

VEGETARIAN DIET IN CHILDREN

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ABSTRACT

Vegetarianism may have implications on the growth of children and adolescents. There are different types of vegetarian diets: some may be suitable for children, other deficient in essential nutrients. If a vegetarian diet is done properly and includes fortified foods it can promote health and reduce risk for major chronic diseases. Restriction or exclusion of products of animal nature can lead to low intake of essential nutrients.

Keywords: vegetarianism, child

Childhood is the period when nutritional habits are acquired, when growth is intense and when deposits of essential nutrients are stored.

According to the Merriam-Webster Dictionary, vegetarianism is defined by "the consumption of a diet that contains vegetables, fruits, nuts, cereals and sometimes eggs and dairy products" (1).

Vegetarianism may have severe implications on the growth of children and adolescents, therefore it is necessary to assess the nutritional status of vegetarians to insure optimum growth and a good health state and to prevent potential deficits.

There are different types of vegetarians (1) – Table 1.

Each of these diets has implications on the nutrition and health of children and adolescents. The reasons for which one adheres to a vegetarian diet are different:

- economic reasons: in some countries, vegetables are cheap;
- the risk of omnivorous diets and the negative publicity on the diseases emerged as a consequence of the consumption of animal products;
- moral reasons: the belief that eating meat involves cruelty and environmental degradation; animal-rights militants;

TABLE 1. Types of vegetarians

Classic vegetarians	New vegetarians
Ovolactovegetarians	Vegetarians consuming small amounts of meat
Lactovegetarians	Vegetarians "to a large extent"
Ovo-vegetarians	Semi-vegetarians
Vegans ¹	Pesco-vegetarians ²
Consumers of the RAW ³ diet	Vegetarians consuming puddings
Seed consumers	
Fruit consumers	
Macrobiotic vegetarians ⁴	

¹consume a diet lacking in any animal product, including meat, eggs and all ingredients deriving from these products

²consume food from vegetal sources and fish

³uncooked vegan diet

⁴consume grain as a food basis and avoid processed and refined products

- ecological reasons: the effect of meat production on the environment involves the inefficient use of the planet resources;
- religious reasons: seventh-day Adventists, some Hindu, Buddhists;
- philosophical reasons: transcendental meditation, yogis, anthroposophists, macrobiotics;
- social influences (1).

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A study done in the USA in 2003 shows that 2% of the children between 2-17 years are vegetarians and approximately 0.5% are vegans (2). Along with the increase in the popularity of the vegetarian diets, more and more parents encourage their children to adopt them. The degree of adherence to the vegetarian diets varies, therefore the nutrients intake varies from one vegetarian to another. The American Dietetic Association and Dietitians of Canada considers that a carefully planned vegetarian diet can be healthy and suitable from the nutritional point of view and can have benefits in the prevention and treatment of certain diseases (1).

The vegetarian diet, including the vegan one, must observe the daily nutrition recommendations (DNR) for proteins, iron, zinc, calcium, vitamin D, vitamin B6 and B12, vitamin A, omega-3 fatty acids and iodine. In some cases, the use of fortified foods or supplements may be useful in covering the recommendations for each nutrient.

The benefits of the vegetarian diet are:

- low intake of saturated fats, cholesterol and animal proteins;
- high levels of carbohydrates, fibers, magnesium, vitamins C and E, carotenoids;
- body mass index lower than that of non-vegetarians;
- lower incidence of obesity, coronary disease, hypertension and diabetes mellitus type 2;
- improvement of the lipid profile;
- vegetarian adolescents are less affected by acne, allergies and gastro-intestinal disorders;
- decrease of mortality caused by cardiovascular diseases, shock, cancer (1,3).

It has also additional implications:

- moderate consumption of or abstinence from alcohol and other stimulating products (nicotine);
- increased involvement in physical activities;
- vegetal products have lower caloric density, therefore they predispose less to obesity (1).

