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Update to the position of the German Nutrition Society on vegan diets in population groups with special nutritional requirements

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Abstract

The position of the German Nutrition Society on vegan diets was published in 2016 [1]. Since then, several additional publications on vegan diets in population groups with special nutritional requirements have been published. In order to identify relevant publications, a systematic literature search update for the search term “vegan” was conducted in the NCBI PubMed, Embase and Cochrane databases using the four eyes principle.

The search term “vegan” yielded a total of 818 publications in the literature for the given time period. Five publications on three studies and one systematic review met the inclusion criteria. No meta-analyses were found for this topic. Since the original studies included in the systematic review were conducted outside of the time period being examined in the current update, the results of the review were excluded from the analysis.

The small amount of non-representative data that is available indicates that there is no statistically significant difference in the vitamin B₁₂ content of breast milk or in the energy intake of children when comparing vegan, vegetarian and omnivorous diets. The anthropometric data indicate that children of women who follow a vegan diet while pregnant are sometimes smaller and lighter at birth, and children fed a vegan diet in the first years of life are also sometimes smaller and lighter than children fed an omnivorous diet, but the values are mostly within the physiological range. Foods consumed by children fed a vegan diet contained more dietary fibre and had a lower added sugar content, which is positive in terms of nutrition.

There is still insufficient evidence on which to base any assessments. The position of the German Nutrition Society on vegan diets in people with special nutritional requirements therefore remains unchanged. When advising pregnant women, lactating women, or children and parents who want to follow a vegan diet or provide their children with a vegan diet, specialists should point out the risks of a vegan diet, highlight ways to deal with these risks, and provide the best possible support to help with the implementation of a vegan diet that meets nutritional requirements and thus prevents any nutrient deficiencies and allows normal development.

Keywords: vegan diets, children, adolescents, pregnant women, lactating women, vitamin B₁₂

Introduction

The position of the German Nutrition Society on vegan diets was published in 2016 [1]. The conclusion of this position was that without supplementation of potentially critical nutrients, it is difficult or impossible to ensure an adequate supply of certain nutrients with a vegan diet.

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Therefore, those who wish to follow a vegan diet should take care to ensure they are adequately supplied with these (potentially) critical nutrients, especially vitamin B₁₂. This can be achieved through the careful selection of foods with high nutrient density and by selecting foods that are enriched with the required nutrients and/or by taking nutritional supplements, as well as by having regular medical check-ups and consulting a qualified nutrition specialist (see Richter et al. 2016 [1]). In population groups with special nutritional requirements, the risk of malnutrition or nutrient deficiency when following a vegan diet is higher than for healthy adults who follow this diet. These population groups include children from infancy onwards throughout the entire growth phase, adolescents, pregnant and lactating women [2]. At the time the position was published, there was a lack of up-to-date, conclusive studies on the basis of which the supply situation for these at-risk groups could be assessed. Therefore, the German Nutrition Society did not recommend a vegan diet during pregnancy or while lactating, or during childhood or adolescence. For those who nevertheless decide to adhere to a vegan diet or feed their children a vegan diet, advice has been issued on how to prevent nutrient deficiencies (see [1]).

Because several new publications on this topic have become available since the German Nutrition Society position on vegan diets was published, a systematic literature search update was performed with regard to the aforementioned at-risk groups.

Methods

In order to identify relevant publications, a systematic literature search for the search term “vegan” was conducted in the NCBI PubMed, Embase and Cochrane databases using the four eyes principle. In addition, the reference lists of the identified publications were checked for further potentially relevant articles. Articles published in German or English between January 2016 and January 2020 were included in the analysis. Original articles, systematic reviews and meta-analyses from interventional and cohort studies that examined the nutritional status, health status and nutrient supply of population groups with special nutritional requirements were included in the analysis. Case reports were not included.

