Nutritional and Health Aspects of Vegan Diet

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Abstract: Veganism, has been increasing in popularity over the past few years, especially among the young population throughout the world. Some studies have shown Vegan diet reduces obesity, cardiovascular diseases, cancer, while some studies have some adverse effects on bone health, mental health. So, the aim of the present review is to know the nutritional status and health status of people with Vegan diets. And what could be the possible reasons for benefits or shortfalls of Vegan diet.

Keywords: Diet, Vegan, Nutritional status, Bone density, Meantal Health, Obesity, Health status, Cardiovascular diseases, Iatrogenic disease, Adverse reaction.

Introduction:

The term**Vegan** refers to a diet not containing (or people who do not consume) any animal foods. Also, by-products of animal husbandry, e.g., milk and honey, are excluded from the diet. Many vegans also exclude other animal-derived products such as leather. (Peter C D & Mariotti F, 2017).Surveys have shown that number of Vegans is increasing day by day through out the world especially among teenagers, youth and females.(Jacobsen MF, 2006). The reasons for avoiding meat and/or other animal products are- ethical reasons (related to killing animals and/or animal welfare); ecological reasons(especially the low efficiency of producing animal food both in terms of calories and protein from edible plant foods in relation to the world food situation and the growing world population); health reasons (related to the notion that consumption of large amounts of animal products high in saturated fat is associated with a wide variety of diseases in affluent societies). Another health reason may be, the use of antibiotics and growth stimulants for the production of animals, the threat of animal-borne diseases, disliking certain types of animal food. This is a very common reason for avoiding one or more specific types of animal foods, e.g., certain types of fish, poultry, pork, beef, lamb, etc. (Craig J Winston, 2009)

Vegan diets generally provide relatively large amounts of cereals, pulses, nuts, fruits and vegetables. Together with the differencesin intakes of animal foods, these differences in food

In take result in several characteristic differences in nutrient intake. Vegan diets are usually rich in carbohydrates,n-6 fatty acids, dietary fibre, carotenoids, folic acid, vitamin C, vitamin E and Mg, and relatively low in protein, saturated fat, long-chain n-3 fatty acids, retinol, vitaminB12 and Zn; vegans can have particularly low intakes of vitamin B12 and low intakes of Ca. These differences in nutrient intake might have favourableor unfavourable effects on the nutritional status and health of vegans. The purpose of the present brief overview is to summarize present knowledge on the nutritional and health effects of vegan diets.

Nutritional status of Vegan Diet:

For energy and macronutrients, it was found that average energy intake was similar across both dietary patterns with a mean (intakes of 2101 (1374- 2985) kcal/d for meat-eaters 1947 (1130-2757) for vegans and 2098 (1495- 2820) in vegetarians. Compared to meat-eaters, average protein, EPA and DHA intake was lower in vegans, yet intake of fiber, PUFA, total n-3 fatty acids, and ALA was higher in plant-based dietary patterns. Except for EPA and DHA, the mean intake of energy and macronutrients plant-based diets was within the recommendations. In meat-eaters, the mean intake of fiber, PUFA, and ALA were below recommendations. (Neufingerl N & Eilander A, 2022).

For micronutrients, vegans generally had lower vitamin B12, vitamin D, and iodine intake status and higher rates of bone turnover markers compared to meat-eaters. Mean iron and zinc intakes were inadequate in vegans due to higher requirements because of the lower bioavailability of these micronutrients in plant-based diets. On the other hand, compared to meat-eaters, folate, vitamin E and magnesium intakes were higher in vegetarians and vegans, and vitamin B1, B6, and C intakes were especially higher in vegans. In meat-eaters, the mean intake of vitamins E and D was in adequate. Mean calcium intakes were slightly above the EAR for all dietary patterns. Furthermore, mean intakes of vitamin A, B2, niacin, and phosphorus were adequate and similar among all dietary patterns. (Rosell M, Appleby P, Spencer E & Key T, 2006).

