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## An overview on the importance of vegan diet

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### Abstract

The prevalence of conserved diets like DASH (Dietary approach to stop hypertension) diet, Mediterranean diet, and mainly vegan diet, is highly on the increase in developed countries. Veganism has gained recognition as a healthy and capable therapeutic dietary choice. Even the more restrictive vegan diet, with its exclusion of meat, fish, dairy and eggs, is gaining more and more demands, mostly amongst adult people. The different intake studies show that key elements of a well-planned vegan diet are: providing adequate energy, covering quantitative protein needs, consuming vegetable and fruit, consuming iodine, mandatory supplementation with B12 vitamin complex, covering other macro- and micronutrient needs with an appropriate variety of food items, and supplementing for specific needs. However, for most vegans there is little to no tolerance in regard to foods, probably because it is comparatively easy to completely avoid animal products altogether in this area, and labels and legislation clearly define what foods can be considered vegan without any exceptions. Vegans are healthier, have lower serum cholesterol and blood pressure, and enjoy a lesser risk of cardiovascular disease (CVD). BMD (Bone mineral density) and the risk of bone fracture may be a concern when there is not a proper intake of calcium and vitamin D. Vegan diets meet the recommended intakes for essential nutrients as well as maximize the intake of protective components present in plant foods. Typically, vegans can avoid nutritional problems if required food choices are made. A strength of this review is the attempt to include all relevant literature on those nutrients and health outcomes that were chosen to be closer examined, leading to a currently unprecedented accumulation of evidence in these areas.

**Keywords:** Vegan, supplementation, cardiovascular disease, bone mineral density, cholesterol, blood pressure

### 1. Introduction

It is widely recognised that a nutritionally sound diet is fundamental to human health and well-being across the lifespan. A poor diet contributes to poor health and is a well-established, modified risk factor for the development of non-communicable diseases (cancer, cardiovascular diseases and diabetes) which are leading causes of death globally. Diet and health examine the many complex issues concerning diet and its role in increasing one decreasing the risk of chronic disease yet when vegan diets are directly compared to vegetarian and omnivorous diets, a pattern of protective health benefits emerges (Glick *et al.*, 2014) [12]. Veganism is an increasingly popular lifestyle within Western societies (Nungent *et al.*, 2020) [25]. The number of consumers following a vegan diet has notably increased in many industrialised countries and it is likely that their include on the food sector will continue to grow (Janssen *et al.*, 2016) [17]. Vegan diets, where animal and all their by-products are excluded from the diet, have gained popularity (Bakaloudi *et al.*, 2021) [3], plants are rich natural source of antioxidants in addition to other nutrients which are the main components of vegan diets (Hanninen *et al.*, 2000) [13]. The choice is made for different reasons primary concern for animals (ethics) and health, which may impact both specific food choice and other lifestyle behaviour linked to health outcomes (Radnitz *et al.*, 2015) [28]. A typical aspects of a vegan diet regarding macronutrients, vegan diets are lower in protein intake compared with all other diet types. Veganism is also associated with low intake of vitamin B2, Niacin(B3), B12, D, iodine, zinc, calcium, potassium and selenium (Clarys *et al.*, 2014; Bakaloudi *et al.*, 2021) [7]. Low-fat vegetarian and vegan diets are associated with weight loss, increased insulin sensitivity and improved cardiovascular health (Barnard *et al.*, 2009) [5]. Well planned vegetarian diet that include a wide variety of plant foods and a reliable source of vitamin B12 provides adequate nutrients intake.

### 2. Types of Vegan diet

The same differentiated view should be applied to vegan diets as that well-planned different quality of omnivore diet, because this principle tends to be neglected, individual examples of

poor vegan diets have had and still do have a strong influence on individual, both in research and clinical settings, where naturally only failed attempts of vegan diets are presenting themselves (Sutter, 2017) [32]. The importance of the distinction between adequate and inadequate vegan diets, and stated that if vegans are aware of possible pitfalls and therefore provide an adequate vegan diet by this, they will thrive like their omnivore peers.