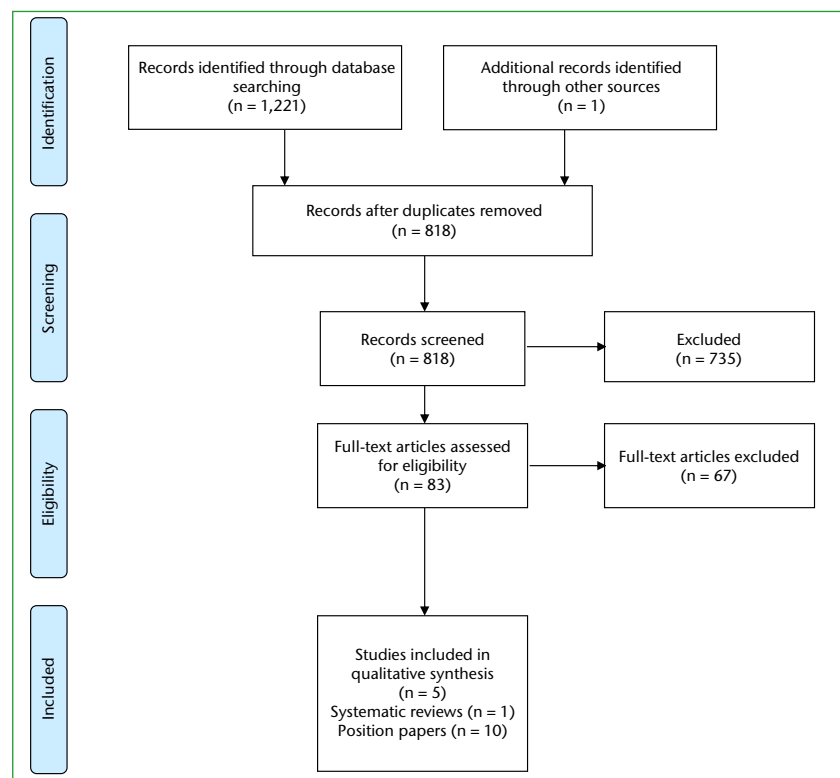


Fig. 1: Flow diagram depicting the study selection process [7]

In addition, position papers and recommendations published or modified by other professional bodies during this period were searched for.

Results

Data used for analysis

The search term “vegan” yielded a total of 818 publications in the literature for the given time period (♦ Figure 1). Five publications on three studies and one systematic review met the inclusion criteria. For this topic, no meta-analyses were found.

The systematic review analysed 24 publications from 16 observational studies or comparative studies on vegetarian diets of children. The studies were published between 1988 and 2013 and they included children aged 0 to 18 years. Only two of the included studies from 1988 and 1989 specifically evaluated data from children fed a vegan diet [3]. Since the original studies included in the systematic review were conducted outside the time period being examined in the current update, the results of the reviews were excluded from the analysis.

In addition, several publications of original data that have so far only been published in the form of abstracts for presentations given in conferences were excluded from the analysis [4–6].

♦ Table 1 lists the study characteristics for the included original articles.



