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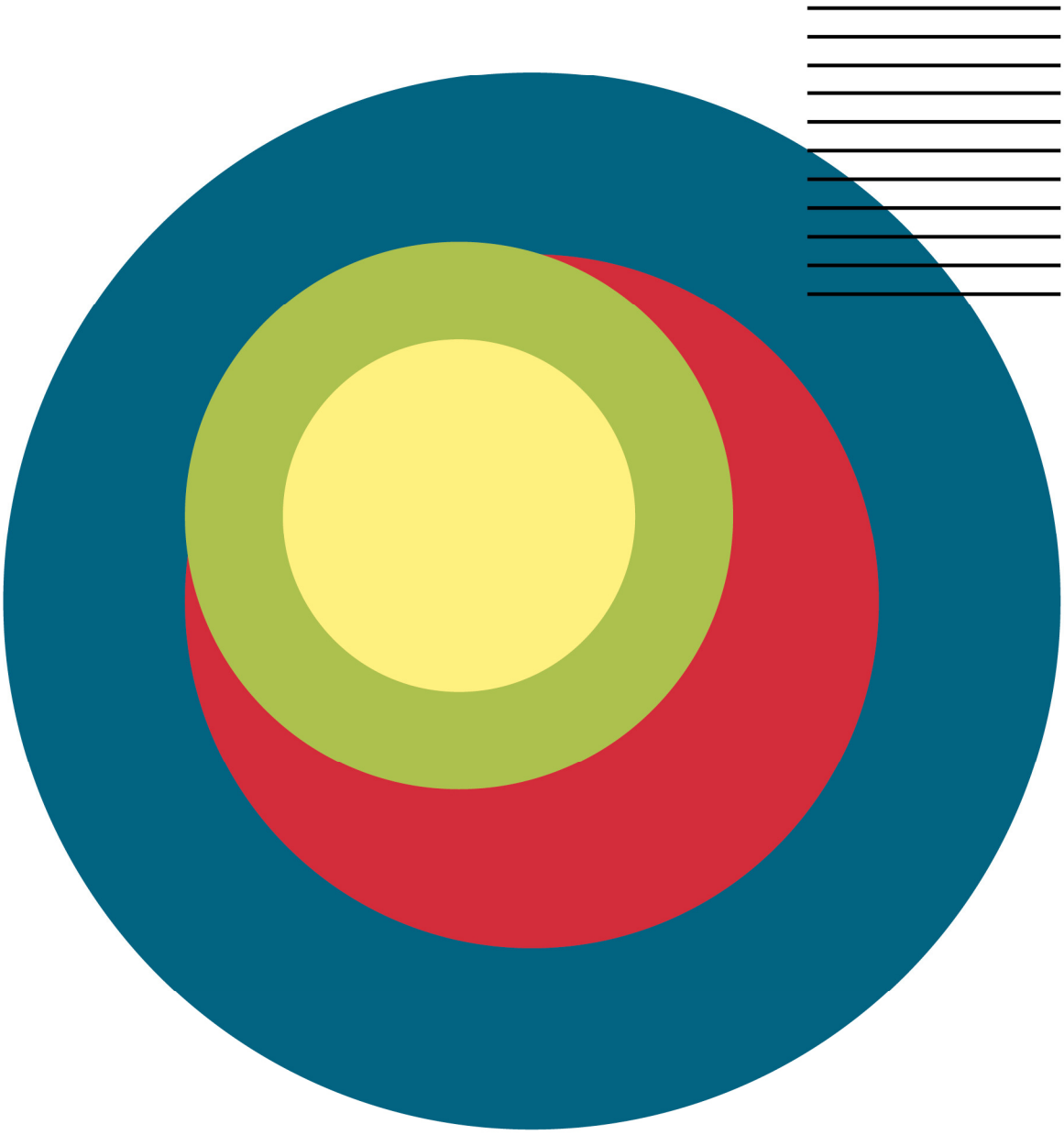
Vegan diets: review of nutritional and health benefits and risks

Management summary and recommendations



Content

1 Introduction and objectives of this review

Current dietary recommendations, such as the Swiss food pyramid, include foods of both animal and plant origin. Advocates of an exclusively plant-based (vegan) diet are finding more and more echoes in the popular media; along with ethical and sustainability motivations, health reasons are being put forward.

The Swiss Federal Commission for Nutrition (FCN) concluded in its 2006 report "Gesundheitliche Vor- und Nachteile einer vegetarischen Ernährung" that a vegan diet requires a very high degree of nutritional competence in order to avoid nutrient deficiencies (e.g. vitamin B12). The FCN therefore stated that a vegan diet cannot be recommended at a general population level, and is particularly critical for specific population groups, such as children, pregnant women and older adults.