Another benefit has been reported in children with an anthroposophical life style. This style involves the increased consumption of organic foods, including naturally fermented vegetal products and products with live lactobacilli, as well as the restrictive use of antibiotics, antipyretics and vaccines. A study that assessed the intestinal flora in children under 2 years old with this life style in comparison to the one of children with a traditional life style showed that the microflora characteristics differ in two groups: this diversity of the bacteria may contribute to the lower prevalence of the atop-

ic disease. The study done in Poland in vegetarian children in the prepubertal period emphasized lower leptine-polypeptid concentrations playing an important role in bone growth and weight adjustment (4).

The risks of the vegetarian diet are:

- emergence of rickets;
- risk of deficiency in vitamin A and subsequently in keratomalacia;
- the emergence of anemia as well as the deficit of proteins and zinc (1,2).

GUIDES REGARDING NUTRIENT INTAKE FOR VEGETARIAN CHILDREN

Caloric intake

The appropriate energetic intake must ensure growth according to the growth curves. The recommendations regarding the caloric intake are similar to the ones for the general population. Caloric sources accepted for babies and children are soy, vegetables, nuts, oil and nut butter and fruit juices. The recommendations for the nutrient intake are increased by up to 2 standard deviations over the DNR average to compensate for the potential intake deficits. Furthermore, the recommendations for the same nutrient may vary in different countries (5).

Protein intake

Despite the low caloric density of strict vegetarian diets, especially if the weaning takes place early, the nutrition intake is usually enough to cover the protein needs. Plant proteins can cover the energetic needs if a variety of plants is consumed. Complementary proteins must not be consumed in the same meal. Different studies (1,6) showed that due to low digestibility of plant proteins, the necessary proteins must be 30-35% higher than in vegan babies, 20-30% in vegans between 2 and 6 years and 15-20% in vegan children over 6 years old.

The 5 major plant protein sources are: vegetables, cereals, nuts and seeds, fruits and vegetal products. Each of them have advantages and disadvantages:

- vegetables and cereals provide relatively large amounts of high quality proteins, but they must be cooked and processed to become tasty and to eliminate substances that decrease digestibility such as amylase inhibitors, lecithin and tannin;
- the amount, quality and digestibility are concern reasons, especially when vegan/ vegetarian diets are used in babies;

- the quality of plant proteins vary: isolated soy proteins ensure the necessary proteins just like the animal proteins, while the wheat proteins are 50% less usable in comparison to the animal proteins;
- the lysine content is lower in all plants in comparison to the animal products, and the methionine and cysteine content is low both in vegetables and in fruits;
- the content of essential amino acids (threonine) is low in cereals, and tryptophan in fruits (1).

Lipid intake

Even if the dietetic fat intake in vegetarian children over 2 years old (25-35% from calories) is lower than in omnivores, the effects on growth seem to be low. Still, when the intake supplies under 15% of the calories, the intake of essential fatty acids must be ensured. The minimum 3% of the calories must be ensured from linoleic acid (omega 3) and 1% from linoleic acid (omega 6). The recommended ratio omega 6: omega 3 varies between 2:1-4:1. The linoleic acid is to be found in nuts, seeds and grains. The alpha-linolenic acid is found in green leaves, phytoplankton, seaweeds, certain seeds, nuts and vegetables as well as in flax, hazelnuts, soy. These may be transformed in non-saturated fatty acids (arachidonic – ARA, eicosapentaenoic – EPA, docosahexaenoic – DHA). The fatty acids must supply 3-10% of the total calories. ARA is found in meat and eggs; EPA and DHA in fish and seafood. Vegans/vegetarians have no sources of long-chain omega-3 fatty acids and obtain them from the alpha-linolenic acid (7).

The pregnant women that are vegan, vegetarian or are on a macrobiotic diet and do not eat fish or eat small amounts of fish and animal products do not get these fatty acids. The risks are high for babies that can be premature, as their capacity of desaturating the alpha linolenic acid in DHA is limited.