Lead author, year	Country	Study design	Study population	Parameters examined
Ferrara 2019 [8]	Italy	Cross-sectional study on the impact of lacto-vegetarian / ovo-lacto vegetarian and vegan diets during pregnancy on the anthropometric parameters of the newborn Survey using an electronic questionnaire Recruitment: 9/2017–5/2018	n = 55 mothers with n = 63 children, of which n = 21 were mothers following a vegan diet with n = 21 children, n = 19 mothers following a lacto vegetarian or ovo-lacto vegetarian diet with n = 21 children, and n = 15 mothers following an omnivorous diet with n = 21 children	Mothers: anthropometric data, diet and lifestyle factors, use of nutrient supplements Children: anthropometric data at birth
Pawlak 2018 [9]	USA	Cross-sectional study on the composition of breast milk Recording of the characteristics of the study participants using an electronic questionnaire Recruitment: 11/2016–4/2017	n = 74 lactating women, of which n = 26 follow a vegan diet, n = 22 follow a lacto vegetarian or ovo-lacto vegetarian diet, n = 26 follow an omnivorous diet	Vitamin B ₁₂ concentration in breast milk Use of nutrient supplements
Perrin 2019 [10]	USA	Cross-sectional study on the composition of breast milk Recording of the characteristics of the study participants using an electronic questionnaire Recruitment: 11/2016–4/2017	n = 74 lactating women, of which n = 26 follow a vegan diet, n = 22 follow a lacto vegetarian or ovo-lacto vegetarian diet, n = 26 follow an omnivorous diet	Fatty acid composition of breast milk Use of nutrient supplements
Perrin 2019 [11]	USA	Cross-sectional study on the composition of breast milk Recording of the characteristics of the study participants using an electronic questionnaire Recruitment: 11/2016–4/2017	n = 74 lactating women, of which n = 26 follow a vegan diet, n = 22 follow a lacto vegetarian or ovo-lacto vegetarian diet, n = 26 follow an omnivorous diet	Choline concentration of breast milk
Weder 2019 [12]	Germany	VeChi Diet Study – a cross-sectional study recording energy, macronutrient intake, and anthropometrics of young children Recording of nutrient intake using a 3-day weighed dietary record, recording of lifestyle factors and anthropometric characteristics of the study participants using an electronic questionnaire Recruitment: 8/2016–3/2018	n = 430 children, of which n = 139 are fed a vegan diet, n = 127 are fed a lacto vegetarian or ovo-lacto vegetarian diet, n = 164 are fed an omnivorous diet Age 1–3 years	Nutrition Lifestyle Body weight Height

Tab. 1: Study characteristics of the five publications included

Pregnant women, lactating women, children

The study by Ferrara et al. [8] compared the height and weight development of children whose mothers followed an omnivorous, lacto vegetarian/ovo-lacto vegetarian or vegan diet during pregnancy. The women exhibited no statistically significant differences in height, weight or BMI. 95.2% of the vegan mothers and 84.2% of the vegetarian mothers reported that they had taken supplements during pregnancy, compared to 26.7% among the

omnivorous mothers. When specifying which supplements they took, 75% of the vegan women reported taking a combined supplement containing vitamin D and vitamin B₁₂, and 15% reported taking a vitamin B₁₂ supplement only.

Birth weight of all children was within the physiological range. The children whose



mothers followed a vegan diet had a statistically lower birth weight than the children in the omnivorous group, both when expressed in grams and in percentiles. In terms of the body length and head circumference of the neonates, there were no statistically significant differences between the three groups. There was no statistically significant difference between the vegan and vegetarian group or between the vegetarian and omnivorous group for any of the parameters [8].

A study in 74 lactating women following either a vegan diet, a lacto vegetarian/ovo-lacto vegetarian diet, or an omnivorous diet analysed the composition of their breast milk [9–11]. At the time of the study, the vegan participants had been following a vegan diet for 6.2 ± 5.5 years and the vegetarians had been following a vegetarian diet for 7.5 ± 5.5 years. There were no statistically significant differences between the groups in terms of the age of the participants, the number of pregnancies, ethnicity or education. However, there were some statistically significant differences in the BMI of the women and the duration of breastfeeding. The vegan women had the lowest BMIs (mean value [MV] \pm standard deviation [SD]: 22.8 ± 3.1) whereas the omnivorous women had the highest (25.8 ± 4.5). At the time of the study, the omnivorous women had breastfed for the shortest period of time (27.5 ± 19.8 weeks on average) and the vegetarian women had breastfed for the longest (54.6 ± 46.0 weeks on average) [9–11].