### 2.1 Standard Vegan Diet

After the 1960s and 1970s, there has been a shift of the vegan population from counter-culture and spiritual orientation towards mainstream. In 1994, they are also called "newer" vegans". With rapid growth of the vegan population within the last few years, as described earlier, it can be assumed that those vegans are overwhelmingly defining modern populations (Weikert *et al.*, 2020) [37]. Today, the major national vegan umbrella organizations, such as the Vegan Society (United Kingdom), the Vegan Gesellschaft Deutschland (Germany) or the Vegan Gesellschaft Schweiz (Switzerland) are central authorities for most of these vegans, and generally urging vegans to consider crucial nutrients, including cobalamin, calcium and iron, with a mandatory supplementation of at least cobalamin (Sutter, 2017) [32].

### 2.2 Religious Vegan Diet

According to a survey by the Vegetarian Resource Group (2017), nearly 47 percent of people in a sample survey of 11,000 said they don't practice religion. Christians represented the second-largest religious group among vegans with 34 percent, followed by Buddhist or Hindu (9 percent), other (7 percent), and Jewish (3 percent). They further restrict their selection of foods on a religious basis, studies on religious vegan diets are hardly representative of vegan diet in general. This population was mostly used in the 1980's, before populations with more external validity were available (Sutter, 2017) [32].

### 2.3 Raw Vegan Diet

An often-stated claim proponents of raw diets is that plant enzymes are important to the human body and should therefore not be degraded by heat. There is only thin evidence for defending the general avoidance of heating food, for example the benefit of a faster excretion of carcinogens through higher fibre content or the Maillard reaction, in which sugar cross-links and destroys amino acids, peptides or proteins, or by which pro-inflammatory products are generated. Heating of proteins can also create mutagenic compounds commonly from frying. Followers of raw vegan diets often hold the simplified belief that processed food will always be less natural and

therefore less healthy (Sutter, 2017) [32].

### 2.4 Natural Vegan Diet

The term "nature" can be extremely ambiguous itself, but is often used to identify the part of our universe which is untouched by technological human influence (Rosi *et al.*, 2017) [29]. For example, it motivates people to 'go back to nature', which can promote eating more home-cooked or fresh foods, spending more time outdoors, and other healthy behaviour (Sutter, 2017) [32]. On the other hand, idealizing nature tends to foster an inherent distrust towards human technology (Rosi *et al.*, 2017) [29].

### 3. Comparison of vegan diet with other types of diet

The comparison of the nutrient intake and the diet quality of vegan (not consuming any animal products), vegetarian (not consuming any meat or fish), semi-vegetarian (consuming red meat, poultry or fish no more than once a week), pesco-vegetarian (consuming no meat but fish), and omnivorous (eating meat or fish almost every day) (Clarys *et al.*, 2014) [7]. The diets are different but nutrition requirements only vary according to body weight, sex, age, physical activity and health status, and therefore can substantially differ between individuals (Bakaloudi *et al.*, 2020) [4]. Anthropometric measures and physical activity levels did not differ significantly between diet groups, but BMI tended to be higher for individuals adhering to a meat-based diet ( $23.5 \pm 3.1$ ) as compared to individuals adhering to lacto-ovo ( $22.4 \pm 2.7$ ) or vegan diets ( $22.3 \pm 2.6$ ) kg/m<sup>2</sup> respectively (Knurick *et al.*, 2015) [11]. Composition of macronutrients is important in every type of diet. People can only balance the micronutrients by some dietary supplements but in small amount (Jang *et al.*, 2010).