Health effects of Vegan Diets:

Obesity:

Follow-up of body weight among 21 966 individuals in EPIC-Oxford study shows a mean body-weight increase of approximately 400 g/year overall among vegetarians and non vegetarians with significantly lower weight gain in vegans.(Rosell M, Appleby P, Spencer E & Key T, 2006). Toohey et al showed body mass index (BMI; in kg/m^2) were significantly lower in African American vegans than in lactoovovegetarians(people consuming dairy and eggs, but no meat, fish, or other seafood (shellfish, shrimp, octopus, etc).(Toohey ML et al., 1998). Data from the Adventist Health Study (AHS) have shown that BMI increases as the amount of animal foods in the diet increases, such that vegans had the lowest BMI, followed by vegetarians, pesco-vegetarians, semi-vegetarians, and omni diets. (Tonstad S, et al., 2013). S Eric in 2022

in apopulation of 1340 reported Vegan Women Have a Higher Prevalence of Underweight. (Sly witch E, Savalli C, Duarte AC & Escrivão MAMS, 2022).

Cardiovascular disease

Cardio-vascular diseases are the most common causes of mortality. Most cardio-vascular diseases result from venous or arterial blockages (thrombosis). These occur by a rupture of atherosclerotic plaque and result in tissue damage from blood starvation. Cerebrovascular and is chaemic heart diseases are the two most common types of cardiovascular disease.

Fraser reported that compared with other vegetarians, vegans are thinner, have lower total and LDL cholesterol, and modestly lower blood pressure. (Fraser G, 2003). Similarly, among Latin Americans, veganshad the lowest plasma lipids than did their vegetarian and omnivore counterparts. (De Biase SG, Fernandes SF, Gianini RJ & Duarte JL, 2007). The same study showed plasma total and LDL cholesterol were 32% and 44% lower among vegans than among omnivores. Because obesity is a significant risk factor for CVD, the substantially lower mean BMI observed in vegans may be an important protective factor for lowering blood lipids and reducing the risk of heart disease. (Davey GK,et al., 2003). Vegans, compared with omnivores, consume substantially greater quantities of fruit and vegetables.(Haddad EH, et al., 1999; Larsson CL & Johansson GK, 2005; Keinan-Boker L,et al.,2002; Djousse´ L,et al., 2004). A higher consumption of fruit and vegetables, which are rich in fiber, folic acid, antioxidants, and phytochemicals, is associated with lower blood cholesterol concentrations a lower incidence of stroke, and a lower risk of mortality from stroke and ischemic heart, disease (Bazzano LA, et al., 2002; Bazzano LA, et al.,2003). Vegans also have a higher consumption of whole grains, soy, and nuts (Haddad EH et al., 1999; Larson CL & Johansson GK, 2005; Larson CL & Johansson GK, 2002) all of which provide significant cardio protective effects.(Mellen PB, Walsh TF & Herrington DM, 2008; Fraser GE, 1999).

Cancer:

Bartley Y T in 2013 reported vegan diets showed statistically significant protection for overall cancer incidence (HR=0.84; 95%CI: 0.72, 0.99) in both genders combined and for female-specific cancers (HR=0.66; 95%CI: 0.47, 0.92). Vegans consume considerably more legumes, total fruit and vegetables, tomatoes, allium vegetables, fiber, and vitamin C than do omnivores.(Haddad EH, et al., 1999; Larsson CL & Johansson GK, 2005; Keinan-Boker L,et al.,2002; Djousse´ L,et al., 2004; Larson CL & Johansson GK, 2002; Fraser GE, 1999). All those foods and nutrients are protective against cancer.(World Cancer Research Fund, 2007). Fruit and vegetables are described as protective against cancer of the lung, mouth, esophagus, and stomach and to a lesser degree some other sites, whereas the regular use of legumes provides a measure of protection against stomach and prostate cancer. In addition, fiber, vitamin

C, carotenoids, flavonoids, and other phytochemicals in the diet are shown to exhibit protection against various cancers, whereas allium vegetables provide protection against stomach cancer, and garlic against colorectal cancer. Foods rich in lycopene, such astomatoes, are known to protect against prostate cancer. (World Cancer Research Fund, 2007). Fruit and vegetables are known to contain a complex mixture of phytochemicals that possess potent antioxidant and anti proliferative activity and show additive and synergistic effects. (Liu RH, 2004; Liu RH, 2003).The phytochemicals interfere with several cellular processes involved in the progression of cancer. These mechanisms include inhibiting cell proliferation, inhibition of DNA adduct formation, inhibiting phase 1 enzymes, inhibiting signal transduction pathways and oncogene expression, inducing cell-cycle arrest and apoptosis, inducing phase 2 enzymes, blocking the activation of nuclear factor-jB, and inhibiting angiogenesis. (Liu RH, 2003)

In Western society, vegans also consume substantially more tofu and other soy products than do omnivores.(Haddad EH, 1999; Keinan- Boker L, et al., 2002). Consumption of isoflavone-containing soy products during childhood and adolescence protects women against the risk of breast cancer later in life (Warri A et al., 2008), whereas a high childhood dairy intake has been associated with an elevated risk of colorectal cancer in adulthood. (Van der Pols JC, et al., 2007). Cancer risk in vegans may be altered because vegans consume soy beverages rather than dairy beverages.