The median vitamin B₁₂ concentrations in the breast milk were 558 pmol/L for the vegan women, 509 pmol/L for the vegetarian women, and 444 pmol/L for the omnivorous women. There were no statistically significant differences in vitamin B₁₂ concentration between the groups. Overall 13 women had a low vitamin B₁₂ concentration in the breast milk (< 310 pmol/L): 19.2% of the vegan women, 18.2% of the vegetarian women and 15.4% of the omnivorous women. There was no statistically significant difference between the groups in terms of the prevalence of low vitamin B₁₂ concentration in the breast milk. 58 of the women took nutrient supplements containing vitamin B₁₂, and the vitamin B₁₂ concentration of these ranged from 4 to 5,000 μ g. There was a statistically significant difference between the three diet groups in terms of the percentage of women who took a vitamin B₁₂ monopreparation. The propor-

tion was highest among the women who followed a vegan diet. There was no difference between the groups in terms of intake of supplements containing several nutrients. The use of a vitamin B₁₂ monopreparation was positively associated with higher vitamin B₁₂ concentration in the breast milk [9].

Another publication examined the fatty acid composition of breast milk. Statistically significant differences in concentrations of saturated, unsaturated and trans fatty acids were found. The breast milk of the omnivorous women contained the highest levels of saturated and trans fatty acids and the breast milk of the vegan women contained the highest levels of unsaturated and n-3 fatty acids, which was due to differences in the levels of α -linolenic acid (ALA). Overall, 82% of the study participants had a low proportion of docosahexaenoic acid (DHA) in the breast milk (i.e. $< 0.3\%$). Eicosapentaenoic acid (EPA) could not be detected in over half of the samples. There was no difference between the three groups in terms of the prevalence of a low proportion of DHA. Ten of the participants reported that they had taken DHA/EPA supplements (26.9% of the vegan group, 9.1% of the vegetarian group and 3.9% of the omnivorous group). The use of these supplements was a statistically significant positive predictor of the ALA, DHA and n-3 fatty acid concentrations of the breast milk and a negative predictor of the n-6 to n-3 fatty acid ratio [10].

In a secondary analysis, the choline concentration of breast milk was also examined. There was no difference in total choline concentration between the three groups. The breast milk of vegan women had a statistically significantly higher concentration of glycerophosphocholine and a lower concentration of phosphocholine compared to vegetarian and omnivorous women. The authors state that it is still unknown whether these differences are biologically relevant [11].

The VeChi Diet Study [12] examined the intake of energy and macronutrients and anthropometric data of children fed a vegan, lacto vegetarian/ovo-lacto vegetarian or omnivorous diet in Germany. There was no statistically significant difference between the groups in terms of the children's energy intake or the energy density of their food. The omnivorous children had the highest total intake of protein, total fat and added sugar, whereas the vegan children had the highest intake of carbohydrates and dietary fibre [12].

The children were classified by birth weight into small for gestational age (SGA; birth weight \leq 10th percentile), appropriate for gestational age (AGA) and large for gestational age (LGA; birth weight \geq 90th percentile). There was no statistically significant difference between the percentages of the children in the three categories. The proportion of children who were too light for their gestational age at birth was 18.7% in the vegan group, 17.8% in the vegetarian group and 15.5% in the omnivorous group; the proportion of children who were too heavy for their gestational age was 10.1%, 3.9% and 1.2% respectively in each of these groups [12].

There were no statistically significant differences between the three investigated groups in the anthropometric data (parameters for the evaluation of height and weight in relation to age: Z-scores height for age, weight for age and weight for height). Even after adjustment for various covariates, there were no statistically sig-



