sup> Worldwide, the percentage of vegetarians varied from 11.2% (0.02% vegan) of the Australian and 10.3% of the New Zealand adult population<sup>4</sup> to 5% of the Israel population,<sup>5</sup> whereas the Indian population counted the highest number of vegetarians (approximately 30%).<sup>6</sup>

In Europe, surveys conducted during the last 5 years reported a percentage of vegetarian population below 5% in countries like Spain (0.5%-1%), Portugal (2%), France (2%), Finland (3%), Poland (3.2%), and Denmark (4%). Larger percentages of vegetarian populations were reported for Germany (9%), Austria (9%), Sweden (10%), and Italy where recent data indicated that vegetarians and vegans have been increasing at a rate of 1600 per day, rising from 6% in 2013 up to 10% in

2016, of which 1% claimed to be vegan<sup>7,8</sup> (0.6% in 2015). The highest rates of vegetarianism in Europe were reported in the United Kingdom, where 12% of the adults and up to 20% of the young population ranging from 16 to 24 years old followed a vegetarian or vegan diet.<sup>7,9</sup> In particular, the number of vegans had risen by 350% in the past decade. The majority of the data reported are limited to the adult population, and scarce information is available on the use of vegetarian and vegan diets in infants and children.<sup>10</sup>

### Health Risks in Infants and Children Following Vegan Diets Lacking Supplementary Constituents

In Europe, several case reports have described that children hospitalized because of various nutritional deficiencies (vitamins, iron, calcium), which developed after they were breastfed or weaned according to vegan regimes.<sup>11,12</sup> For instance, in Italy an 11-month-old child weaned according to a vegetarian diet was hospitalized in 2015 because of a serious vitamin B12 deficiency, and in 2016 a 2-year-old infant, whose diet was exclusively based upon breastfeeding from a mother following a long-lasting vegan diet, was hospitalized because of a severe nutritional deficiency caused by his diet. In both cases, their diets had not been combined with appropriate supplements. Furthermore, several cases of children presenting severe vitamin B12 deficiency following a vegan diet were reported in Italy requiring hospitalization.<sup>13</sup> In 2016, a case report described a malnourished 14-month-old child with growth failure, 5.5 kg body weight, and hypocalcemia who was brought to hospital by his grandparents against the will of the parents. In this case, a court order was issued, forcing the child to remain in the custody of the hospital.<sup>13</sup> The proposed "criminalization of the vegan lifestyle"<sup>13</sup> has sparked debate in public opinion in Europe and the US.

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## Nutritional Deficiencies because of Rigorous Diets Excluding Meat in Children

Special attention should be paid to intensify communicating with parents when caring for infants and children growing up in families practicing vegetarian or vegan diets. It is mandatory to ensure that an adequate nutrient intake is provided during the breastfeeding and complementary feeding periods.<sup>14</sup> In fact, several fundamental nutrients are reported to possibly become insufficient in children practicing meat excluding diets, such as vegetarian and vegan (Table II; available at [www.jpeds.com](http://www.jpeds.com)). The number of such deficient nutrients increase if the diet becomes more restricted.<sup>14</sup>

Human milk is recommended as the exclusive nutrient source for full-term infants during the first 6 months after birth, as it provides sufficient support to optimal growth and development.<sup>15</sup> In many countries, breastfeeding is expanded by appropriate supplementations of vitamin D and iron, and it could be continued after weaning for the first 12 months and thereafter for as long as mutually desired if the mother feeds normally.<sup>15</sup>

The maternal diet influences the composition of breast milk.<sup>13</sup> In vegan mothers, breast milk is deficient in multiple vitamins.<sup>16</sup> On the other hand, it has been shown that milk of vegan women has lower concentration of saturated fat and eicosapentaenoic acid and a higher concentration of linoleic and linolenic acid.<sup>17</sup> Furthermore, milk of vegetarian women has a lower level of environmental pollutants such as DDT, chlordane, and polychlorinated biphenyls, compared with the milk of omnivorous women.