Bone Health:

The prospective EPIC-Oxford cohort study evaluated the fracture risk between vegetarians, non vegetarians and vegans. (Appleby P, Roddam A, Allen N, Key T, 2007). When compared with meat eaters and after adjustment for body mass index (BMI), socio-economic factors and lifestyle confounders, the risks of hip fracture were highest among vegans. Moreover, vegan subjects also showed higher risks of total fractures, leg fractures, and other main fractures (than meat eaters.).An inadequate protein and low calcium intake has been shown to be associated with bone loss and fractures at the hip and spine in the elderly. (Chan HHL, et al, 1996; Lau E, Donnan S, Barker DJ, Cooper C, 1988). Although lactovegetarians generally consume adequate amounts of calcium, vegans typically fall short of the recommended daily intake for calcium. (Davey GK et al., 2003; Appleby P, Roddam A, Allen N, Key T, 2007; Smith AM, 2006). Bone health depends on more than just protein and calciumintakes. Research has shown that bone health is also influenced by nutrients such as vitamin D, vitamin K, potassium, and magnesium and by foods such as soy and fruit and vegetables.(Lanham-New SA, 2008; Yaegashi Y, et al., 2008; New SA, 2003; Cassidy A et al., 2006). Vegandiets do well in providing a number of those important substances. The maintenance of acid-base balance is critical for bone health. A drop in extracellular pH stimulates bone resorption (Arnett TR & Spowage M, 1996), because bone calcium is used to buffer the pH drop. An acid forming diet, therefore, increases

urinary calcium excretion.(Buclin T, Cosma M, Appenzeller M, et al., 2001). However, a diet rich in fruit and vegetables that is typical of a vegan diet has a positive effect on the calcium economy and markers of bone metabolism in men and women. (Yaegashi Y et al., 2008).The high potassium and magnesium content of fruit and vegetables provides an alkaline ash, which inhibits bone resorption. (Tucker KL, Hannan MT, Kiel DP, 2001). Higher intakes of potassium are associated with greater BMD of the femoral neck and lumbar spine of premenopausal women. (New SA, Bolton-Smith C, Grubb DA, Reid DM, 1997).

Mental Health:

The most recent systematic review, which included eighteen studies, compared meat abstainers versusmeat eaters in terms of mental health. (Dobersek U et al, 2021). The research included 160,257 individuals (85,843 females and 73,232 men) from various geographic areas, including 149,559 meat eaters and 8584 meat abstainers (aged 11 to 96 years). The study highlights the high incidence of mental health problems among vegans, emphasizing the vital need of increasing awareness of these illnesses to facilitate early intervention. Women notably appeared to be adversely impacted by mental disorders such as stress.(Singh A & Singh D, 2023; Singh D et al., 2017).Iguacelet al in their meta analysis reported Vegan or vegetarian diets were related to a higher risk of depression and lower anxiety scores. (Iguacel I, Huybrechts I, Moreno LA & Michels N, 2021).

Effects on pregnancy, fetal outcomes, and lactation:

Optimal fetal growth requires balanced maternal nutrition during pregnancy. Mothers on rigorous vegan diet are at risk of vitamin insufficiency, which can lead to poor fetal outcomes. A recent study included 273 women, including 112 omnivores, 37 fish eaters, 64 lacto-ovo-vegetarians, and 60 vegans, respectively. (Avnon T, 2021). Incomparison to an omnivorous diet, the vegan diet was substantially linked with an elevated risk of smallfor- gestational-age infants (RR = 5.9, 95 percent CI, 1.2-21.8). All the groups had a similar incidence of preterm births. Birth weight in vegans was lower compared to lacto-ovo-vegetarians (3015 ± 420 g vs. 3285 ±482 g, P = 0.004) and to omnivores (3328 ± 495 g, P < 0.001) but not to fish-eaters. Vegans also had a lower mean gestational weight gain compared only to omnivores (11.6 ± 4.2 kg vs. 14.3 ± 4.6 kg, P = 0.001). A review of 13 low and middle-income nations found low docosahexaenoic acid levels in breast milk in mothers on plant-based diets but greater in the fish-eating population. (Michaelsen KF, et al., 2011)

