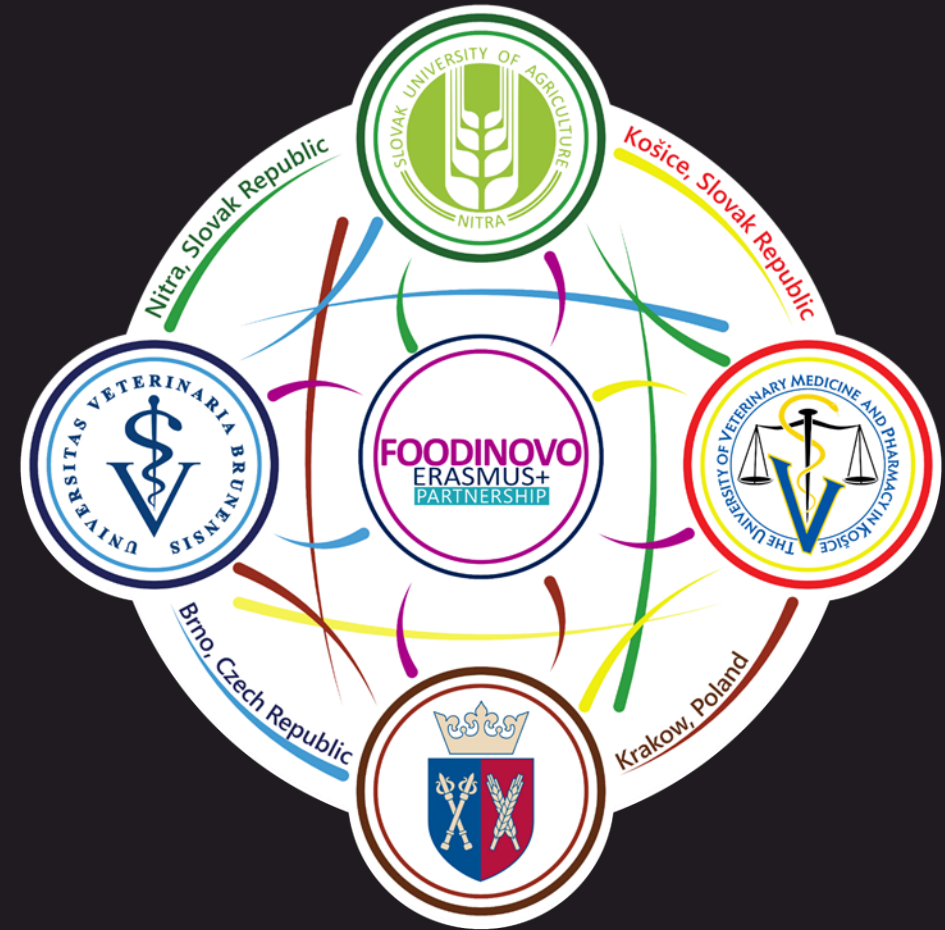


# Plant-based diet



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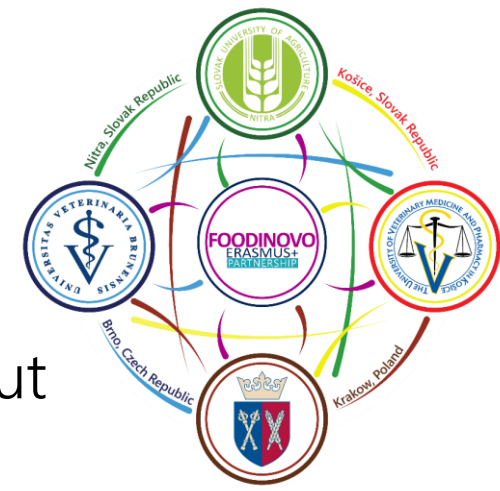
# Presentation plan

1. Plant-based diet - definitions, ethical considerations.
2. Types of plant-based diets.
3. Dietary characteristics of vegetarian diets.
4. Assessment of the impact of plant-based diets on human health: non-communicable disease prevention e.g. obesity, cardiovascular diseases, cancer, diabetes, chronic kidney disease, total mortality.
5. Benefit-risk analysis related to vegan and vegetarian diets, meeting the nutrient reference values, e.g. protein, iron, B<sub>12</sub>, n-3 fatty acids, vitamin D.
6. The vegetarian and vegan nutrition pyramid.
7. Conclusions.



# Introduction

- More and more people are shifting towards plant-based diets for reasons relating to health, as well as to ethical considerations about climate change and animal welfare (WHO, 2021).
- Diet that is predominantly plant-based and low in salt, saturated fats and added sugars is recommended as part of a healthy lifestyle.
- Such diets are widely associated with a lower risk of premature mortality and offer protection against noncommunicable diseases (NCDs). This advice complements the overall evidence indicating that limiting consumption of red meat (beef, pork and lamb) and processed meat (such as sausages and cured, smoked and salted meats) could protect against various NCDs.
- Nevertheless, strict plant-based diets, such as vegan diets, also raise concerns about micronutrient deficiencies (such as iron and vitamin B<sub>12</sub>).



# Definition



- Vegetarianism is a broad term that encompasses a diverse and heterogeneous range of dietary practices.
- According to the Academy of Nutrition and Dietetics, a vegetarian diet is one that "*does not include meat (including fowl) or sea-food, or products containing these foods,*" which varies from one that incorporates dairy products (lacto-vegetarianism) or eggs (ovo-vegetarianism) to one that avoids all flesh, dairy, and egg foods and sometimes honey (veganism).



# Types of plant-based diets

- Plant-based diets constitute a diverse range of dietary patterns that emphasize foods derived from plant sources coupled with lower consumption or exclusion of animal products.