After analysis of the diet questionnaire and the food frequencies questionnaire (FFQ) by Clarys *et al* in 2014 [7], 1475 participants were classified on the basis of diet consumption are as vegans (n =104), vegetarians (n = 573), semi-vegetarians (n = 498), pesco-vegetarians (n = 145), and omnivores (n = 155). The percentages of participants with normal weights varied from 78.8% for vegans to 67.7% for omnivores; 8.7% of vegans were underweight, which was comparable with vegetarians and pesco-vegetarians. The highest calcium consumption was found in semi-vegetarians and pesco-vegetarians, the lowest in vegans, with respectively 1470, 1470 and 738 mg/day (Clarys *et al.*, 2014) [4]. Protein intake was reduced ~30% in individuals consuming lacto-ovo ( $68 \pm 24$ ) and vegan diets ( $69 \pm 29$ ) as compared to those consuming meat-based diets ( $97 \pm 47$ ) g/day respectively; yet dietary protein was only associated with bone mass density for those following vegan diets (Knurick *et al.*, 2015) [18].

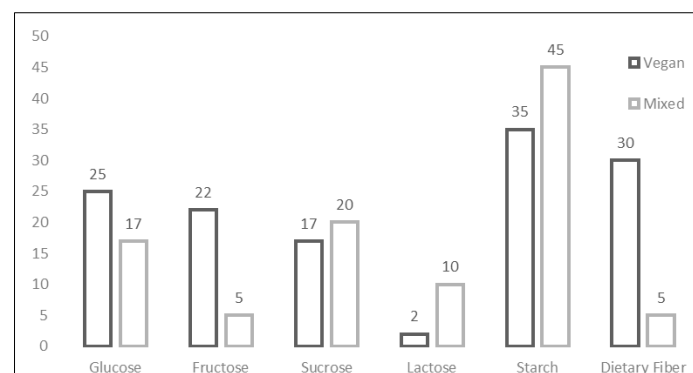


Fig 1: Carbohydrate composition in the vegan diet compared with the mixed diet (Bauer and Yeh, 2014) [10]

#### 4. Nutritional aspect of Vegan Diet

Vegan diets have increased in popularity, veganism has gained recognition as a healthy and potentially therapeutic dietary choice (Bauer and Yeh, 2014) <sup>[10]</sup>. Even the more restrictive vegan diet, with its exclusion of meat, fish, dairy and eggs, is gaining more and more popularity, especially amongst adult people (Clarys *et al.*, 2014) <sup>[7]</sup>. A vegan diet as part of a developed countries differs from a traditional plant based diet of developing countries, where it is often accompanied by restricted food availability and low energy intake, due to low income and level of education.

According to the World Health Organisation (WHO) / Food and Agriculture Organisation (FAO), 23-27 kcal/kg/day would be adequate for a healthy BMI (Body Mass Index) maintenance (18.5-24.9 kg/m<sup>2</sup>) for healthy and normally active individuals aged 18-60 (years) and slightly lower for those above 60 years old (19-22 kcal/kg/day). However, energy requirements should be adapted for body weight, sex, age, physical activity and health status, and therefore can substantially differ between individuals (Bakaloudi *et al.*, 2020) <sup>[3]</sup>.

Typical components of the vegan i.e., fruit, vegetables, low fat content, low sodium content contributed to the high total score for these components (Clarys and *et al.*, 2014) <sup>[7]</sup>. The vegan diet extract ~10% of energy from fat, 15% of energy from protein, and 75% of energy from carbohydrate that consist of vegetables, fruits, grains, and legumes. No meals were provided to meet the vitamin B<sub>12</sub> needs of the vegan group while maintaining it in body, a vitamin B<sub>12</sub> supplement (100 µg) to be taken every other day (Barnard *et al.*, 2006) <sup>[4]</sup>.

Furthermore, the possibility that a vegan health advantage may be associated with a unique gut microbiota profile will be explored as a mechanism by which a vegan diet might be protective against metabolic and inflammatory disease like Obesity, Rheumatoid arthritis, and Cardiovascular disease (Bauer and Yeh, 2014) <sup>[10]</sup>.

According to the research study conducted by Clarys *et al.* (2014) <sup>[7]</sup>, it was found that vegans obtained a zero score for the milk and dairy component since the alternatives for these products were classified under the component protein sources by plants and legumes. But vegan diets may prove useful as medical nutrition therapy in treating the conditions of metabolic syndrome, including obesity, diabetes and cardiovascular risk, and may confer protection against inflammatory conditions such as rheumatoid arthritis (Bauer and Yeh, 2014) <sup>[10]</sup>.