The objective of this narrative review is to independently evaluate recent investigations and recommendations and then to outline whether a revision of the 2006 FCN nutritional recommendations for the Swiss population is necessary. In this event, recommendations addressed to the Federal Food Safety and Veterinary Office (FSVO) and other stakeholders should be evidence-based. These recommendations will be focused on aspects pertaining to potential nutritional risks and benefits of a vegan diet. Reviewing environmental and ethical aspects of a vegan diet is beyond the scope of this report.

2 Methods

The literature search for this narrative review was performed with the keywords "vegetarian" and/or "vegan" in bibliographic databases. Inclusion criteria were: publication date after 2006, definitions of vegan diets and /or studies on the association between vegan diets and potential health outcomes such as possible nutrient deficiencies, selected biomarkers for non-communicable diseases (NCDs), and selected NCDs. Furthermore, the selection favoured larger primary studies (cross-sectional surveys, prospective cohorts and randomised control studies) performed in Europe and the USA, as well as meta-analysis and systematic review articles. Available Swiss statistical data were collected to assess the prevalence of vegetarianism/veganism.

3 Overview of the individual chapters

3.1 Historical / anthropological / philosophical aspects *(Salvatore Bevilacqua)*

Veganism, as a lifestyle including and going beyond simple food choices, excludes all edible goods originating from animals. Its underlying philosophical premise is based on an ethical principle that does not accord legitimacy or necessity to any form of animal exploitation. Veganism has its roots in the vegetarianism of the 19th century. The term "vegan" itself was coined in Scotland in 1944 by Donald Watson, and follows anti-speciesism principles of not discriminating against other animal species and respecting their different rights. According to this worldview, nothing justifies that animals are "naturally" available for human needs.

From a socio-anthropological perspective, veganism cannot be reduced to a homogeneous set of dietary and consumption practices defining a social group per se. The phenomenon should be seen as a lifestyle guided by an ethical deal and a personal fulfilment search whose meanings and motivations are variable and are part of a wider system of social representations and food trends that are linked with increasingly widespread values in Western societies. These representations and values are based on a reflexive and proactive attitude in regard mainly to exploitation and animal abuse, individual health and environmental sustainability.

Current anti-speciesism stands on an ethical and moral vision that involves responsibility and even guilt in human domination and violent destruction of animals for consumption. The process that leads an individual to consume exclusively plant products reflects an ethical awareness and a critical choice (or even a duty) to relinquish properties, nutritional and symbolic, historically and culturally attributed to killed animal flesh. The ensuing "food decision" is the result of a process of rationalization and incorporation by the individual which, depending on its cultural frame of reference and its successive socialisations, leads him to "choose" one or other diet and to define himself in relation to the "opposite" one.

Environmental concerns also lead to a general preference for organically grown food. In a German study with over 800 vegans, the major motivations for choosing a vegan diet were objections to mass animal husbandry, environmental concerns and health issues. In a US study with both vegetarians and vegans, ethical reasons (animal rights, ethics, spiritual beliefs, environment and non-specified other ethical reasons) were more commonly (75%) given as a reason for becoming vegetarian/vegan. Health reasons (general health, weight loss, other health-related reasons) were mentioned by 18.5% of the participants; other minor reasons were taste, family/friends, upbringing, politics and saving money. A recent qualitative study performed in Germany also concludes that ethical and political considerations are the main motivation for a vegan lifestyle.

3.2 Definitions and statistics *(Beatrice Baumer)*

In general, vegetarian and vegan diets are characterized by abstention from the consumption of foods of animal origin, the extent of which can vary, but generally excludes consumption of animal flesh. Swiss food legislation has defined conditions required for the labelling of vegetarian foods:

a) "Vegetarian" or "ovo-lacto-vegetarian", whenever neither ingredients, nor processing aids, of animal origin are included, with the exception of milk, milk components such as lactose, eggs, egg components and honey.

b) "Ovo-vegetarian", whenever neither ingredients, nor processing aids, of animal origin are included, with the exception of eggs, egg components and honey.

c) "Lacto-vegetarian", whenever neither ingredients, nor processing aids, of animal origin are included, with the exception of milk, milk components and honey.

d) "Vegan", whenever no ingredients of animal origin are included.

These definitions are consistent with a large part of the reviewed literature where, however, veganism also excludes processing aids of animal origin. Furthermore, some studies included participant groups following specific forms of near-vegetarian diets (e.g. pesco-vegetarians). An overview of the different diet forms reported in the literature is provided in the main report. However, this classification is not standardized, and most studies rely mainly on self-reporting or on general questions concerning intake of food items of animal origin, based on food frequency questionnaires developed for the general, omnivorous population.