Professional body and publication	Position regarding vegan nutrition in population groups with special nutritional requirements
International	
<p>Europe Complementary feeding: a position paper by the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) Committee on Nutrition [13]</p>	<p>For pregnant and breastfeeding women following a vegan diet, it is necessary to ensure an adequate nutrient supply, especially of vitamins B₁₂, B₂, A and D, by taking nutrient supplements or by eating fortified foods. Infants should only be fed a vegan diet with appropriate medical supervision and with nutrition counselling from a qualified specialist. Parents should understand the serious consequences of an undersupply of essential nutrients, including irreversible cognitive damage and death. In the case of infants/young children in particular, careful attention is required to ensure an adequate supply of critical nutrients (vitamin B₁₂, vitamin D, iron, zinc, folate, long-chain n-3 fatty acids [especially DHA], protein and calcium) and to ensure adequate energy density. A vegan diet with appropriate supplementation can support normal growth and development.</p>
National	
<p>USA Position of the Academy of Nutrition and Dietetics: Vegetarian Diets [14]</p>	<p>Appropriately planned vegetarian, including vegan, diets, are healthful and nutritionally adequate. They may provide health benefits for the prevention and treatment of certain diseases. Vegans require reliable sources of vitamin B₁₂, such as fortified foods or supplements. Purely plant-based diets are appropriate for all stages of life, including pregnancy, lactation, infancy, childhood, adolescence, older adulthood, and for athletes. Vitamin B₁₂ intake of vegan infants and children should be assessed and fortified foods and/or supplements used as needed to insure adequacy.</p>
<p>Italy Position paper on vegetarian diets from the Working Group of the Italian Society of Human Nutrition [15]</p>	<p>Well planned vegetarian diets that include a wide range of plant foods and a reliable source of vitamin B₁₂ provide adequate nutrient intake. A separate statement on vegan diets is not given.</p>
<p>Italy Scientific Society for Vegetarian Nutrition (SSNV) Vegan nutrition for mothers and children: practical tools for healthcare providers [16]</p>	<p>A well planned vegan diet can meet nutritional requirements and it can be suitable for all stages of life, including pregnancy, lactation, infancy and childhood. A well-planned vegan diet should: a) include a wide variety of plant-based foods eaten throughout the day and should not exclude any plant-based food groups and b) pay attention to ensuring an adequate supply of potentially critical nutrients. Especially during pregnancy, lactation, infancy and childhood, critical nutrients include protein, n-3 fatty acids, iron, zinc, iodine and calcium. Pregnant and lactating women and parents who feed their child a vegan diet must be aware of the dietary sources of potential critical nutrients and the food preparation techniques and cooking practices that enhance their bioavailability. If sun exposure is insufficient or ineffective, vitamin D supplements are required. Vitamin B₁₂ supplementation is essential for all vegans.</p>
<p>France Vegan diet in children and adolescents. Recommendations from the French-speaking Pediatric Hepatology, Gastroenterology and Nutrition Group (GFHGNP) [17]</p>	<p>A vegan diet does not meet all micronutrient requirements. Therefore, there is a risk of nutritional deficiencies that can have serious consequences, especially when this diet is introduced at an early age, a period of significant growth and neurological development. A vegan diet is not recommended for infants, children and adolescents due to the risk of nutritional deficiencies that are inevitable in the absence of supplements and can have lifelong negative effects. If, despite this, a vegan diet is followed, regular dietary monitoring is essential. Supplementation of vitamin B₁₂ and vitamin D is always necessary, while calcium, iron, zinc, iodine and DHA should be supplemented on a case-by-case basis. It is therefore essential that children undergoing a vegan diet be referred to competent health professionals who will prescribe the nutritional supplements essential to their dietary balance.</p>
<p>Spain Position paper on vegetarian diets in infants and children. Committee on Nutrition and Breastfeeding of the Spanish Paediatric Association [18]</p>	<p>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. New tools have recently become available to facilitate a vegetarian diet and help decrease the risk of deficiencies. Like any diet, a vegetarian or vegan diet should be carefully planned. Vitamin B₁₂ supplementation is required at all ages. A vegetarian diet at any age is not necessarily unsafe but it is advisable for infants and young children to follow an omnivorous diet or, at least, an ovo-lacto vegetarian diet.</p>
<p>Austria Safety and risks of vegetarian and vegan nutrition during pregnancy, lactation and the first years of life. Statement by the Nutrition Committee of the Austrian Society of Pediatric and Adolescent Medicine on the safety and risks of various forms of vegetarian and vegan nutrition of the mother during pregnancy and lactation and in infants and toddlers [19]</p>	<p>For the safe implementation of vegetarian diets during pregnancy, lactation and early childhood, good knowledge of nutrient requirements and the supply of critical nutrients is essential. The risk of severe vitamin B₁₂ deficiency symptoms in infants of pregnant and lactating mothers following a vegan diet without vitamin B₁₂ supplements has been shown to be particularly high. Due to the necessity of dietary supplementation, insufficient study data, and inconsistent dosage data for safe vitamin B₁₂ supplementation, a vegan diet for pregnant and lactating women and young children cannot be recommended by the Nutrition Committee of the Austrian Society of Pediatric and Adolescent Medicine at present. If a vegan diet is nonetheless pursued, professional medical and dietary supervision is essential.</p>
Germany	
<p>Diet and lifestyle before and during pregnancy – practical recommendations from the Germany-wide Healthy Start – Young Family Network [20] Nutrition and physical activity of infants and breastfeeding women. Updated recommendations from “Healthy Start – Young Family Network, an IN FORM initiative” [21]</p>	<p>In the case of a purely plant-based (vegan) diet, the supply of critical nutrients must be checked by a physician and individual nutritional counselling given. As well as iodine and folic acid, additional micronutrient supplementation (particularly vitamin B₁₂) is required to prevent a nutrient deficiency and subsequent damage to the child's development [20]. A vegan diet of a breastfeeding mother carries serious health risks, especially for the development of the infant's nervous system. A vegan diet always requires special medical advice and the intake of micronutrient supplements [21].</p>
<p>Vegetarian diets in childhood and adolescence. Position Paper of the Nutrition Committee. German Society for Pediatric and Adolescent Medicine (DGKJ) [22, 23]</p>	<p>With restrictive diets, the more the range of foods is restricted, the greater the risk of the development of nutrient deficiencies. Without appropriate and consistent supplementation, a vegan diet (excluding all animal-derived foods) leads to vitamin B₁₂ deficiency in the long term. Therefore, dietary supplementation is necessary. Moreover, particular attention should also be paid to the supply of iron, zinc, iodine, DHA, calcium, protein and energy to reduce the risk of serious clinical consequences such as failure to thrive, anemia or neurological damage. The supply of vitamin B₁₂ is not only critical for children and adolescents fed a vegan diet, but can also cause serious deficiency symptoms in the infant due to insufficient intake during pregnancy and breastfeeding. Therefore, pregnant and breastfeeding women on vegan diets should ensure they have an adequate intake of vitamin B₁₂ by taking oral supplements.</p>