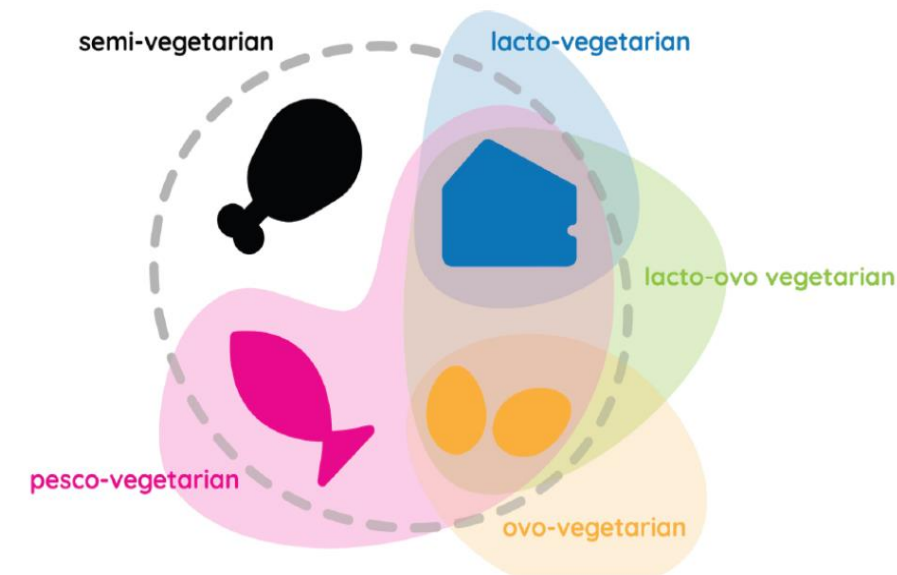


## Common vegetarian diets

- **Vegan** diets omit all animal products, including meat, dairy, fish, eggs and (usually) honey.
- **Lacto-vegetarian** diets exclude meat, fish, poultry and eggs, but include dairy products such as milk, cheese, yoghurt and butter.
- **Lacto-ovo vegetarian** diets include eggs and dairy, but not meat or fish.
- **Ovo-vegetarian** diets exclude meat, poultry, seafood and dairy products, but allow eggs.
- **Pesco-vegetarian** (or **pescatarian**) diets include fish, dairy and eggs, but not meat.
- **Semi-vegetarian** (or **flexitarian**) diets are primarily vegetarian but include meat, dairy, eggs, poultry and fish on occasion, or in small quantities.

# Types of plant-based diets

- Vegetarian diets typically comprise of plant foods such as grains, legumes, nuts, seeds, vegetables, and fruit, and exclude all kinds of animal food including meat (pork, beef, mutton, lamb, poultry, game, and fowl), meat products (sausages, salami, and pâté), fish, mollusks, and crustaceans.
- Vegetarian diets usually include dairy products, eggs and honey. Then we distinguish two main directions:
- (1) Lacto-ovo-vegetarianism (LOV). This excludes meat but includes dairy products, eggs, and honey, together with a wide variety of plant foods. Subcategories are lacto-vegetarianism (LV), which excludes eggs, and ovo-vegetarianism (OV), which excludes dairy products.
- (2) Veganism (VEG), which excludes meat, dairy products, eggs, and honey, but includes a wide variety of plant foods.



# Prevalence of vegetarianism in the world

- India ranks first among nations with the largest population of vegetarians, and 40% of Asian Indians are vegetarian. Not surprisingly, India ranks first among nations with the largest population of vegetarians, estimated to be 300–400 million.
- Vegetarianism in India is unique in many ways. It is usually practiced lifelong and spans across multiple generations.
- As against the Western perspective of vegetarianism being a lifestyle choice adopted during adulthood, vegetarianism in India is a tradition since birth.
- People consume vegetarian diets due to ethical, moral, cultural, religious, or political reasons. They constitute a significant minority of the world's population.



## Which Countries Have The Most Vegetarians?

India, which ranks No. 1, has cultural and religious traditions that promote vegetarianism.



RadioFreeEurope  
RadioLiberty

(\*) Estimate  
C. Coelho. Sources: USDA, UN Food and Agriculture Organization, media reports.



# Vegan diet

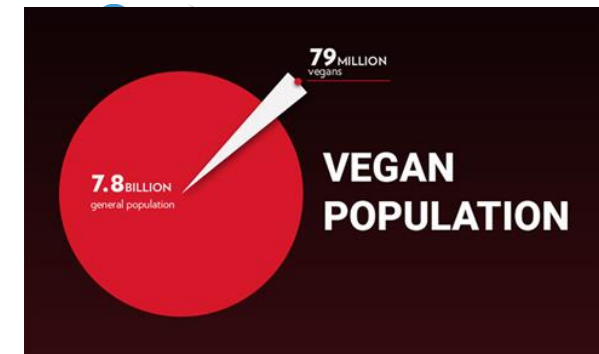
- Regarding macronutrients, vegan diets are lower in protein intake and have a low glycemic load compared with all other diet types. No significant differences in fat intake is observed.
- Veganism is also associated with low intake of vitamins B<sub>2</sub>, Niacin, B<sub>12</sub>, D, iodine, zinc, calcium, potassium, selenium. Vitamin B<sub>12</sub> intake among vegans is significantly lower (0.24-0.49 mg, recommendations are 2.4 mg) and calcium intake in the majority of vegans is below recommendations (750 mg/d).
- Vegan diets are not related to deficiencies in vitamins A, B<sub>1</sub>, B<sub>6</sub>, C, E, iron, phosphorus, magnesium, copper and folate.
- Following a vegan diet may result in deficiencies in micronutrients (vitamin B<sub>12</sub>, zinc, calcium and selenium) which should not be disregarded.
- However, low micro- and macronutrient intakes are not always associated with health impairments. Individuals who consume a vegan diet should be aware of the risk of potential dietary deficiencies.





# Vegan diet

- Veganism has increased in popularity and exposure across the Western world. The prevalence of vegans in Europe has been estimated to be between 1 and 10%.
- The vegan diet is mainly associated with religious and ethical beliefs, environmental concerns, cultural and social values, as well as potential health benefits.
- Several studies have shown 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 behaviors, compared to individuals following different types of diet.
- Such health benefits have been suggested to include, among others, a lower incidence of non-communicable diseases (NCD), such as colon cancer, type 2 diabetes mellitus (DMT2), as well as obesity, non-alcoholic fatty liver disease (NAFLD) and cardiovascular diseases (CVD).

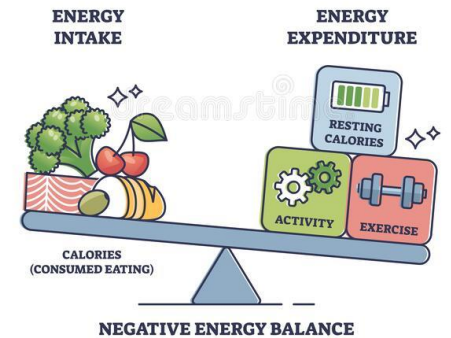


# Energy intake

- In the majority of studies, a vegan diet was characterized by the lowest total energy intake (TEI), followed by vegetarians.
- Despite having a lower TEI, vegans met the recommended daily intake of Energy, with intakes ranging between 1672 and 2055 kcal/d (7.0-8.6 MJ/d)
- Carbohydrates and soy protein are the main energy sources for vegans. According to the WHO/FAO 23-27 kcal/kg/d would be adequate for a healthy BMI maintenance (18.5-24.9 kg/m<sup>2</sup>) for healthy and normally active individuals aged 18-60 and slightly lower for those above 60 years old (19-22 kcal/kg/d). However, energy requirements should be adapted for bodyweight, sex, age, physical activity and health status, and therefore can substantially differ between individuals.
- TEI among vegans is reported as in the lower levels of the normal range.
- The majority of vegans are characterized by a lower body weight, which is often associated with a lower energy intake. This implies consumption of less food, which by definition makes vegans more prone to a lower nutrient intake.