The most recent data on the prevalence of veganism in the adult population in Switzerland are provided by the menuCH survey (based on 2'000 respondents, with an estimated prevalence of 0.38%, data collected in 2014–2015); another study, commissioned by Swissveg, showed a prevalence of 3% +/- 0.9 (data collected in 2016). The data provided by Swissveg show that the prevalence is higher among younger population groups. For further studies, the recommendation is to follow up with more specific questions on the motivations for and duration of the vegan diet.

3.3 Vegan diets from the nutrient perspective *(Beatrice Baumer)*

A number of European studies published since 2015 have investigated vegan diets and calculated nutrient intake based on country-specific food item lists and the corresponding food composition databases. Some studies also analyzed biological samples (blood, urine). At a macronutrient level, mean intake values often fulfil general nutritional recommendations; however, the variability, as seen in the standard deviations, is very high. This could be problematic in the case of protein intake. No study performed an analysis of intake patterns in order to identify possible sub-groups (i.e. groups with a diet fulfilling dietary requirements vs groups with potentially unbalanced diets). The data confirm that a vegan diet covers the recommended fibre intake and is low in saturated fatty acids.

Variability in dietary patterns is observed whenever data is provided on fruit and vegetable intake. It appears that on average the recommended intake (approx. three portions of vegetables and two portions of fruit) is covered, here again with a very wide variability in consumption. These data suggest that there is no evidence that a vegan diet is always associated with a dietary pattern rich in fruit and vegetables. It is therefore difficult to assume that a vegan diet automatically benefits from the advantages of a fruit and vegetable rich diet. This is one of the axioms of most position papers.

Concerning micronutrient data, the data are often limited by the lack of specific data on supplementation. Most studies show that vitamin B12 supplementation, although necessary, is not widespread (50–70% of participants). Lack of detailed information on possible supplementation limits the evidence degree of calculated intake data, which show that deficiencies are possible, in particular for iodine (higher than for other dietary forms), calcium (high variability, with an average intake of approx. 800 mg/day being reported) and possibly selenium.

Calculated intake data do not take into account the bioavailability of the different micronutrients; of particular concern are zinc and iron, which can be bound in phytate complexes. Analyses of blood and urine samples for selected nutrients show specific deficiencies (below cut-off values) in a sample of Swiss vegans, e.g. for zinc and iodine. In the same sample, vegans and vegetarians were more susceptible to vitamin B2 and B6 deficiencies than omnivores.

In conclusion, well-planned vegan diets could cover energy and nutrient needs, but require good knowledge about food composition, and supplementation based on individual regular blood monitoring for the most critical micronutrients.

3.4 Pregnancy and breastfeeding *(Katharina Quack-Lötscher)*

Data are lacking on this topic. In general it is assumed that a vegan diet would need to take into account the specific higher nutrient needs in pregnancy and breastfeeding. The critical nutrients in pregnancy are the same that are critical in a vegan diet. For this reason, monitoring of pregnant women following a vegan diet (e.g. blood samples) and nutritional counselling are necessary.

3.5 Infancy *(Oswald Hasselmann, Pascal Müller)*

Little is known about the prevalence of infants and children fed on a vegan diet in Switzerland. In a large German nutritional survey (KiGGS study) only 1.7% of boys and 3.2% of girls older than 3 years reported a vegetarian diet; no information is available about children on an exclusively vegan diet.

When choosing a particular diet for a child, caregivers should be aware that the consumed food will form the basis for the rapidly developing biological organism. Furthermore, the type of early nutrition has an influence on feeding preferences as adults. When parents/caregivers decide on a vegan diet for their young children, they depart from well-established feeding patterns and assume the whole responsibility of providing adequate nutrition for their children.

Due to the limited data on the impact of vegetarian diets in childhood, it remains difficult to draw conclusions on long-term health benefits or risks of these diets. The common (mainly adult-based) knowledge about potential nutrient deficiencies should form the basis for preventive substitution of missing nutrients or adaptation of vegan diets in childhood, taking into account specific nutrient needs.

Plant protein has a lower digestibility and a more limited amino acid composition than animal-derived protein. Its intake should be increased by 30–35% for children up to the age of two years, by 20–30% for two to six year olds and by 15– 20% for those older than six years of age to meet the required level. This will translate into an additional 2 to 14 g of high-quality protein per day, which is needed to fulfil the higher requirements for essential amino acids in infancy and childhood, compared to adulthood. To ensure a complete and sufficient essential amino acid supply, a well-planned mixture of different plant-derived proteins should be provided within a 24-hour period.