Veganism is also associated with low intake of vitamins B<sub>2</sub>, Niacin (B<sub>3</sub>), B<sub>12</sub>, D, iodine, zinc, calcium, potassium, selenium (Bakaloudi *et al.*, 2020) <sup>[3]</sup>. The highest Healthy Eating Index (HEI) -2010 total scores were found for the vegans and the lowest for omnivores (Clarys *et al.*, 2014) <sup>[7]</sup>. Also, other dietary components differed in vegan diet compared to normal diet. The beneficial effects of a vegan diet on human health due to the higher daily consumption of fresh fruits, vegetables, cereal grains, nuts, legumes and seeds suggesting that vegan individuals have healthier lifestyle, compared to individuals following different types of diet (Bakaloudi *et al.*, 2020) <sup>[3]</sup>.

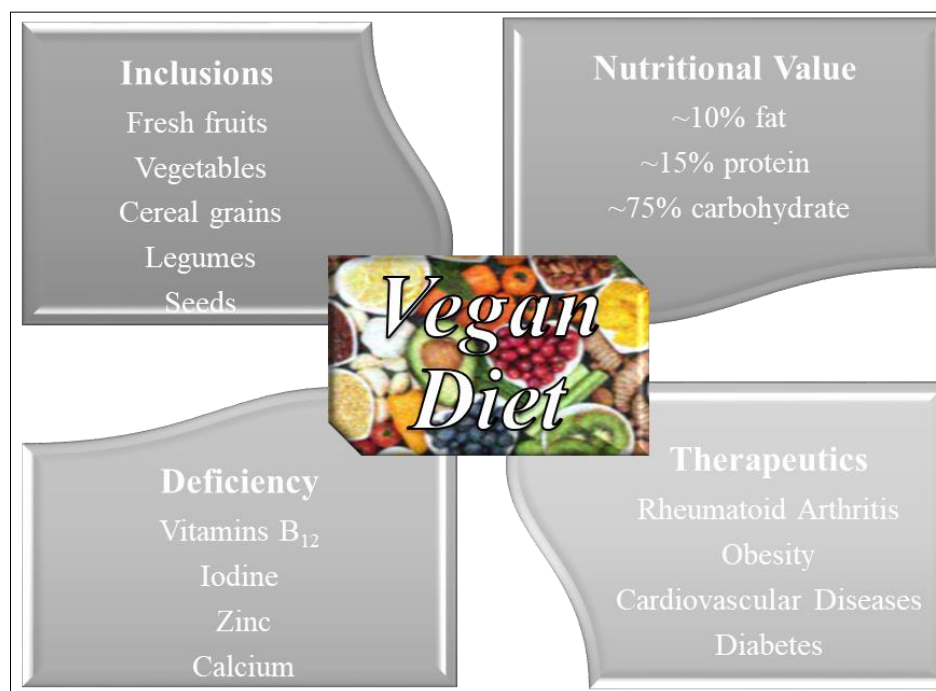


Fig 2: Nutritional aspects of vegan diet

#### 5. Beneficial effects of Vegan Diet

Vegan diets have enjoyed a rise in popularity within the past few years. Veganism is a way of living which seeks to exclude, as far as is possible and practicable, all forms of exploitation of, and cruelty to, animals for food, clothing or any other purpose (Sutter, 2017) <sup>[32]</sup>. A vegan diet has gained recognition as a healthy and potentially therapeutic dietary choice. Plant-based diets have been associated with significant improvement in emotional well-being, physical well-being, quality of life,

and general health (McEwen and Bingham, 2019) <sup>[21]</sup>.