nificant differences between the groups in the average parameters for assessment of height and weight in relation to age. However, 3.6% of the vegan children and 2.4% of the vegetarian children were categorized as too small for their age according to the WHO growth standards. By contrast, a higher proportion of the omnivorous children (3.0%) were classified as overweight or in the range of potential risk for overweight (20.1%) compared to the vegan children (2.2% and 15.8% respectively) and the vegetarian children (2.4% and 15.7% respectively) [12].

International and national statements and position papers

Since the German Nutrition Society position on vegan diets [1] was published, numerous national and international professional bodies have published or updated position papers and statements on vegan diets. Their positions are shown in ♦ Table 2.

Discussion

The aim of this update of the position of the German Nutrition Society on vegan diets [1] was to systematically review all articles on nutrient supply and the health status of population groups with special nutritional requirements that have been published since the initial publication of the position. Only five publications from three studies with original data on the nutritional and health status of vegan pregnant women, lactating women and/or children that were published since January 2016, could be identified.

Therefore, data on nutrient supply in population groups with special nutritional requirements remains very scant. Furthermore, the studies included in this update do not cover all of the (potentially) critical nutrients.

Vitamin B₁₂ and lactation

As expected, the supply of vitamin B₁₂ was examined. It was found that the vitamin B₁₂ concentration of breast milk or the prevalence of low concentrations did not differ statistically significantly between women with vegan, vegetarian and omnivorous diets. The intake of vitamin B₁₂ supplements was positively associated with vitamin B₁₂ concentration in the breast milk [9]. Although the available study results indicate that many vegan lactating women do supplement with vitamin B₁₂ – which is absolutely necessary on a vegan diet to ensure an adequate supply of this vitamin – the available data must nevertheless be considered insufficient due to the small number of available studies on the topic and the lack or representativeness among the study participants.