## ENERGY BALANCE



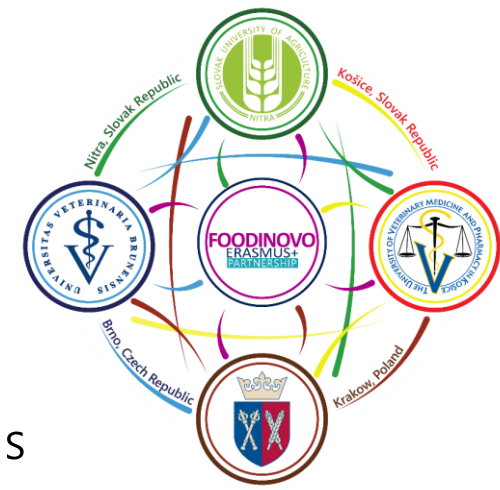
# Carbohydrates and fibers

- A vegan diet is characterized by a high consumption of carbohydrates. Fiber intake is higher in vegans than in omnivorous subjects.
- Over 50% of TEI derived from carbohydrates and fibers for vegans.
- A vegan food pattern can lead to an increased consumption of carbohydrates and fibers. High fiber intake (>30 g/d), mainly from fruits and vegetables, is common in vegan diets. Such high fiber diets can play a significant role in glycemic control and can have a protective role against insulin resistance and DMT2.
- Studies showed that shifting from a non-plant based diet to a plant-based diet can reduce the incidence of DMT2 by 53%.



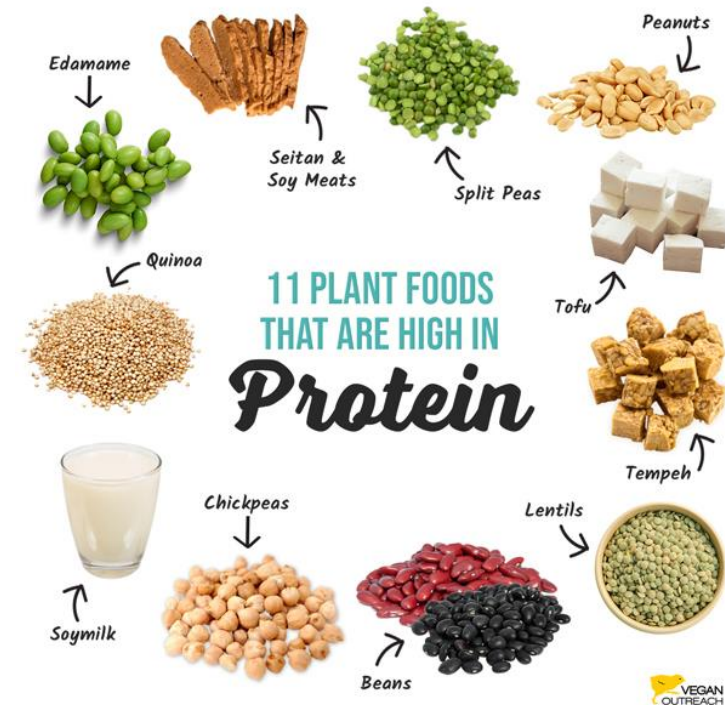
# Fats

- TEI from fats among vegans is in agreement with the WHO guidelines (<30% of TEI). However, significant differences are noticed in the consumption of fat subgroups (MUFA, PUFA, SFA).
- Intake of monounsaturated fatty acids (MUFA) and saturated fatty acids (SFA) is lower among vegans, with the main source of fat being polyunsaturated fatty acids (PUFA) .
- Studies showed that mean daily intake of SFA is 21 g among vegans, rising to 54 g for omnivores. The mean consumption of PUFA n-3 and n-6 among vegans was 1.7 g/d and 15.0 g/d respectively. Vegan diets are characterized by lower consumption of MUFAs and SFAs, and higher consumption of PUFAs.
- PUFAs are obtained from food and cannot be synthesized in the body. Rich-sources for PUFAs include rapeseed/canola, walnut, linseed oil and nuts (n-3-PUFAs) or corn and sunflower oil (n-6-PUFAs). N-3 fatty acids (e.g.  $\alpha$ -linolenic acid) are strongly associated with the prevention of atherosclerosis and can optimize the lipid profile by limiting inflammatory response and by reducing oxidative stress. Among n-3 fats, only  $\alpha$ -linolenic acid (ALA, 18:3, n-3), can be found in adequate amounts in plant sources (e.g. flaxseed, walnuts, chia seeds and their oils)
- The favorable omega fat profile of vegan individuals is the main reason for the potential protective role of vegan diets against CVD and stroke.



# Proteins

- Total protein intake in vegan groups was the lowest compared to other diet groups. TEI from protein was approximately 13-15%.
- WHO recommends protein intake 15% of TEI, dependent on factors such as sex, age, activity, health condition etc. In total 27.3% of the vegan population were below the acceptable range of protein intake. In addition, 64.5% of vegans met the recommended daily protein intake and in 8.1% of vegans' intake of protein was reported to be above the acceptable range. Specifically tyrosine and the other essential AA (lysine, methionine and tryptophan) show the lowest plasma concentrations in vegan diets compared to other diet types. Glycine and alanine are the AAs with the highest plasma concentrations in vegan individuals.
- There is concern that vegan diets might contain low amounts of protein.
- Vegans aim to meet their necessary protein intake by consuming protein-dense plant foods like seeds, nuts, legumes, processed meat analogues and soya protein foods. Although intake of some essential amino acids in vegan diets is recorded lower than in non-vegan diets.