Vegan diets are usually higher in dietary fibre, magnesium, folic acid, vitamins C and E, iron, and phytochemicals, and they tend to be lower in calories, saturated fat and cholesterol, long-chain omega-3 fatty acids, vitamin D, calcium, zinc, and vitamin B-12. In general, vegans typically enjoy a lower risk of cardiovascular disease (CVD), obesity, type 2 diabetes, and some cancers (Craig, 2019) <sup>[7]</sup>. A vegan diet appears to be useful for increasing the intake of protective nutrients and

phytochemicals and for minimizing the intake of dietary factors implicated in several chronic diseases (Radnitz *et al.*, 2020) <sup>[27]</sup>. Vegans are healthier, 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 (Craig, 2009) <sup>[7]</sup>. Vegan diets

meet all the current recommended intakes for essential nutrients as well as maximize the intake of protective components present widely in plant foods (Marsh *et al.*, 2017) <sup>[22]</sup>. Typically, vegans can avoid nutritional problems if appropriate food choices are made (Craig, 2009) <sup>[7]</sup>.

**Table 1:** Effect of consuming Vegan diet on diseases

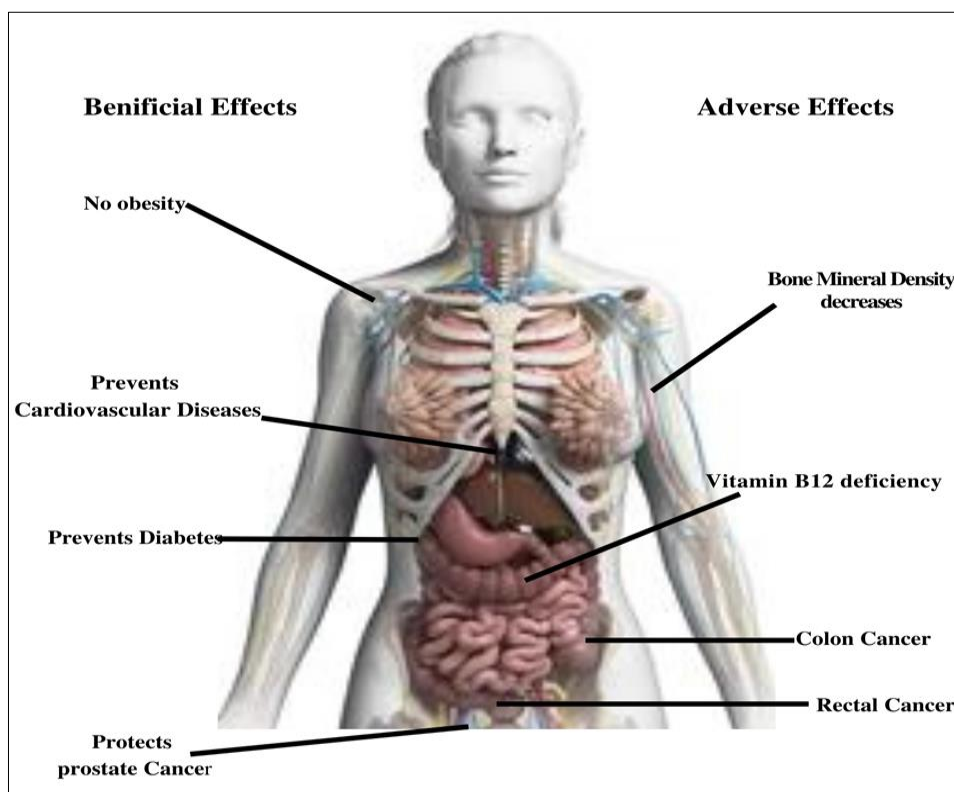
S. no.	Diseases	Mechanism	References
1.	Cardiovascular Diseases	<ul style="list-style-type: none"> <li>• Lowers the value of low-density lipoprotein (LDL).</li> <li>• Decrease in Cholesterol level.</li> <li>• Reduced the risk of hypertension.</li> <li>• Reduce the risk of heart stroke.</li> </ul>	Marsh <i>et al.</i> , 2011
2.	Cancer	<ul style="list-style-type: none"> <li>• Lower risk of colon cancer.</li> <li>• Lower incidence of colorectal cancer.</li> <li>• The bulking effect of fibre may increase the transit rate of carcinogens through the bowel.</li> <li>• Reduce the surface contact exposure of carcinogenic compounds with the bowel wall.</li> </ul>	Radnitz <i>et al.</i> , 2020 <sup>[27]</sup>
3.	Obesity	<ul style="list-style-type: none"> <li>• The lowest BMI (22.49 kg/m<sup>2</sup> in men, 21.98 kg/m<sup>2</sup> in women).</li> <li>• The lower fat intake,</li> <li>• Higher intake of dietary fibre.</li> <li>• Lower energy density.</li> </ul>	Barnard <i>et al.</i> , 2006
4.	Type 2 Diabetes	<ul style="list-style-type: none"> <li>• Vegan diet was found to have a diabetes prevalence that was approximately one third that of nonvegetarians (2.9% vs 7.6%).</li> <li>• American Diabetes Association (ADA) guidelines found that the vegan diet reduced HbA1c level.</li> </ul>	Marsh <i>et al.</i> , 2011