Fiber intake

Depending on age and gender, the recommended daily fiber intake is of:

- 19 g/zi for 1 to 3-year old children;
- 25 g/zi for 4 to 8-year old children;
- 38 g/zi for adolescents.

For very small children, the low energetic density of diets rich in fibers can make difficult the sufficient caloric consumption and may inhibit the absorption of certain minerals. The cereal grind and

the squash of the vegetal products may increase their digestibility, and the partial replacement of whole-wheat with refined cereals poorer in fibers may increase the energetic intake. The ovo-lacto-vegetarians usually consume appropriate – not excessive – amounts of fibers (5).

Vitamin intake

– *Vitamin A*: as vegetal foods contain only carotenoids, the necessary vitamin A must be covered by 3 portions/day of vegetal products rich in beta-carotene such as vegetal products and yellow or orange fruit. The beta-carotene absorption is less efficient when the vegetal products are uncooked or raw than when they are cooked, chopped or mashed or when small amounts of fats are added upon cooking or consuming (7).

– *Riboflavin*: the riboflavin intake seems similar in vegetarians and omnivorous. Occasionally, people on very restrictive or macrobiotic diets may face deficits of riboflavin. Sources of riboflavin: soy, wheat germs, fortified cereals, yeast, enriched grains (1,5).

– *Folic acid*: usually, the consumption of an increased amount of fruit and vegetables ensures a suitable intake of folic acid. People who consume vegetal products boiled or roasted at high temperatures and rarely eat cereals fortified with folic acids or fruit juices may face deficiencies (1,5).

– *Vitamin B12*: no vegetal food, even fortified contains vitamin B12. Mushrooms are often considered a source of vitamin B12, but actually they contain a compound structured similarly to vitamin B12 that does not act like vitamin B12 in the organism. Ovo-lacto-vegetarians receive sufficient amounts of vitamin B12 if they consume dairy products regularly. The typical vegetarian diets are rich in folic acid that may mask the deficit hematologic symptoms, leading to a tardy diagnosis. The regular intake of foods fortified with vitamin B12 or dairy products must be encouraged in vegetarians and especially in breastfeeding mothers (1,5).

– *Vitamin D*: children must consume daily foods such as cow milk, certain types of soy milk, rice milk, cereals enriched with vitamin D2 or D3. The bioavailability of vitamin D2 is lower, consequently the needs are high for certain vegetarians. If sun exposure and the intake of fortified foods is insufficient, then supplements are recommended (8).

Mineral intake

– *Iron*: is vital in all ages, especially in babies, adolescents and pregnant women. The iron deficit

is the most frequent micronutrient deficit in vegetarian children, as well as in non-vegetarian children. It is more frequent especially in vegan children, as vegetal foods contain non-heme iron, in comparison to the animal products, which contain heme iron. Non-hem iron is more sensitive to factors inhibiting iron absorption such as phytates, calcium, plant tea, cocoa, certain spices and fibers. Vitamin C and other organic acids from fruits and vegetal products that increase iron absorption. In vegetarians, the recommended intake is 1.8 times higher than in non-vegetarians due to the low bioavailability of iron in vegetarian diets and lower iron deposits of vegetarians, despite the fact that serum ferritin is usually within normal limits (4,5).

– *Zinc*: in American diets approximately half of the zinc comes from meat and fish. Foods such as red meat contain high zinc and protein amounts that increase its bioavailability. Human milk does not contain sufficient zinc for babies over 6 months old. The bioavailability of plants relatively rich in zinc, such as whole-cereals, soy, grains, nuts, peas, lentil, tends to be low as many of them contain phytates and fibers that inhibit the zinc absorption. In ovolactovegetarians, the zinc absorption is approximately one third lower than in omnivorous. In vegans, the daily necessary must be 50% higher. Sources of plants rich in zinc are whole-cereal bread made with yeast and zinc fortified cereals (4,5).