# Proteins

- Plant protein in comparison with animal protein is associated with decreased CVD, slow cancer growth and lower mortality rates. There are substantial differences in the level of digestibility among plant proteins, with soy protein or gluten reaching 95% that of animal protein sources and whole cereals and pulses reaching levels between 80 and 90%. The level of digestibility of plant proteins can be even lower (50-70%), or adversely influenced by food processing mechanisms, such as heating.
- In general, soya proteins are among the main protein sources for the majority of vegans. Soya consumption has also been found to be related to a low incidence of prostate cancer. However, animal-source foods are related to increased insulin-like growth factor-1 (IGF-1), which is related to a higher prevalence of prostatic adenocarcinoma.
- Insufficient protein intake in vegans could be observed, especially in cases where the consumption of legumes, seed and nuts is restricted. There is a concern that vegan diets might contain low amounts of protein.



**Table 1.** Protein intake of vegetarians compared to meat-eaters in the EPIC-Oxford study, classified according to answers to questions on whether those involved ate any meat, fish, eggs, and dairy products. Data from Sobiecki et al. [5].

	Meat-Eaters	Fish-Eaters	Lacto-ovo-Vegetarians	Vegans
<i>n</i> (%)	18,244 (60)	4531 (15)	6673 (22)	803 (3)
Energy (kcal)	2091	2030	2002	1944
% Energy from protein	17.2	15.5	14.0	13.1
Protein (g/kg of body weight) <sup>1</sup>	1.28	1.17	1.04	0.99
Protein (g) <sup>2</sup>	90	79	70	64
Body weight (kg) <sup>2</sup>	70	67	67	64

<sup>1</sup> Based on a subsample of 29,028 individuals with information on body weight; <sup>2</sup> As calculated by ourselves.

**Table 2.** Protein intake of vegetarians compared to meat-eaters in the Nutrinet-Santé Study, based on declarations about being a vegetarian (i.e., not eating meat but eating other animal products) or a vegan (not eating any meat, fish, eggs or dairy). Data from Alles et al. [6].

	Meat-Eaters	Neither Meat-Eaters nor Vegan	Vegans
<i>n</i> (%)	90,664 (96.6)	2370 (2.5)	789 (0.8)
Energy (kcal)	1899	1814	1877
% Energy from protein	17.6	14.2	12.8
Protein (g) <sup>1</sup>	84	64	60

<sup>1</sup> As calculated by ourselves.



### Plant-Based Protein Sources

It's easy to find plant-based sources of protein at the grocery store. Just look at all these options! These foods also tend to be high in fiber, vitamins, minerals and other important nutrients.



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# Micronutrients

## Vitamin A

- The findings vary between diet groups regarding their micronutrient intake.
- Many studies reported that animal-based products provide a superior form of vitamin A. However, vegans had been classified as the group least prone to developing vitamin A deficiencies.
- Vegans were characterized by higher b-carotene intake when compared to the intake of other diets. However, lower serum b-carotene in vegans compared to non-vegetarians was observed in another study.
- According to the WHO, daily recommended intake of Vitamin A is reported as 500 mg for females between 19 and 65 years and 600 mg for 65 years and 600 mg for males of all ages.





# Vitamin B complex

- Vegans had the highest intake of vitamin B<sub>1</sub> and B<sub>6</sub>.
- However, vegans had the lowest intake of vitamins B<sub>2</sub>, Niacin, and B<sub>12</sub>. On average, vitamin B<sub>12</sub> intake was reported to be 0-0.9 mg/d in vegans, which is well below the recommendations of 2.4 mg/d.
- To avoid vitamin B<sub>12</sub> deficiency, it was recommended that vegans supplement their diets with vitamins B<sub>2</sub> and B<sub>12</sub>.
- The low intake of vitamin B<sub>12</sub> is one of the major issues in vegan diets because of the exclusion of vitamin B<sub>12</sub> rich foods, such as meat, poultry and eggs. Vitamin B<sub>12</sub> deficiency is related to neurological and hematologic disorders. It is clear that low vitamin B<sub>12</sub> intake has important clinical implications.



# Vitamin B<sub>12</sub>

- Vitamin B<sub>12</sub> is found almost exclusively in animal based foods and is therefore a nutrient of potential concern for those following a vegetarian or vegan diet.
- Vegans, and anyone who significantly limits intake of animal-based foods, require vitamin B<sub>12</sub>-fortified foods or supplements.
- Vitamin B<sub>12</sub> deficiency has several stages and may be present even if a person does not have anaemia. Anyone following a vegan or vegetarian diet should have their vitamin B<sub>12</sub> status regularly assessed to identify a potential problem.
- A useful process for assessing vitamin B<sub>12</sub> status in clinical practice is the combination of taking a diet history, testing serum vitamin B<sub>12</sub> level and testing homocysteine, holotranscobalamin II or methylmalonic acid serum levels.
- Pregnant and lactating vegan or vegetarian women should ensure an adequate intake of vitamin B<sub>12</sub> to provide for their developing baby.
- In people who can absorb vitamin B<sub>12</sub>, small amounts (in line with the recommended dietary intake) and frequent (daily) doses appear to be more effective than infrequent large doses, including intramuscular injections.
- Fortification of a wider range of foods products with vitamin B<sub>12</sub>, particularly foods commonly consumed by vegetarians, is likely to be beneficial, and the feasibility of this should be explored by relevant food authorities.



# Vitamin B<sub>12</sub>

- Vegetarian diets are at serious risk of vitamin B<sub>12</sub> depletion and/or deficiency.
- Vitamin B<sub>12</sub> is an essential micronutrient that plays a specific role in the synthesis of DNA and red blood cell division and in one carbon metabolism.
- Vitamin B<sub>12</sub> transfers the methyl group in a methionine synthase-requiring reaction, converting homocysteine to methionine.
- It is essential for the synthesis of energy in mitochondria and for erythropoiesis in the bone marrow. It is also necessary for the synthesis of myelin and the maintenance of neural axons.
- Vitamin B<sub>12</sub>, also called cobalamin, is found in adequate ranges only in animal and dairy foods. If the consumption of animal foods is absent as seen in vegetarian diets it results in low intake and cobalamin deficiency due to its scarce presence in plant foods, although vegetarians consume some fortified foods as cereals and soy products.
- Vitamin B<sub>12</sub> deficiency is related to neurological and hematologic disorders. It is clear that low vitamin B<sub>12</sub> intake has important clinical implications.
- Therefore, it is important that vegans are monitored on a regular basis for vitamin B<sub>12</sub> concentration, and in most cases could easily maintain the recommended intakes through supplementation (under appropriate medical supervision) or/and through consumption of fortified foods.