Maternal B12 status influences their offspring's B12 levels and is an independent risk factor for neural tube defects (NTD).(Molloy AM ,2018). Studies have shown an association between low B12, low birth weight, and pre-term delivery.(Molloy AM, Kirke PN, Brody LC, Scott JM, Mills JL, 2008).A Chinese study associated increased maternal pickled vegetable consumption with NTD due to excessive nitrate, nitrite,

and N-nitroso compound content. (Li ZW,et al, 2011). They found that eating pickled vegetables more frequently (>6 meals/week) increased the risk of NTD. The investigators also found that maternal consumption of meat, eggs, or milk (>1 meal/week) reduced the risk of NTD. Vegan mothers may have poor prenatal nutritional status, resulting in low maternal fat reserves for breastfeeding. The postpartum nutritional profile of vegetarian mothers declines without sufficient energy intake, thus maternal nutritional reserves are lost to promote infant normal development.

Potential Nutritional Shortfalls:

The following section deals with nutrients of concern in the vegan diet.

n–3 Polyunsaturated Fat:

Vegan Diets generally lack the long-chain n–3 fatty acids, eicosapentaenoic acid (EPA; 20:5n23) and docosahexaenoic acid (DHA; 22:6n23), which are important for cardiovascular health, blood vessels, lungs, immune system, endochrine system as well as eye and brain functions. The plant-based n–3 fatty acid a-linolenic acid (ALA; 18:3n23) can be converted into EPA and DHA, but with a fairly low efficiency. (Burdge GCet al, 2003; Burdge GC& Wootton SA, 2002). Compared with nonvegetarians and vegetarians, vegans tend to have lower blood concentrations of EPA and DHA.(Rosell MS, 2005). However, vegans can obtain DHA from microalgae supplements containing DHA, as well as from foods fortified with DHA. However, EPA can be obtained from the retroconversion of DHA in the body. The oil from brown algae has alsobeen identified as a good source of EPA. Vegans should be able to easily reach the n–3 fatty acid requirements by including regular supplies of ALA-rich foods in their diet and also DHA-fortified foods and supplements. However, DHA supplements should be taken with caution. Although they can lower plasma triacylglycerol, they can raise total and LDL cholesterol (Geppert J, Kraft V, Demmelmair H, Koletzko B, 2006; Sanders TA, Gleason K, Griffen B, Miller GJ, 2006). cause excessively prolonged bleeding times, and impair immune responses. (Food and Nutrition Board, Institute of Medicine of the National Academies, 2005).

Iron:

Vegans in the UK Biobank have little or no intake of heme iron (Burdge GC & Wootton SA, 2002), which is more easily absorbed than non-heme iron present in plant foods such as cereals, vegetables, pulses, and fruits. (Houston, M. S., Summers, S. L. and Soltesz, K. S, 1997; Sambol SZ, Stimac D, Orlić ZC, Guina T, 2009). Although vegan diets are usually high in vitamin C (Hua, N. W., Stoohs, R. A. and Facchini, F. S, 2001), which enhances iron absorption, plant-based diets also contain significant amounts of phytates and tannins, which inhibit non-heme iron absorption.(Houston, M. S., Summers, S. L & Soltesz, K. S, 1997). Previous studies showed that vegetarians