If an infant cannot be breastfed, the only adequate alternative for a vegan diet is a soy-based methionine-fortified infant formula. Compared to infant formulas based on cow's milk, soy-based formulas can have a higher concentration of phytates, aluminum and phytoestrogens; nevertheless, a systematic review concluded that modern soy-based infant formulas were safe, regarding growth and bone health as well as metabolic, reproductive, endocrine, immune and neurological functions.

Omega-3 fatty acids (ALA, EPA, DHA) are essential for neurological development. As DHA and EPA are abundant in seafood and algae, a child not receiving these foods can only rely on precursors such as ALA. Preterm children are at higher risk of developing a deficiency. Supplementation with long-chain n-3 fatty acids could be considered.

Iron requirements are higher during infant growth and adolescent growth spurts. Children low on iron seem to score lower in developmental screening tests. Due to the potentially decreased bioavailability of iron and zinc in plant-based foods, children fed on a vegan diet should increase their iron intake by 1.8 times, compared to those fed on animal products. Sufficient amounts of vitamin C rich food can in part increase the bioavailability of iron. Data on zinc serum concentrations are sparse and difficult to correlate with dietary intake. Clinical signs of deficiency are rare among vegetarian and vegan children. Zinc should be supplemented (5 mg Zn/day for children aged 6–36 months, 10 mg Zn/day for older children) in the case of a low dietary intake. Dietary intake of vitamin D in a vegan diet is very limited, but vitamin D can be produced endogenously via skin exposure to ultraviolet light, however, the recommended minimum of 30 min/day on uncovered arms without sunscreen application is not always feasible or possible. Children with a limited dietary intake, lack of sun exposure, or dark skin, are at risk of hypovitaminosis D and are encouraged to supplement with 600 IU of vitamin D3.

The abstinence from milk and milk products in a vegan diet decreases the intake of calcium, relevant for infants after being weaned from breast milk or supplemented infant formulas. Green vegetables are good sources of bioavailable calcium. Alternative sources are calcium-fortified plant drinks, juices and calcium-rich water.

As with other micronutrients, the content of iodine in breast milk is dependent on the iodine status of the mother. Low intakes during pregnancy and breastfeeding can exacerbate an iodine deficiency, in both mother and infant. Infants fed with formula milk receive the recommended daily supply of 80 µg per day. A risk of iodine deficiency can occur if they are solely fed with self-prepared food. To prevent a deficiency, the FCN publication "Ernährung in den ersten 1000 Lebenstagen" recommends partially replacing self-prepared food with iodine-supplemented food or adding iodine supplementation of 50 µg per day. An unsupplemented vegan diet is lacking in vitamin B12; a prolonged vitamin B12 deficiency will lead to a severe and potentially not fully reversible delay in the neuropsychological development of affected children. Vitamin B12 deficiency under a vegetarian diet (measured by MMA and holoTCII) has been reported in 25%–86% of children. Breastfed infants will suffer from birth if their mother's milk is low in vitamin B12. There are so far no studies giving evidence on the necessary quantity and time interval of orally supplied vitamin B12 to reach a physiologically adequate concentration. The recommended supplementation of vitamin B12 for breastfed vegan

infants is 0.4 µg/day during the first four months after birth and 0.8 µg/day from five months of age.

3.6 Ageing *(Roger Darioli, Beatrice Baumer)*

No longitudinal prospective study was found monitoring very long-term vegan diets (including the assessment of specific dietary patterns and degree of adherence) and their impact on health. The consequences of long-term adherence to a vegan diet compared to the impact of a dietary switch to a vegan diet at a later stage of life have also not been investigated. No specific vegan dietary recommendations have been made for an ageing population. General nutrient recommendations for older adults are often higher than for healthy adults (<65 years old); some of the critical nutrients are those which are often at risk of deficiency in a vegan diet, e.g. protein, vitamin D, zinc, vitamin B12 and calcium. A vegan diet could therefore exacerbate nutritional deficiencies, which could be critical in the case of polymorbidity and frailty. In particular, protein recommendations for older adults following a vegan diet should be investigated, taking into account the higher needs at older ages (1.0–1.2 g/kg body weight) and the possible lower digestibility of plant proteins.

3.7 Vegan diets and non-communicable diseases *(main author Roger Darioli)*

Both the previous report and several authors, including a US position paper, have given a favorable evaluation for the impact of well-balanced vegetarian diets on health outcomes such as NCDs. These views were mainly based on the assumption that vegetarian and vegan diets are rich in fruit and vegetables. This high intake, combined with the lack of meat and low saturated fats, would have a protective effect against non-communicable diseases.

Historically, results from Seventh-Day Adventist (SDA) studies have provided most data for this assumption, showing significant decreases in the risks of NCDs. SDA vegetarians and vegans exhibit generally heathier lifestyles than non-vegetarians. In a non-SDA context, conflicting results arise, both disproving the assumption that vegans consistently eat a high quantity of fruit and vegetables, and that vegan diets therefore significantly reduce the risk of NCDs.