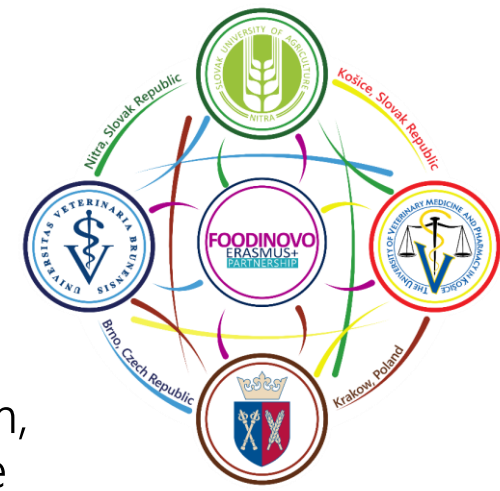
# Vitamin D

- Vegan diet characterized by a lower intake of vitamin D when compared to other diets, or lower than the intake reference value (5 mg/d for 19-50 years, 10 mg/d for 51-61 years and 15 mg/d for 65 years).
- This review shows that vitamin D intake is lower among vegans, but deficiencies are not often observed. Vitamin D intake is limited in vegan diets, especially due to fish exclusion, environmental and/or lifestyle factors which reduce sunlight exposure can affect vitamin D production in the skin and also contribute to deficiencies.
- Fortified bread and/or cereals could also provide a source of vitamin D for vegan individuals. Seasonal changes for parathyroid hormone (PTH) concentrations due to the low intake of vitamin D have been reported only in menopausal women, which could increase the incidence of negative effects on bone health in this group.
- Vitamin D intake is limited in vegan diets, especially due to fish exclusion, but serum concentrations are not below healthy levels. Eating mushrooms and ensuring adequate sun/UV-B exposure can help achieve adequate amounts of vitamin D. However, environmental and/or lifestyle factors which reduce sunlight exposure can affect vitamin D production in the skin and also contribute to deficiencies.
- Fortified bread and/or cereals could also provide a source of vitamin D for vegan individuals.



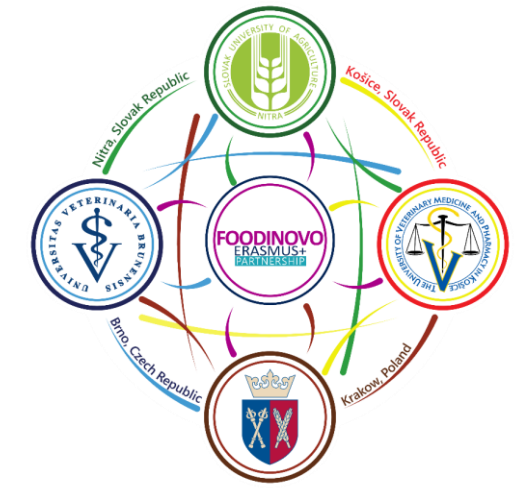
# Vitamin E

- Dietary intake of vitamin E is considered adequate in vegan diets, with several studies showing that vegans had the highest intakes.
- The main dietary sources of vitamin E are vegetable oils, peanuts, soybean, wheat germ, sunflower and almonds. The less diverse the vegan diet, the higher the vitamin E intake recorded.
- Despite the high intakes of vitamin E in vegan diets, this was not correlated to higher serum concentrations of vitamin E, which were found to be higher among vegetarians.



# Iron

- Despite the higher iron intake, its absorption was not correspondingly high, due to the low bioavailability of iron in plant-based foods. The ferritin level seemed to be lower among long-term vegans. Iron requirements could be higher among vegans.
- Vegans' iron requirements are higher than those following other diet types, primarily because non-heme iron from plant-based food has lower bioavailability. This could be improved by the parallel consumption of vitamin C rich foods (e.g. citrus, oranges, lemons, pepper, sauerkraut) and foods rich in organic acids (e.g. citric and malic acid).
- Nevertheless, despite the low ferritin concentration that can be observed in vegans, the overall incidence of iron deficiency anemia is no greater than in individuals following other diets. However, iron supplements are often recommended in specific populations (e.g. premenopausal vegan females), or in the presence of specific needs (e.g. due to higher iron losses).



# Calcium

- Low intake of calcium among vegans was found in many studies. Approximately 76% of vegan subjects consumed less than it is required - WHO limit of 525 mg/day. Calcium plasma concentration of vegans is lower compared to non-vegans.
- Calcium intake among vegans is lacking not only due to the exclusion of dairy products but also due to bioavailability issues of calcium in plant-based foods.
- Calcium added to food products like some brands of tofu show the same level of bioavailability as milk.
- Low calcium intake has been linked with several clinical conditions. Extremely low levels of calcium are related to high incidence of fractures and vegans have been shown to present a 30% higher rate of bone fractures than omnivores.
- Vegan individuals could ameliorate their calcium status by consuming more broccoli, sprouts, tofu, fortified plant milks and juices as well as fortified mineral waters.