– *Calcium*: is important for bone health; approximately 45% of the bone mass is formed by the age of 8, 45% between 8-16 years and 10% in the following decade. In vegans, the calcium intake tends to be low in comparison to the lactovegetarians and non-vegetarians. Although the plant oxalates, phytates and fibers reduce the availability of calcium in vegetal products, it is higher than in milk. Calcium is contained by broccoli, cabbage, turnips, and kale leaves (4,5).

– *Iodine*: if iodised salt is consumed, the iodine deficit is rare. Vegans whose diets are restrained to non-iodised sea salts and contain substantial intake of goitrogenic foods such as broccoli, mustard, cabbage, kales, have iodine deficit risk. They are recommended iodine fortified foods (4,5).

RECOMMENDATIONS ON AGE GROUPS

Recommendations for babies

Until the age of 4-6 months, the vegetarian and non-vegetarian babies' diets are identical, the human milk being the best food for this period, due to its well-known advantages. Babies that receive hu-

man milk or different milk formulas have appropriate calory and nutrient sources (iron vitamin B12, vitamin D) ensuring their normal growth. For the vegan babies that are not naturally fed, the soy milk is the only option, but – just like rice and goat milk – it does not contain an optimum ratio between nutrients and can lead to unbalances. The guides for the nutrition diversification are similar in vegetarians and non-vegetarians. Babies older than 6 months run a potential risk of deficiencies due to the restrictive diet, being more vulnerable if they receive a macrobiotic diet and can develop a psycho-motor retard. By the age of 6 months the iron reserves of the organism are exhausted and the diet must include foods rich in iron, in order to increase the absorption of iron, the consumption of foods rich in vitamin C is recommended (citrus fruit, green leaf products rich in vitamin C (citrus fruit, green leaf products) (1,5).

Recommendations for children

This period is important for the development of nutrition habits that can be the basis of a healthy diet during adulthood. Vegetarian children, except those who receive extremely restrictive diets (non-macrobiotic vegan diets) experience a growth comparable to that of non-vegetarian children of the same age. Vegan children may need large quantities of proteins due to the differences in the digestibility of proteins and in the profile of amino acids. They also need a suitable intake of calcium, zinc, iron. Special attention must be paid to allergy prevention. Foods such as nuts, grapes, honey or corn syrup must not be fed before the age of three, especially to children with family history of allergy, eczema or asthma (1,5).

Recommendations for adolescents

Even if they have recently become vegans or they are vegans from their early childhood, nutritional unbalance has major consequences in adulthood. The vegetarian practices at this age can be a marker in the identification of adolescents tending to have eating disorders or weight obsession. It has been noticed that 30% of the vegetarian adolescents receive the recommended calcium intake of 1,300 mg/day (1,5).

Vegetarian mothers and natural nutrition

If the diet is correct, human milk may be sufficient for the baby up to 6 months. The diet must contain:

- proteins from nuts, eggs, dried grains, lentil and tofu;

- dairy products (cow milk, cheese, yoghurt) or calcium fortified soy products;
- fortified or whole cereals;
- fruits and vegetables (green leaf vegetal products);
- poly-/ monosaturated oils.

Breastfeeding vegan mothers need vitamin and mineral supplements. If these mothers' diet contains small amounts of vitamin B12, then their milk will contain insufficient amounts of vitamin B12. They will need vitamin B12 supplements or will have to consume vitamin B12 sources (fortified cereals, soy, oat extract). The vitamin D content of human milk varies depending on the mother's diet and her sun exposure. The docosahexaenoic acid is necessary for the development of the eyes and brain, and vegetarians' source is the alpha-linolenic acid contained by

the human milk of the vegetarian woman, if her diet contains flax and rape seed oil (9).

CONCLUSIONS

1. The more restrictive the diet and the younger the child is, the higher the deficiency risk.

2. Vegetarians must be assessed individually by frequent nutrition questionnaires regarding the dietetic intake.

3. Vegetarian diets may cover the children and adolescents' nutritional needs if carefully planned and monitored.

4. Even if the vegetarian diet observes the current recommendations for all nutrients, the use of supplements and fortified foods is necessary to prevent deficiencies.

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