Fatty acid concentration of breast milk

In addition to vitamin B₁₂ concentration, the fatty acid concentration of breast milk was also examined. The breast milk of vegan women had the highest content of unsaturated fatty acids and n-3 fatty acids. DHA was low across all three groups [10]. There is no evidence of metabolic compensation for low EPA and DHA intake. However, there are only very limited data on DHA status in pregnant women, lactating women and children on vegetarian (including vegan) diets. The available studies mostly only involved a small number of participants. Furthermore, there are no studies on how low DHA status due to maternal vegetarian or vegan diets may affect cognitive function in children [24]. Therefore, further studies on n-3 fatty acids in the vegan diet will be required to obtain more robust results.

Energy intake and energy density

Energy intake and energy density, which were examined in only one of the studies, did not differ between children on vegan, vegetarian and omnivorous diets [12]. For all three diet types, the energy intake was below the German Nutrition Society reference value for children aged 1 to 4 years (with a Physical Activity Level [PAL] of 1.4). The intakes of the energy-supplying nutrients carbohydrates and fat differed between the different diets, but the intakes were within the respective reference values. For all three groups, protein intake was above the recommended protein intake [2].

However, there are no representative data available on intakes and supply status, especially for micronutrients. Although the data of the VeChi Youth Study will be published in the 14th Nutrition Report of the German Nutrition Society in 2020, the results of this one study will improve the insufficient data situation only to a limited extent.

Anthropometric data

With regard to the anthropometric development of the children, the studies that were evaluated show that children whose mothers followed a vegan diet during pregnancy or who were fed a vegan diet were sometimes smaller than children in the omnivorous group, although the differences were partly not statistically significant [8, 12]. If a child's birth weight is not classified as SGA [12] and their development is considered physiological [8], a lower birth weight may be beneficial in terms of obesity prevention.

◀ Tab. 2: International and national statements and position papers regarding vegan nutrition in population groups with special nutritional requirements
DHA = docosahexaenoic acid



National and international differences

The national and international statements and position papers that have been newly published or revised since 2016 reflect the fact that the available scientific evidence is being evaluated and interpreted in a variety of ways. The US Academy of Nutrition and Dietetics considers a well-planned vegan diet healthy and nutritionally appropriate for all stages of life [14], but the French-speaking Pediatric Hepatology, Gastroenterology and Nutrition Group [17] and the Nutrition Committee of the Austrian Society of Pediatric and Adolescent Medicine [19] do not recommend a vegan diet for infants, children, adolescents [17] and pregnant women, lactating women or young children [19] due to the risk of nutrient deficiencies and due to the lack of study data and the lack of consensus around the dosages for safe vitamin B₁₂ supply.

However, all of the professional bodies emphasize the necessity of adequate supplementation of nutrients, especially vitamin B₁₂. In addition, they emphasize the need for medical advice and/or qualified nutrition counselling for population groups with special nutritional requirements in the case of a vegan diet [13, 14, 16, 18–22]. The Italian Scientific Society for Vegetarian Nutrition also describes the requirements for a well-planned vegan diet and the knowledge that pregnant women, lactating women and parents who want to feed their children a vegan diet need to have [16].

One reason for the variation in how the risk of nutrient deficiencies is assessed in different countries is that the underlying food situations in these countries are very diverse. For example, in the USA, fortification of foods is a widespread practice (including enrichment of vegan foods with vitamin B₁₂ and other potentially critical nutrients), which means that the risk of nutrient deficiencies is lower overall. This benefits people on special diets, including those following a vegan diet.

However, there is no nationwide fortification of foods in Germany, which means that the baseline situation is different. This may justify different recommendations.

Potential benefits

Assuming that the diet contains all essential nutrients, is rich in nutritionally beneficial nutrients such as dietary fibre and is low in added sugar and saturated fat, a vegan diet (like other plant-based diets) can have long-term beneficial effects on children's health. Examples include a lower prevalence of overweight or obesity and a lower risk of cardiometabolic diseases in adulthood [25]. However, there are currently no long-term data on these associations.