3.7.1 Overweight / obesity

Observational and case-control studies show that a long-term vegan diet is associated with a lower body weight than an omnivorous diet. A follow-up study (EPIC–Oxford) over 5.3 years shows that a vegan diet does not prevent age-associated weight gain; however, the annual weight gain is significantly lower in the vegan participants, compared to omnivores. The mean age-adjusted BMI (kg/m2) increased from values of 22.6 to 23.2 (male vegans) and from 22.4 to 22.9 (female vegans), whereas omnivores had an initial mean age-adjusted BMI of 24.7 (males) and 23.8 (females), and increased to 25.3 and 24.8 respectively. In this study the vegan group had a lower mean energy intake (-279 kcal/day, compared to omnivores). This study does not permit a conclusion as to whether the vegan diet or the caloric restriction contributed to the lower BMI.

Weight loss in overweight / obese subjects

The question thus arises whether a vegan diet could be an effective weight-loss strategy in overweight or obese subjects. Several systematic reviews and meta-analysis of mostly randomized controlled trials (RCTs) have shown that a vegan diet can lead to significantly greater weight loss in comparison to their control (non-vegetarian) diet groups. However, these changes are not statistically different from other weight-loss diets reported in a recent systematic review and meta-analysis, such as energy-reduced omnivore diets, ovo-lacto-vegetarian diets, or Atkins diets. Most of these studies have a high heterogeneity and are of a rather short duration, in addition to other limitations that reduce their scientific evidence to level C. Therefore, long-term intervention trials are needed to investigate the effects of vegan and vegetarian diets, taking into account caloric restriction, weight loss and further health benefits (e.g. NCD risks).

3.7.2 Type 2 Diabetes

The role of nutrition and other lifestyle factors in the prevention and treatment of type 2 diabetes (T2DM) has been recognised. There is good evidence (grade A) of the impact of a balanced energy intake and weight loss (-5% of body weight), as well as B-grade evidence for diets with fruit and pulses as the main carbohydrate sources that are rich in fibre. These are potential benefits of a well-planned vegan diet. Therefore, recent epidemiological literature was screened in order to evaluate the impact of a self-chosen vegan diet on the risk of T2DM (preventive effects) and the efficacy of a vegan diet as a nutritional therapeutic approach.

Prevention

A case-control study performed with the Adventist Health Study 2 (SDA) showed that the adjusted odds ratio (OR) for the prevalence of self-declared T2DM was 0.51 for vegans, 0.54 for ovo-lacto-vegetarians, 0.70 for pesco-vegetarians and 0.76 for semi-vegetarians, when compared to the reference group (omnivores). Furthermore, in a subgroup in this SDA cohort, after a follow-up of two years, a lower incidence of T2DM for vegans (0.54%), lacto-ovo-vegetarians (1.08%), pesco-vegetarians (1.29%) and semi-vegetarians (0.92%) was reported, compared to the omnivores (2.12%, $p<0.001$). No data have been mentioned for non-SDA subjects; furthermore, a direct comparison with other lifestyle and dietary choices which have shown a protective effect (e.g. Mediterranean diet) is still lacking, therefore vegan diets are not specifically recommended to delay T2DM.

Therapy

In a 2014 systematic review, vegan diets (N=4) and lacto-vegetarian diets (N=1) were compared to control diets, using glycated hemoglobin A1c (HbA1c) measurements as the outcome in T2DM patients. In the pooled analysis, consumption of vegan diets was associated with a significant mean reduction in HbA1c (-0.39%), compared to non-vegetarian diets. The corresponding mean reduction in fasting blood glucose levels was not significant. In this analysis, consumption of vegetarian diets was also associated with significant mean differences in energy intake (-139.8 kcal/day) as well as for the other macronutrients. The magnitude of the effect size on fasting glucose levels is approximately one-half of that seen with metformin, which is used as first-line oral therapy for elevated HbA1c levels.

A 2013 systematic review on dietary approaches to the management of T2DM, based on RCTs, showed that the largest reduction in HbA1c was observed for a Mediterranean diet (-0.47%); the only vegan RCT reported in this study showed a significant reduction (-0.41%) when compared to the diabetic diet recommended by the American Diabetic Association. The changes were however non-significant when reported for the intention-to-treat analysis. The authors thus concluded that low-carbohydrate, low-glycemic index, Mediterranean and high-protein diets are effective in improving glycemic control and should be therefore considered in the overall strategy of T2DM management; no specific recommendations were given for the vegan/vegetarian diets.