# Zinc

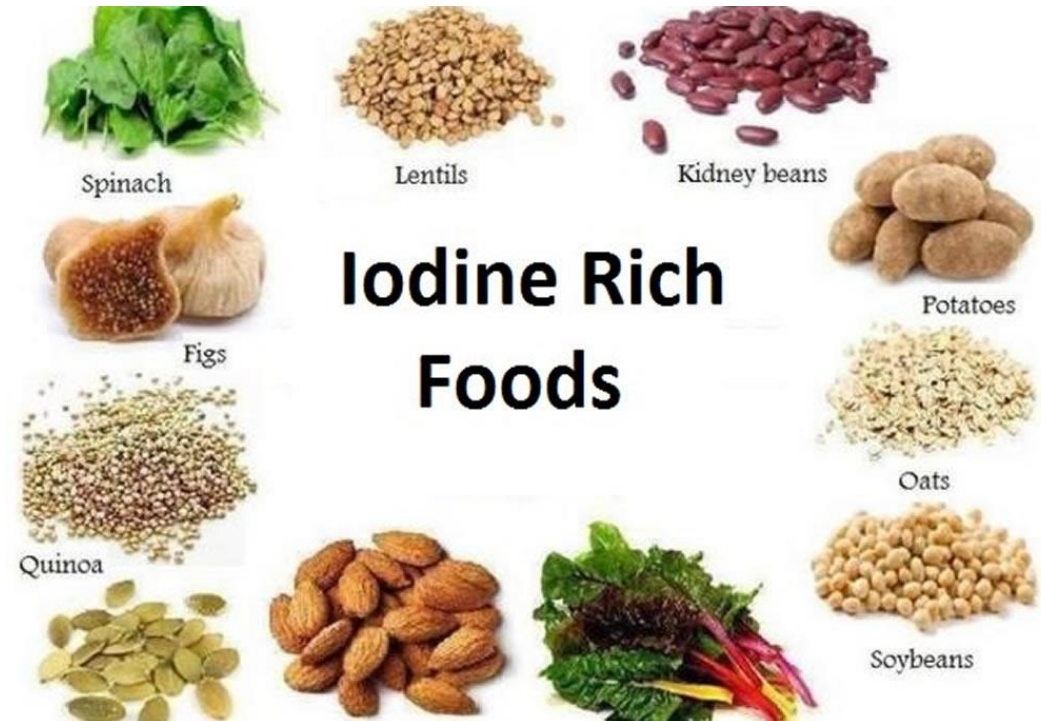
- Vegans have shown the lowest zinc intake when compared to groups with different dietary habits. Vegans are more likely to contain inadequate amounts of serum zinc
- Meat, dairy and eggs are zinc-rich foods, whereas some zinc-rich plant foods (e.g. nuts, seeds and whole grains) present bioavailability issues due to the presence of phytate, which lowers absorption in the intestine. Phytate content could be reduced after applying specific methods of soaking, germination, fermentation, enzymatic interventions or even genetic-modification in grains.
- Zinc is an important part of the regulation of the immune system and in the function of many enzymes. Inadequate zinc intake could be related to some conditions such as mental health disorders (e.g. depression), dermatitis, diarrhea and alopecia, whose incidence is higher in vegans.
- Intake of both zinc and calcium is recorded as the lowest in vegan populations compared to non-vegan individuals.





# Iodine

- Intake of iodine among vegans has been shown to be significantly lower compared to non-vegan population, especially among males.
- Low iodine intake, combined with soy products and vegetables is linked to lower prevalence of hypothyroidism and vegans have a lower prevalence of hyperthyroidism compared with omnivorous diets.
- Iodized salt, cranberries, seaweeds and prunes are some of the foods that can be consumed by vegans with a view to iodine status improvement.



# Macro- and micronutrient intake in plant-based diets

- There are some concerns about the nutritional adequacy of plant-based diets, particularly vegan diets which exclude all forms of animal foods in their entirety.
- While the absorption and availability of specific micronutrients (such as iron, vitamin A and zinc) may be lower in plant than animal foods, obtaining recommended levels of these micronutrients can still be achieved with an appropriately planned vegan diet that includes a variety of different plant foods.



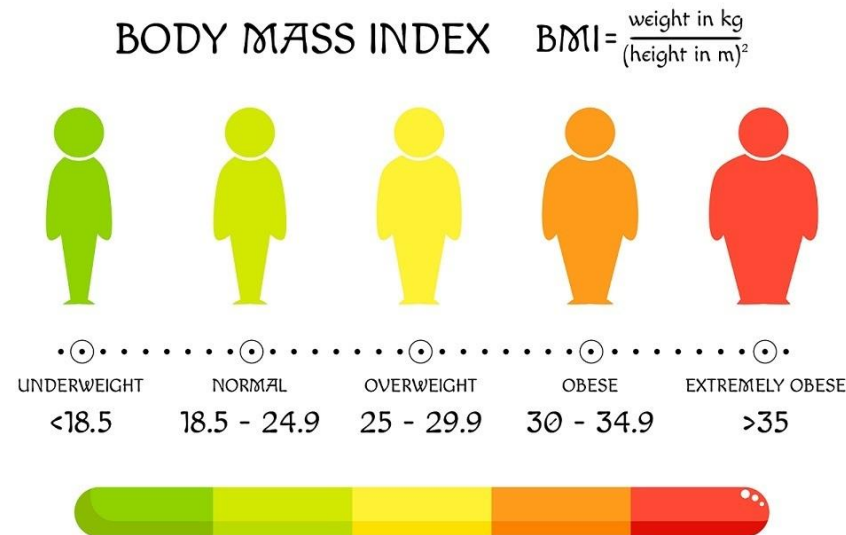
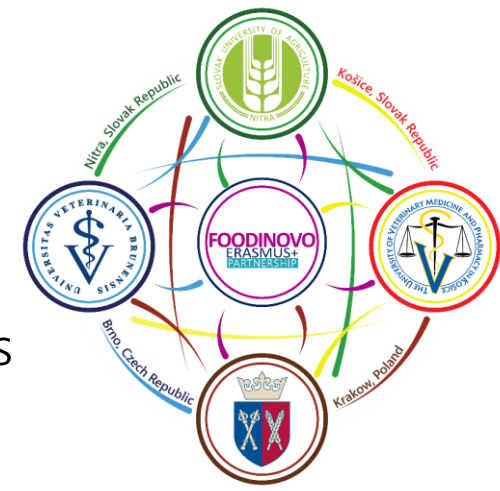
# Macro- and micronutrient intake in plant-based diets

- Vegan diets are typically associated with relatively low intakes of vitamins B<sub>2</sub>, B<sub>12</sub>, D, iodine, zinc, calcium and selenium.
- Intake of vitamin B<sub>12</sub> (important for several bodily functions including a healthy nervous system) was found to be significantly lower in vegans.
- Vegan diets are characterized by lower consumption of saturated fat and higher consumption of beneficial unsaturated fat.
- Vegan diets are not associated with a risk of insufficient intake of vitamins A, B<sub>1</sub>, B<sub>6</sub>, B<sub>9</sub> (folate), C, E, iron, phosphorus, magnesium or copper in adult populations.
- As for other micronutrients such as vitamin D and vitamin B<sub>12</sub>, which are mostly found in animal sources, vegans may consider the consumption of fortified foods and – in the specific case of vitamin D – adequate sun exposure. Accordingly, individuals who consume a vegan diet should remain aware of potential micronutrient insufficiencies.



# BMI

- The mean weight difference between vegan females and omnivore or vegetarian females is about 5 kg, while the EPIC-Oxford study showed that mean BMI in vegans was lower compared to omnivores by 1.92 kg/m<sup>2</sup> and 1.54 kg/m<sup>2</sup> in males and females, respectively.
- Vegan individuals had a healthier BMI in comparison to people who follow other diet types.
- Vegans seem to have the lowest BMI of all the diet groups and subsequently a lower risk of becoming obese.