had lower non-heme and total iron absorption, as well as lower ferritin concentrations, compared with nonvegetarians, despite similar or higher total dietary iron intake. (Sambol SZ, Stimac D, Orlić ZC & Guina T ,2009; Hua, N. W., Stoohs, R. A & Facchini, F. S, 2001). Given the crucial role of iron in hemoglobin synthesis and red blood cell production (Craig J Winston, 2009)., it is expected that compared with regular meat eaters, vegans may have lower levels of hemoglobin and red blood cells and a higher risk of anemia.(Houston, M. S., Summers, S. L & Soltesz, K. S , 1997). Clinical evidence of vitamin B12 deficiency has been reported in some vegans.(Antony AC , 2003). Recent research using more sensitive indicators of vitamin B12 status (plasma methylmalonic acid, homocysteine and holotranscobalamin II) has shown that substantial proportions of vegans and even of vegetarians have suboptimal vitamin B12 status according to these criteria, both among affluent western vegetarians and in other countries including India, China and Taiwan. (Mann NJ et al., 2009; Refsum H et al., 2001; Hung CJ et al, 2001; Kwok T, Cheng G, Woo J, Lai WK & Pang CP, 2002; Herrmann W, Schorr H, Obeid R & Geisel J, 2003; Koebnick C et al., 2004). Recent work shows that vegans must be careful to ensure that they do consume adequate amounts of vitamin B12. (Herrmann W & Geisel J 2001; Antony AC, 2003; Stabler SP & Allen RH, 2004). The current UK dietary reference values for vitamin B12 (1. 5 mg/d in adults; Department of Health, 1991) were derived partly from studies of vegetarians and vegans that have suggested that intakes of vitamin B12 of approximately 0. 3 mg/d are sufficient to prevent anaemia and macrocytosis. However, intakes of 0. 3 mg/d may be probably associated with moderate elevation in homocysteine that might be detrimental to health.

Vitamin D

In the EPIC-Oxford study, vegans had the lowest mean intake of vitamin D (0.88 lg/d), a value one-fourth the mean intake of omnivores. (Davey GK, Spencer EA, Appleby PN, Allen NE, Knox KH, Key TJ, 2003). For a vegan, vitamin D status depends on both sun exposure and the intake of vitamin D-fortified foods. Those living in areas of the world without fortified foods would need to consume a vitamin D supplement. Living at high latitudes can also affect one's vitamin D status, because sun exposure in that region is inadequate for several months of the year. (Webb AR, Kline L & Holick MF, 1988). Those who are dark skinned, elderly, who extensively cover their body with clothing for cultural reasons, and who commonly use sunscreen are at an increasedrisk of vitamin D deficiency. (Smith AM, 2006). Another matter of concern for vegans is that vitamin D2, the form of vitamin D acceptable to vegans, is substantially less bioavailable than the animal-derived vitamin D3. (Trang HM, Cole DE, Rubin LA, Pierratos A, Siu S & Vieth R, 1998). In Finland, the dietary intake of vitamin D in vegans was insufficient to maintain serum 25-hydroxyvitamin D and parathyroid hormone concentrations within normal ranges in the winter, which appeared to have a negative effect on long-term BMD. (Outila TA, Karkkainen MU, Seppanen RH &

Lamberg-Allardt CJ,2000).Throughout the year serum 25-hydroxyvitamin D concentrations were lower and parathyroid hormone higher in vegan women than in omnivores and other vegetarians. BMD in the lumbar region of the spine was 12% lower in vegans than in omnivores.

Zinc

Vegetarians are often considered to be at risk for zinc deficiency. Phytates, a common component of grains, seeds, and legumes, binds zinc and thereby decreases its bioavailability. (Hunt JR, 2002). Although vegans have lower zinc in take than omnivores, they do not differ from the nonvegetarians infunctional immune competence as assessed by natural killer cellcytotoxic activity. (Haddad EH, Berk LS, Kettering JD, Hubbard RW & Peters WR, 1999). It appears that there may be facilitators ofzinc absorption and compensatory mechanisms to help vegetariansadapt to a lower intake of zinc. (Gibson RS,1994). In addition, zinc is a catalyst in iron metabolism (Kelkitli E et al., 2016) and is less bioavailable in vegetarian diets (Hunt JR, 2003), and low serum zinc levels have been associated with anemia..(Kelkitli E,etal.,2016;Houghton LA, Parnell WR, Thomson CD, Green TJ & Gibson RS, 2016).Vegetarians or vegans also tend to have lower intakes of other micronutrients, such as vitamin A or riboflavin (Kristensen NB et al., 2015), which might also have roles in blood cell or hemoglobin production.(Owers HJ et al., 2011; García Casal MN et al., 1998).

Recommendations:

Most guidelines on vegetarian and vegan diets have provided neutral advice on supplementing certain nutrients with plant sources. Guidelines such as those from the United Kingdom, Australia, Belgium, Lebanon, Malaysia and Malta indicate that all nutrients can be obtained from a vegan diet,by combining a variety of foods and consuming an appropriate
amount of calories. (Klapp AL, Feil N & RisiusA, 2022).