Considerations for practice

The topic of a vegan diet for people with special nutritional requirements is becoming increasingly important in practice. A survey of pediatricians from Germany about the relevance of vegan nutrition and the need for information and communication structures in relation to this topic highlights the increased relevance of the topic “vegan nutrition in children” in practice: among 65 pediatricians interviewed, 60% were caring for children on a vegan diet [26].

Therefore, health professionals who intend to advise pregnant women, lactating women or parents who are vegan and/or want to feed their children a vegan diet should:

- have comprehensive knowledge of the risks of a vegan diet,
- point out ways to deal with the aforementioned risks and
- provide the best possible support in the implementation of a vegan diet that meets nutritional requirements and thus prevents any nutrient deficiencies and maldevelopments.

Practice-oriented scientific reviews and reference works (e.g. [16, 20–22, 27–29]) may be helpful in this respect. Software can also be used for planning better vegan meals for children and adolescents (for example, a Spanish working group developed a program for swapping foods [30]).

Limitations

This article has some limitations that should be considered in the qualitative evaluation. Although the literature search was performed in three databases using the four eyes principle and an additional review of the reference lists, it is possible that not all relevant publications were included. Furthermore, publications written in other languages than German or English were not considered. In addition, congress reports for which no subsequent full publication could be identified were not considered due to a lack of detailed information on the studies [4–6]. This may also have left relevant results unconsidered.

Conclusions

Because the available data remain insufficient, no satisfactory assessment can be made with regard to micronutrient intake and supply status or prevalence of nutrient deficiencies or other adverse health effects regarding a vegan diet in these special population groups. However, the small amount of non-representative data that is available indicates that there is no statistically significant difference in the vitamin B₁₂ concentration of breast milk or in the energy intake of children when comparing vegan, vegetarian and omnivorous diets. The anthropometric data shows that children whose mothers followed a vegan diet while pregnant and children who are fed a vegan diet in early childhood are sometimes smaller and lighter at birth or in early childhood than



omnivorous children, but the values are still mostly within the physiological range. The diet of vegan children contained more dietary fibre and had a lower added sugar content, which is positive in terms of nutrition.

Due to the largely unchanged insufficient basis of evidence, the position of the German Nutrition Society on vegan diets in people with special nutritional requirements remains unchanged:

- The German Nutrition Society still does not recommend a vegan diet during pregnancy or lactation, as well as in infants, children and adolescents due to the increased risk of under-supply of nutrients and nutrient deficiencies and the consequences of this, some of which are irreversible.
- A well-planned and wholesome food selection as well as the reliable supplementation of vitamin B₁₂ and if necessary other critical nutrients can contribute to an adequate supply of nutrients and thus to a health promoting diet.
- Pregnant women, lactating women, children and adolescents who want to follow a vegan diet and parents who want to feed their children a vegan diet, need particularly well-founded nutritional knowledge. Therefore, nutrition counselling from a qualified specialist is strongly recommended.
- Specialists should point out the risks of a vegan diet, highlight ways to deal with these risks, and provide the best possible support to help with the implementation of a vegan diet that meets nutritional requirements and thus prevents any nutrient deficiencies and maldevelopments.

The potential health benefits of a vegan diet have not been systematically considered for this update of the German Nutrition Society's position. It is unclear whether the effects that have been observed in adults [31, 32] would apply to children and adolescents. Therefore, no conclusive statement can be made regarding this at the moment. However, it is important to the authors not only to focus on deficiencies, but also to point out that there are indications of beneficial health effects and that these should be subjected to systematic analyses.

Conflict of Interest

The authors declare no conflict of interest.

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Important comment:

Scientific findings are constantly changing as a result of new research and clinical experience – especially in the fields of nutritional science and medicine.

The authors, editors and publisher of this publication have examined the contents of this work with the greatest care and have carefully considered the advice given. Liability for personal injury, material damage or financial losses is excluded.



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