In conclusion, given the limited number of studies with sufficient methodological quality providing a low level of scientific evidence (C), new findings are required to assert that vegan diets offer more advantages than non-vegetarian diet for the metabolic control of type 2 diabetes.

3.7.3 Cardiovascular diseases

Today, cardiovascular diseases (CVD) such as ischemic heart disease (IHD) and stroke significantly increase the burden of disease in Switzerland (e.g. premature deaths, CVD morbidity, rising costs in the health sector).

Risk factors for cardiovascular diseases

Healthy dietary practices have been recommended as a cornerstone of CVD prevention in all individuals, in particular plant-based dietary patterns, due to a variety of reported health benefits on overall health and on cardiovascular (CV) risk and disease in particular. Most evidence for the association between nutrition and CVD is based on observational studies; randomized clinical trials estimating the impact of diet on clinical endpoints are scarce. The aim of this chapter is to highlight scientific knowledge concerning the influence of vegan diets on CV risk factors and CVD morbidity and mortality, namely ischaemic heart disease (IHD) and cerebrovascular disease (CerVD).

Risk factor hypertension

The main diet-related determinants of hypertension are high salt intake, obesity and excess alcohol consumption. Western vegetarians have a lower average BMI than non-vegetarians, but do not necessarily have low intakes of salt and alcohol. A systematic review with meta-analysis examined the association between vegan and vegetarian diets and blood pressure. In the 32 observational cross-sectional studies considered, vegetarian diets were associated with both a significantly lower mean systolic blood pressure (BP) and diastolic BP, when compared to omnivorous diets. A significant reduction of systolic BP (-28 to -4.9 mmHg) was also observed in the four vegan studies included in the systematic review. Due to the wide heterogeneity of these results and the multiple limitations of such studies, the scientific evidence for the anti-hypertensive effects of vegan and vegetarian diets must be considered as low (C).

In the same publication, a meta-analysis was performed, based on seven controlled trials, with participants without hypertension at the baseline. Vegetarian or vegan diets were associated with a significant reduction in mean systolic BP (-4.8 mmHg) and diastolic BP (-2.2 mmHg), compared to omnivorous diets. The magnitude of the anti-hypertensive effect was less pronounced here than in the observational studies. Overall, these effect sizes are similar

to those observed with commonly recommended lifestyle modifications, such as adoption of a low-sodium diet or a weight reduction of 5 kg, and are approximately half the magnitude of those observed with pharmaceutical therapy. Because the two vegan diets had diverging outcomes, it is not possible to draw a conclusion regarding the effect of this diet on BP; further studies are necessary.

Risk factor dyslipidemia

Vegan and vegetarian diets may have a beneficial effect on the blood lipid profile due to the lower intake of saturated fats and higher intake of fibre, thus lower concentrations of TC, LDL-C and TG are to be expected, when compared to omnivore diets. This topic was subject of a systematic review and meta-analysis, based on an RCT. A majority of recruited patients were diabetics or with BMI >25 kg/m² and some were receiving lipid lowering agents. The results provide evidence that vegetarian diets significantly lower the mean blood concentrations of total cholesterol, LDL-cholesterol and HDL-cholesterol (pooled estimated changes were -0.36 mmol/l, -0.34 mmol/l and -0.10 mmol/l respectively), without affecting triglyceride levels. The observed reduction in cholesterol levels was significant in two of the four vegetarian diet studies. Among the six vegan studies, the estimated changes in cholesterol ranged from -0.78 to 0 mmol/l, and were significant only in two older studies (published before 2002).

Again, the studies included in this meta-analysis suffer from several limitations acknowledged by the authors and consequently reduce the level of scientific evidence (C). Moreover, the causal evidence chain, linking changes in lipid profile induced by vegetarian diets to effective CVD prevention, is still lacking.

Cardiovascular diseases

An older collaborative analysis of five prospective studies showed that mortality from IHD was 26% lower in vegans (RR 0.74) and 34% lower for other vegetarians (RR 0.66), when compared to omnivores. This study was based on observational studies that suffered from major limitations, and therefore does not provide a sufficient degree of evidence to allow extrapolation to the general population.

Prevention of cardiovascular diseases

To examine whether vegan and vegetarian diets, as compared to non-vegetarian diets, are associated with reduced incidence of a first CV event, the risk of hospitalization for incidents of non-fatal or fatal IHD was analysed among participants in the EPIC–Oxford study. After an average follow-up of 11.6 years, vegetarians (including vegans) had a significant 32% lower risk of IHD events than did non-vegetarians, when adjusted for factors such as BMI, age, smoking, alcohol, physical activity, educational level, etc. The stratified analysis by sex showed a significant risk reduction of non-fatal and fatal IHD in both men (-26%) and women (-36%). However, no specific analysis was performed here to examine whether vegan diets might be associated with similar benefits for CerVD or CVD in general.