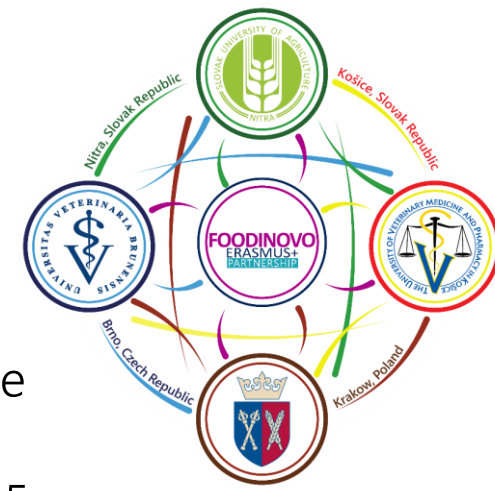


# Pregnancy and lactation

- The available evidence shows that well planned vegetarian and vegan diets may be considered safe during pregnancy and lactation, but they require a strong awareness for a balanced intake of key Nutrients..
- Balanced maternal nutrition during pregnancy is imperative for the mother's health status and, consequently, for offspring, and is crucial to maintain an adequate environment for optimal fetal development.
- According to the theory of "early life programming" environmental factors and lifestyle during pregnancy determine the risk of developing chronic diseases later in life and also influence lifelong health in offspring.
- Pregnancy requires an increased intake of macro and micronutrients and balanced diet. For that, it offers a critical window of opportunity to acquire dietetic habits that are beneficial for fetal healthy.

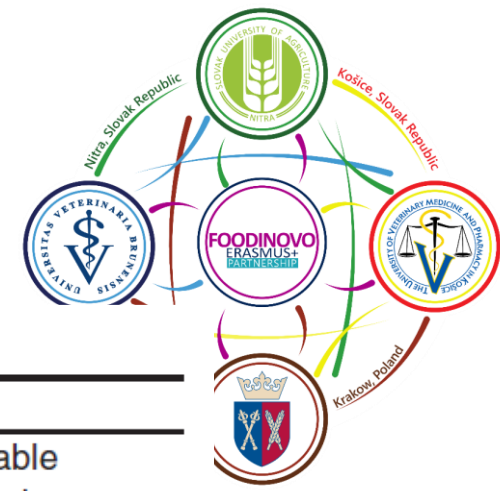


# Vegetarian athletes



- Appropriately planned vegetarian diets can provide sufficient energy and an appropriate range of carbohydrate, fat and protein intakes to support performance and health.
- The acceptable macronutrient distribution ranges for carbohydrate, fat and protein of 45–65%, 20–35% and 10–35%, respectively, are appropriate for vegetarian and non-vegetarian athletes alike, especially those who perform endurance events.
- Vegetarian athletes can meet their protein needs from predominantly or exclusively plant-based sources when a variety of these foods are consumed daily and energy intake is adequate.
- All athletes should carefully plan their diets to contain sufficient energy and nutrients to fully support their training and competition. There is sufficient evidence to indicate that a well planned vegetarian diet can meet the energy and macro- and micro-nutrient needs of an athlete and may reduce the risk for certain chronic diseases.
- Limited data from well controlled studies are available to support or refute that consumption of a vegetarian diet influences athletic performance. At present, the majority opinion is that athletic performance is neither compromised nor enhanced by habitually eating a vegetarian diet.

# Vegetarian athletes

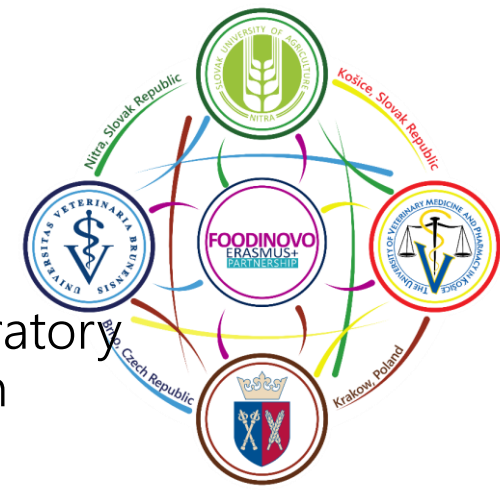


**Table II.** Micronutrients of special concern for vegetarian athletes

Micronutrient	Function	Sources in a vegetarian diet and comments
Iron	Required for synthesis of haemoglobin and myoglobin, essential components in transport and delivery of oxygen within blood and to the muscles	Fortified breakfast cereals, bread, textured vegetable protein, legumes, dried beans, soy foods and meat alternatives, nuts, dried fruits and green leafy vegetables, vitamin C (ascorbic acid) enhances iron absorption
Zinc	Involved in immune function, protein synthesis and blood formation	Legumes, whole grains, cereals, nuts, seeds, soy and dairy products, vitamin C and soaking beans, grains and seeds enhances zinc absorption
Vitamin B <sub>12</sub> (cyanocobalamin)	Coenzyme required for normal metabolism of nerve tissue and of protein, fat and carbohydrate	Dairy products, eggs, fortified soy milk and cereals
Vitamin D (cholecalciferol)	Necessary for bone growth, promotes bone mineralisation, aids in absorption of calcium and maintaining nervous system, and normal heart action	Dairy products, eggs, fortified soy milk and cereals
Riboflavin	Coenzyme involved in production of energy, stored in muscles and used during muscular fatigue	Dairy products, soy milk, soy yogurt, soy cheese, fortified breakfast cereals, grains and textured vegetable protein
Calcium	Necessary for blood clotting, nerve transmission, muscle stimulation, vitamin D metabolism, and maintaining bone structure	Dairy products, calcium-fortified soy milk, tofu, soy yogurt, cereals, low oxalate green vegetables such as broccoli, bok choy and kale

# Non-communicable diseases prevention and plant-based diets

- Non-communicable diseases (NCDs), such as heart disease, cancer, chronic respiratory disease, and diabetes, are the leading cause of death worldwide and represent an emerging global health threat.
- They are responsible for 71% of all premature deaths (41 million deaths a year) globally, where 80% are due to the four most common NCDs:
  - cardiovascular diseases account for 17.9 million deaths,
  - cancers (9 million),
  - chronic respiratory diseases (3.9 million)
  - diabetes mellitus (1.6 million).
- The European WHO Region has the greatest burden of NCD-related morbidity and mortality, at almost 90% of all deaths.
- Overweight and obesity are a major NCD risk factor and affect over 59% of adults and 29% of children in the European Region.
- Globally, one in every five deaths in adults is associated with unhealthy diet.