Vegan infants unable to breast feed are usually given a formula based on methionine-fortified soy protein isolate. The exclusive use of soy-based formula in these children is still debated. In fact, although some studies have reported that vegan infants exclusively fed with this soy-based formula grow and develop normally,<sup>18</sup> others suggest that commercial soymilk should not be introduced before the first year because of inadequate intake of protein, sodium, potassium, and chloride; even if the content of micronutrients such as iron and zinc in soymilk is higher and similar to that present in cow milk, respectively, their bioavailability is reported to be relatively lower.<sup>18</sup> Yet, a soy-based infant formula is the most recent recommendation for infants, including vegan, who are not receiving breast milk.<sup>14</sup>

Current guidelines suggest that solid food should be introduced by the age of 6 months in all children, despite of their families being vegetarian or vegan, and a gradual introduction of a variety of food is recommended to promote good eating habits.<sup>19</sup>

Considering that commercial products provide a limited selection for older vegan infants, their parents may opt for preparing homemade vegan food for their own baby, particularly those foods typically included in a vegan diet such as legumes, tofu, and leafy green vegetables.<sup>20</sup> Thus, families who wish to wean their baby on a vegan diet may face extra challenges that include the risk of inducing multiple nutritional deficiencies, such as vitamin B12, iodine, calcium, and a general energy deficit.<sup>14</sup> Therefore, a specific supplementation must be provided to all vegan infants during weaning under the supervision of a pediatrician, who may also advise vegan families to request a dietetic referral prior to commencing weaning.

## Conclusions

The popularity of vegetarianism and veganism in the adult population can be explained by health beliefs that differ from the majority of people in society. These health beliefs are based on a variety of factors that may not match those of the majority of pediatricians, thus, leading to a more complicated communication between parents and caregivers. In particular, young vegetarian parents may want their children to share their own eating habits.<sup>1</sup> However, dietetic regimens excluding meat, particularly vegan diets, should be practiced by parents under appropriate pediatrics or dietary supervision to ensure that the infant receives a sufficient supply of nutrients. European Paediatric Association-Union of National European Paediatric Societies and Associations would like to encourage pediatricians to play a proactive and fairly friendly key role<sup>21</sup> in informing and advising those parents who intend to raise their children with a strict meat excluding dietetic regimen, such as vegan diets. In fact, parents should be advised about the importance of a proper diet supplementation. They must be informed on the serious consequences of failing to follow the advice and prescriptions regarding supplementation of the diet, which may include irreversible cognitive damage from vitamin B12 deficiency and death.<sup>14</sup> However, the discussions on whether differing health beliefs as vegan diets with appropriate supplements allow normal growth and development, provided that regular pediatric and dietetic supervision ensures nutritional adequacy of the diet, should not affect the relationship with the pediatrician.<sup>14</sup> ■

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**Table I. Classification of dietary patterns**

Dietary patterns	Definition	Beef	Poultry	Fish	Dairy/eggs
Nonvegetarian	Eat red meat, poultry, fish, milk, and eggs more than once a week	Yes (++)	Yes (++)	Yes (++)	Yes
Semivegetarian	Eat red meat, poultry, and fish less than once per week and more than once per month	Yes (+)	Yes (+)	Yes (+)	Yes
<b>Vegetarians</b>					
Pescatarian (pesco)	Eat fish, milk, and eggs but no red meat nor poultry	No	No	Yes	Yes
Lacto-ovo	Eat milk and eggs but no red meat, poultry nor fish	No	No	No	Yes
Vegan	Eat no red meat, poultry, fish, dairy, and eggs	No	No	No	No

**Table II. Nutrients deficiencies reported in vegetarian and vegan diets**

Nutrients	Vitamin A	Vitamin B2	Vitamin B12	Vitamin D	Iron	Zinc	Calcium	n-3 fats (DHA)	Protein
Diets									
Vegetarian									
Ovo			●	●	●	●	●	●	●
Lacto				●	●	●		●	●
Lacto-ovo				●	●	●		●	●
Vegan	●	●	●	●	●	●	●	●	●

DHA, docosahexaenoic acid.