Studies were performed with two Danish religious community cohorts (Danish Seventh-Day Adventist Church (SDA) and Baptists), both encouraging healthy lifestyles, in particular abstention from smoking and alcohol consumption. The SDA community additionally recom-

mends an ovo-lacto-vegetarian diet, and encourages physical activity and stable social relationships. During the 12-year follow-up, incidence rates for the first IHD were significantly lower in women (-9%), but not significantly in men (-8%), when compared with the general Danish population. For a first CerVD this ratio was not significantly lower, either in women (-3%) or in men (-7%). Similar trends were obtained among the Baptists, with a significantly lower incidence ratio of IHD in women (-22%) but not in men (-3%), while the ratio for CerVD was not significantly reduced, either in women (-6%) or in men (-8%). Whether similar results could be obtained by vegan diets needs to be determined.

Due to the very small number of studies available to date (two Danish studies, one EPIC–Oxford), and to the limitations of such observational studies, the scientific evidence in favour of vegetarian diets for the primary prevention of CVD is low. Nevertheless, the results reported here show that vegetarian diets are associated with a significant reduction in the risk of hospitalization for a first IHD in women, but not clearly in men, and with a non-significant reduction for CerVD. Whether vegan diets may have similar effects has not yet been demonstrated. Further research is clearly required to prove the potential benefits of vegan and vegetarian diets for the primary prevention of CVD.

CVD mortality

In the period between 2007 and 2018, three systematic reviews looked at prospective cohort studies, evaluating the link between vegetarian diets and the risk of CV mortality; these reviews overlap extensively in terms of their selected primary studies, but differ in perspectives and follow-up.

In a first review of seven studies, significantly lower IHD mortality rates were observed in vegetarians and vegans combined, compared to a non-vegetarian diet. Lower, but not significant, rates were observed for CerVD mortality and circulatory disease mortality. In a second review, data were stratified by diet type (without specific data for vegan diets) and by SDA/non-SDA studies. This study showed that significantly lower IHD mortality rates were observed mainly in SDA studies; non-SDA studies also showed a slight reduction. A similar trend, with more beneficial effects, albeit non-significant, reported in the SDA cohorts, was observed for CerVD mortality. In a third review, similar observations were confirmed.

Two recent studies, not included in these three reviews, confirm the differences between SDA and non-SDA cohorts; furthermore, these studies include specific data for vegans. The SDA studies also provide data stratified by sex; in particular, the subgroup of vegan women showed an increase for CVD total risk (non-significant), and specifically for IHD (significant), when compared to omnivores. For vegan men, a significant decrease was observed for both CVD total mortality and IHD mortality. The non-SDA cohorts were analysed not by sex, but by disease. Only one result was comparable for both cohorts: the non-significant reduction (-10%) of IHD mortality for vegans, when results for men and women are combined. Otherwise, the non-SDA cohorts showed a non-significant increase for CerVD and total CVD mortality, when compared to omnivores. These results contradict the historic conclusion of long-term benefits of vegan diets on CVD risks. Further research, with more detailed analysis and stratification (e.g. by by sex) is necessary, before vegan diets could be added to the nutritional guidelines for the prevention of CVD in the general population.

3.7.4 Cancer

The previous report concluded that cancer incidence and mortality were lower among vegetarians than among non-vegetarians, with men benefiting rather more than women. Vegan diets were not mentioned.

Cancer incidence

Recent meta-analysis of three cohort studies suggests that, in comparison with non-vegetarian diets, vegan diets might be associated with a significantly lower risk of all cancers (-15%, all results pooled and adjusted). Similar results were observed for all cancers in both the individual SDA and non-SDA cohorts. No significant association was found between a vegan diet and the different specific cancer sites. A direct and more specific comparison between SDA and non-SDA studies is only possible for a few cancer types, in part showing contrasting, albeit non-significant risks, e.g. for colorectal cancer, -14% (SDA) and +31% (non-SDA EPIC–Oxford study). For other cancer forms, e.g. prostate cancer, the SDA cohort shows a significant risk decrease (-34%), whereas the decrease is non-significant in the non-SDA cohort (-39%). The SDA showed a significant increase in urinary tract cancers (+73%).

Cancer mortality

In contrast, the evidence available to date is still insufficient to confirm that vegan and vegetarian diets are associated with a significant reduction in risk of mortality due to all cancers pooled.

Once again, SDA and non-SDA studies lead to partially contrasting results for all cancers pooled, but in particular for breast cancer and colon cancer. A meta-analysis suggests that a longer diet duration (follow-up >14 years) can increase the risk of breast cancer, contrasting with the significant reduction for breast cancer observed with shorter follow-up (<14 years). These results challenge the expectations that a long-term plant-based diet would have a protective effect on these specific cancer forms.