## 6. Adverse effect of vegan diets

Veganism is increasingly popular in western societies. Recent estimates suggest that between 3 and 5% of the population is on vegan diets, and this proportion is increasing with time vegans typically enjoy a lower risk of cardiovascular disease (CVD), obesity, type 2 diabetes, and some cancers although the difference in mortality between vegetarian and non-vegetarian groups is a controversial issue (Chang-Claude *et al.*, 2005; Key *et al.*, 2009a, 2009b). Although, vegan diets have not shown any adverse effects on health, restrictive and monotonous vegetarian diets may result in nutrient deficiencies with deleterious effects on health. (McEvoy *et al.*, 2012) <sup>[20]</sup>. The quality of vegan diets to meet nutritional needs and support peak performance among people especially athletes continue to be questioned although a properly planned vegan diet can provide a sufficient amount of energy and an appropriate range of carbohydrate, fat and protein intakes to support performance and health. Bone health among vegans has been a concern for some time, although bone mineral density (BMD) in vegetarians, particularly vegans, is lower than non-vegetarians (Ho-Pham *et al.*, 2009) <sup>[12]</sup>; the risk of fracture in vegans is different from other diet (Appleby *et al.*, 2007) <sup>[1]</sup> and thus vegan diets do have adverse effects on bone loss and fracture

but as corticosteroid use and high intakes of animal protein and animal lipid were associated with BMD. In addition to this, the potential adverse effect of a vegan diet on iron status is based on the bioavailability of iron from plant foods rather than the amount of total iron present in the diet thus haemoglobin concentrations and the risk of iron deficiency anaemia are similar for vegans (Craig *et al.*, 2009) <sup>[7]</sup>. A total elimination of all animal products from the diet increases the risk of certain nutritional deficiencies. Micronutrients of special concern for the vegan include vitamins B-12 and D, calcium, and long-chain n-3 (omega-3) fatty acids. Although vegans avoid consuming red meat and eggs altogether, they consume greater amounts of legumes than do omnivores, this protein source was seen in the Adventist Health Study to be negatively associated with risk of colon cancer (Fontana *et al.*, 2007) <sup>[9]</sup>. Data from the Adventist Health Study showed that consumption of soy milk by vegans protected them against prostate cancer whereas a high childhood dairy intake has been associated with an elevated risk of colorectal cancer in adulthood (Fontana *et al.*, 2007) <sup>[9]</sup>. In general, veganism is seen as a healthy lifestyle, because it has been suggested that individuals on vegan diets have lower risk of chronic diseases and lower risk of mortality.