For adults aged 18 to 60 years, it is recommended to maintain a total energy intake ranging from 23 to 27 kcal/kg, while those over 60 years should target a range of 19 to 22 kcal/kg. To ensure a balanced carbohydrate and fiber intake, individuals should consume a minimum of 400 g (equivalent to five portions) of fruits and vegetables daily, excluding starchy root and vegetables. Dietary fat intake should be limited to less than 30% of total energy intake, with saturated fats kept below 10% and trans-fats below 1%. It is recommended to substitute saturated and trans fats with unsaturated fats. Protein intake should contribute to approximately 15% of total energy intake. Additionally, it is advised to limit free sugar intake to around 5% of energy and restrict salt intake to 1,500 mg/day when adhering to a vegan diet. To ensure adequate intake of vitamins B12 and D throughout the year can be achieved through vitamin-fortified meals or supplements, and EPA/DHA supplementation (alternate source of EPA/DHA

algal oil) is also recommended.(Jakše B, 2021; Wang, F, Zheng, J, Yang, B, Jiang, J, Fu, Y & Li, D, 2015).).

A vegan should regularly consume plant foods naturally rich in the n–3 fatty acid ALA, such as ground flaxseed, walnuts, canola oil, soy products, and hemp seed–based beverages. In addition, it is recommended that vegans consume foods that are fortified with the long-chain n–3 fatty acid DHA, such as some soy milks and cereal bars. Those with increased requirements of long-chain n–3 fatty acids, such as pregnant and lactating women, would benefit from using DHA-rich microalgae supplements. To avoid B-12 deficiency, vegans should regularly consume vitamin B-12–fortified foods, such as fortified soy and rice beverages, certain breakfast cereals and meat analogs, and B-12–fortified nutritional yeast, or take a daily vitamin B-12 supplement. Fermented soy products, leafy vegetables, and seaweed cannot be considered a reliable source of active vitamin B-12. No unfortified plant food contains any significant amount of active vitamin B-12.

To ensure an adequate vitamin D status, especially during the winter, vegans must regularly consume vitamin D–fortified foods such as soy milk, rice milk, orange juice, breakfast cereals, and margarines that are fortified with vitamin D. Where fortified foods are unavailable, a daily supplement of 5–10 lg vitamin D would be necessary. The supplement would be highly desirable for elderly vegans. (Messina V, Melina V & Mangels AR, 2003).

To ensure adequate calcium in the diet, calcium-fortified plant foods should be regularly consumed in addition to consuming the traditional calcium sources for a vegan (green leafy vegetables, tofu, tahini). The calcium-fortified foods include readyto-eat cereals, calcium-fortified soy and rice beverages, calcium-fortified orange and apple juices, and other beverages. The bioavailability of the calcium carbonate in the soy beverages and the calcium citrate malate in apple or orange juice is similar to that of the calcium in milk (Andon MB, Peacock M, Kanerva RL & De Castro JA, 1996). Tricalcium phosphate–fortified soy milk was shown to have a slightly lower calcium bioavailability than the calcium in cow milk.(Zhao Y, Martin BR & Weaver CM, 2005).

Vegans are thinner, have lower serum cholesterol and blood pressure, and enjoy a lower risk of CVD. BMD and the risk of bone fracture may be a concern when there is an inadequate intake of calcium and vitamin D. Where available, calcium- and vitamin D–fortified foods should be regularly consumed. vegan diets showed statistically significant protection for overall cancer incidence in both genders. Vegan diets were related to a higher risk of depression. Birth weight of children from vegan mother's was lower compared to lacto-ovo-vegetarians. There is a need for more studies on the relation between vegan diets and risk of diabetes, and osteoporosis. Vitamin B-12 deficiency is a potential problem for vegans, so that the use of vitamin B-12–fortified foods or supplements are essential. To optimize the n–3 fatty acid status of vegans, foods rich in ALA, DHA-fortified foods, or DHA supplements should be regularly consumed. vegans may have lower levels of hemoglobin and red blood cells and a

higher risk of anemia. Their health status appears to be at least as good as other vegetarians and vegans can avoid nutritional problems if appropriate food choices are made.

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