3.7.5 All-cause mortality

In the previous report, it was assumed that plant-based diets (rich in fruit, vegetables and nuts) were associated with a higher life expectancy. No specific data on all-cause mortality were included for vegan diets.

The recent data are derived from one systematic review and meta-analysis (including seven cohort studies), and two single cohort studies suggest that the scientific evidence for an association between total mortality risk and vegan diets (or vegetarian) diets, is inconclusive. Moreover, these data also suggest that vegan diets do not seem to provide advantages over other vegetarian diets. In view of the importance of dietary patterns for life expectancy, further research is necessary to assess the long-term effects of vegan vs vegetarian vs other diets on all-cause mortality.

3.7.6 Bone frailty

Although vegan diets include bone-protecting constituents and could decrease the potential renal acid load (PRAL), as well as urinary calcium, there is no evidence that these improve

bone health, as stated in the previous report, derived from studies on the effects of a plant-based diet, but not necessarily vegan diets. In two recent case-control studies, a modest trend (significant in one study) towards a lower bone mass density, with a non-significant higher risk of fracture, was observed when comparing vegan diets to omnivorous diets. The EPIC–Oxford cohort also showed a non-significant increase in incidence risk ratio for all bone fractures (+15%) predominantly among men, even after adjustment for multiple confounding factors (follow-up of 5.2 years on average). However, this risk was not increased among vegans consuming more than 525 mg calcium/day. Due to the paucity of available data, more research is necessary to determine the long-term consequences of vegan diets on bone health.

3.7.7 Irritable Bowel Syndrom (IBS)

The existing data suggest a significant increase in IBS symptoms when following a vegetarian/vegan diet. Further research is required to investigate the effects of FODMAP-reduced vegetarian/vegan diets, which would then be very restricted diets, possibly linked to nutrient deficiencies.

3.7.8 Fertility

The topic of fertility disorders was not discussed in the previous report. Due to the clinical relevance of this issue, the paucity of available data and the discrepancies between results, further research is required to elucidate the impact of vegan/vegetarian diets on fertility, and to deliver appropriate advice to young people interested in or choosing such diets.

3.7.9 Mental diseases

Mental disorders were not specifically discussed in the previous report. Despite inconclusive data based on the previous case-control studies, recent available European data suggest that vegetarian diets might be associated with a higher risk of mental disorders. However, further studies are needed to clarify this topic.

3.7.10 Eating disorders

This topic was not mentioned in the previous report. Recent studies show contrasting results, possibly due to different methodological approaches. Further prospective studies, with appropriate designs, are necessary, in particular with younger population groups, and a longer follow-up might be required.

4 Conclusions and recommendations

A well-planned and supplemented vegan diet could in theory cover nutrient needs; however, results show that in reality deficiencies for some nutrients are common. If highly motivated adult subjects want to adopt or maintain a vegan diet, they should be made aware of dietary guidelines, supplementation needs and possible monitoring precautions.

Guidance is needed, provided either by societies endorsing vegan lifestyles (Swiss Vegan Society, Swissveg), or by the Swiss Society of Nutrition, as well as by dieticians, paediatricians and gynaecologists. Ideally, these recommendations should include food items most commonly consumed in Switzerland. Communication strategies should take into account the underlying motivation for choosing a vegan diet.

More nutritional data is needed for food items frequently consumed by vegans, e.g. vitamin B12 content in fermented products. More data on phytate and oxalate content would be interesting. More research on the impact of processing and cooking on the phytate content of foods could be encouraged.

Monitoring of intake of selected nutrients which are generally critical in the Swiss population, and not only in vegan subjects, e.g. iodine and selenium, is recommended (calculated, but also verified with biological samples). Monitoring campaigns should include an assessment of eating habits, including supplements and fortified food intakes. An estimate of the percentage of organic food vs non-organic food could also provide information on potential pesticide residue risks.

The latest European studies show that the effects of long-term vegan diets on health (NCDs such as CVD, T2DM) are not indisputably beneficial. Given the small number of vegan studies and the limited scientific evidence derived from divergent results on NCDs, more research is needed before recommending such a diet as a public health measure in Switzerland. These studies should furthermore consider the demographic shift towards an ageing population and take into account the duration of vegan diets (and possibly life-long alternating patterns, or switches between various forms of diets), typical eating patterns and motivations for a vegan diet, as well as lifestyle choices.

Further information:
The complete report (in English) was approved by the Federal Commission for Nutrition on the 30th November 2017, on condition of some details to be integrated in the final version. This report is available online at: https://www.eek.admin.ch/eek/de/home.html

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