**Fig 3:** Health implications of vegan diet

**7. Impact of vegan diet**

The main concern regarding these dietary approaches is the risk of developing nutritional deficiencies of proteins, ω-3 fatty acids, vitamin B12, iron, zinc, iodine, vitamin D and calcium. However, vegan diets can be appropriate for all age groups, including pregnant or lactating women, if they are well designed and balanced. People that actively choose to adopt a PBD are more concerned about the environment and animals for ethical, health, and/or financial reasons. While there are a number of clinical trials that support vegan diets, long-term clinical studies on the vegan diet are sparse. The goal of this review is to gather and compile recent accessible evidence from the literature in order to determine whether a vegan diet is beneficial for maintaining good health (Marrone *et al.*, 2021) [19, 24]. In fact, if properly balanced, the vegan diet can be a valid therapeutic adjuvant tool to counteract metabolic syndrome (MetS) onset and to reduce CVD risk (Marrone *et al.*, 2021) [19, 24]. In this review, we discuss the potential benefits arising from

the adoption of a vegan diet compared to an omnivorous diet, in order to prevent and/or treat MetS and CVD. In particular, we explored the effects induced by PBDs, focusing on vegan diet (where available) and on its impact on the clinical impairments typical of MetS, such as high blood pressure values, high body weight and body circumferences, dyslipidaemia and glucose intolerance. Moreover, we discuss the positive effects exerted by these dietary patterns on CVD risk (Noce *et al.*, 2021) [24]. Vegan diets that exclude all animal products from the food register are not adapted to the human species. The inevitable nutritional deficiencies they cause are particularly serious in children, as they will be adversely affected throughout their lives. It is therefore essential that children undergoing this type of diet be referred to competent health professionals who will prescribe the nutritional supplements essential to their dietary balance (Marrone *et al.*, 2021) [19, 24].

**Table 2:** Impact of Vegan diet on different age groups

Categories	Impacts	References
Children and Adolescent	<ul style="list-style-type: none"> <li>BMD of children was lower than that of a other type of diet.</li> <li>Although no studies in teenagers have shown that this decrease in BMD increases the risk of fracture</li> </ul>	Sutter, 2017 [32] Ambroszkiewicz <i>et al.</i> , 2019
Adult	<ul style="list-style-type: none"> <li>Needed essential amino acids (EAA) included in dietary protein are essential for the long-term preservation of muscle development and strength.</li> <li>The ability of a protein source to change muscle protein balance is determined by digestion and absorption, amino acid uptake, plasma amino acid availability, amino acid transportation to the muscle, amino acid uptake by the muscle, and intramuscular-signalling.</li> </ul>	Appleby <i>et al.</i> , 2007 Ambroszkiewicz <i>et al.</i> , 2019
Pregnant women	<ul style="list-style-type: none"> <li>All pregnant and breastfeeding women are at risk for iron insufficiency, which often necessitates supplementation following careful monitoring of iron levels.</li> </ul>	Corsello <i>et al.</i> , 2010 Marrone <i>et al.</i> , 2021 [19, 24]
Lactating Mother	<ul style="list-style-type: none"> <li>Vegan diets in lactating mothers might cause vitamin B12 deficiency in their children, putting their neurological development at risk.</li> <li>Suffering from macrocytic anaemia as a result of a vitamin B12 deficiency.</li> </ul>	Wagson <i>et al.</i> , 2008 Corsello <i>et al.</i> , 2010

## 8. Conclusion

This overview suggests that a vegan diet can cover the macronutrient recommendations i.e., carbohydrates, fats, including low saturated fatty acid, dietary fibre, total energy as reported in all studies. More intake of foods of plant source derived (fruit, vegetables, cereals, pulses and nuts), covers the needs of many micronutrients typically found in these food groups. Compared to ovo-lacto-vegetarians and omnivores, vegans have a higher intake status for several nutrients: magnesium, vitamins C, B1, B6, folic acid, as recorded and measured. It can be expected that a vegan diet also provides a wide array of phytochemicals, with potential health benefits. When assessing the micronutrient, a German qualitative study confirms that a minority of vegans do not see the necessity of a supplementation, believing that a well-balanced vegan diet provides all necessary nutrients except supplements for vitamin complex. A vegan diet is associated with a significant lower mortality risk, when compared to other vegetarian diets in men. The different intake studies show that key elements of a well-planned vegan diet are: providing adequate energy, covering quantitative protein needs, consuming vegetable and fruit, consuming iodized salt, mandatory supplementation with B12 vitamin complex, covering other macro- and micronutrient needs with an appropriate variety of food items, and supplementing for specific needs.

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