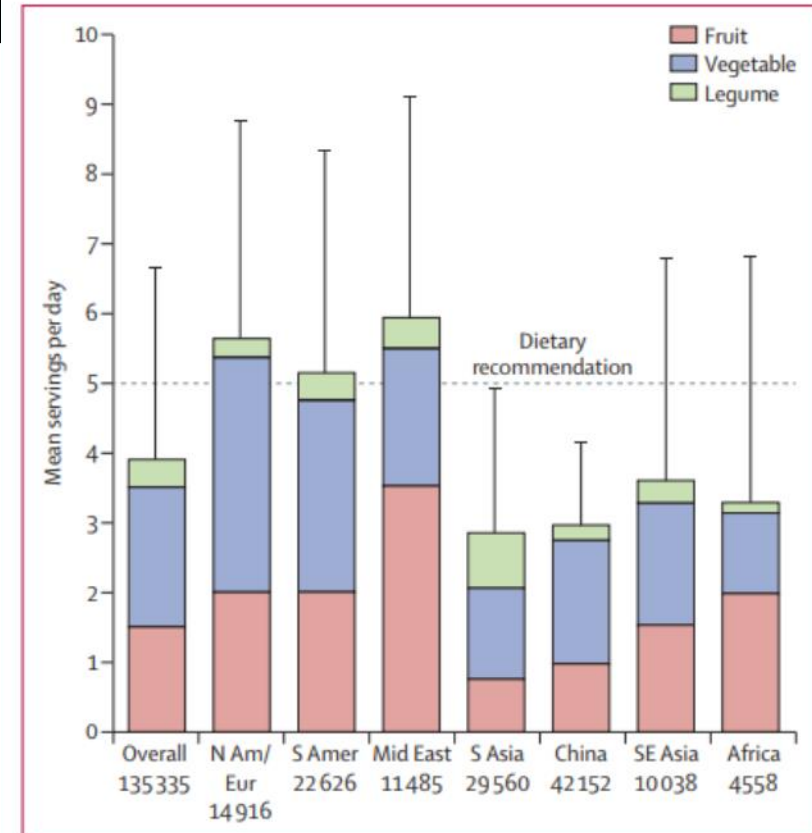




# Non-communicable diseases prevention and plant-based di



- Low fruit and vegetable consumption is linked to poor health and increased risk of NCDs.
- Recent studies have shown that high fruit and vegetable intake is associated with lower risks of heart disease and stroke.
- WHO recommends consuming at least 400 g (five portions) of fruits and vegetables (excluding potatoes and other starchy tubers) per day.
- There is large variation in fruit and vegetable intake across Europe. In more than half of the countries in the WHO European Region, consumption of fruits and vegetables is lower than 400 g per day, and in one third of the countries (particularly those in eastern Europe), the average intake is less than 300 g per day.



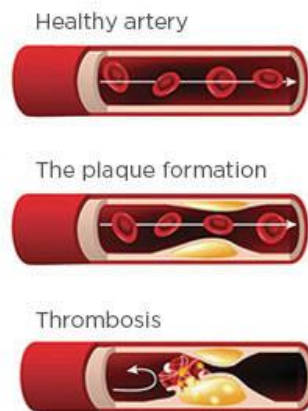
**Figure 1: Mean fruit, vegetable, and legume intake overall and by geographical region**

Data are from 135 335 individuals. N Am/Eur=North America and Europe: Canada, Poland, and Sweden. S Amer=South America: Argentina, Brazil, Chile, and Colombia. Mid East=Middle East: Iran, occupied Palestinian territory, Turkey, and United Arab Emirates. S Asia=south Asia: Bangladesh, India, and Pakistan. SE Asia=southeast Asia: Malaysia. Africa=South Africa and Zimbabwe.



# Non-communicable Diseases prevention and plant-based diets

- Cardiovascular disease causes more than half of all deaths across the European Region.
- Overall, evidence suggests that vegetarian and vegan diets have a protective effect against coronary heart disease, but increased risk of stroke has been reported in recent analyses.



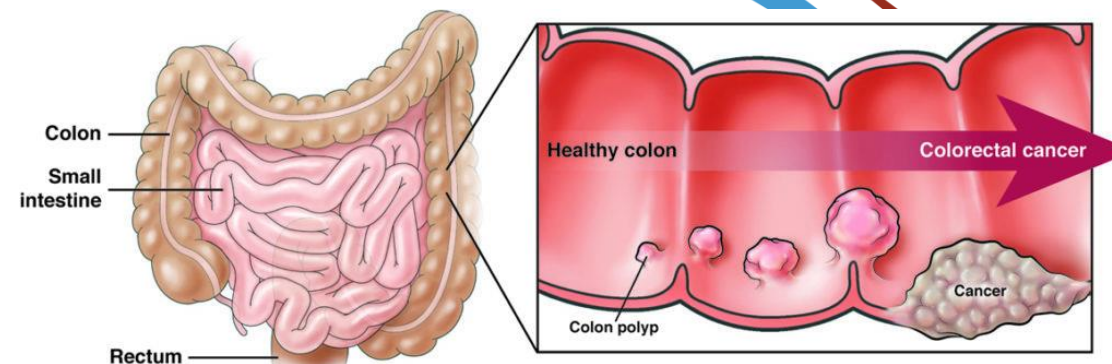
# Non-communicable Diseases prevention and plant-based diets

- Numerous cross-sectional studies have found that, in industrialized countries, after adjustments for age, sex and body weight, **blood pressure** (BP) was lower among vegetarians than non-vegetarians.
- As shown in numerous observational and epidemiological studies the dietary components capable of lowering BP include the following:
  - a reduced salt intake;
  - a high potassium intake, related to high consumption of fruits and vegetables is associated with lower BP;
  - a higher intake of fibre, especially insoluble ones, may contribute to lower BP.Enhanced insulin sensitivity, improved vascular endothelial function and improved magnesium intestinal absorption have been proposed to explain the BP-lowering effect of dietary fibres.



# Non-communicable Diseases prevention and plant-based diets

- The strongest association found so far between diet and **cancer** risk is for bowel cancer (also known as colorectal cancer).
- Frequent consumption (four or more portions per week) of processed meat and unprocessed red meat has been found to increase the risk of bowel cancer. However, calcium – mainly from dairy products – offers some protection against colorectal cancer.
- Vegans, vegetarians and pescatarians have been found to have a lower risk for all cancers compared to non-vegetarians.
- According to the World Cancer Research Fund, diets that reduce the risk of cancer contain no more than modest amounts of red meat and little or no processed meat.



# Non-communicable Diseases prevention and plant-based diets

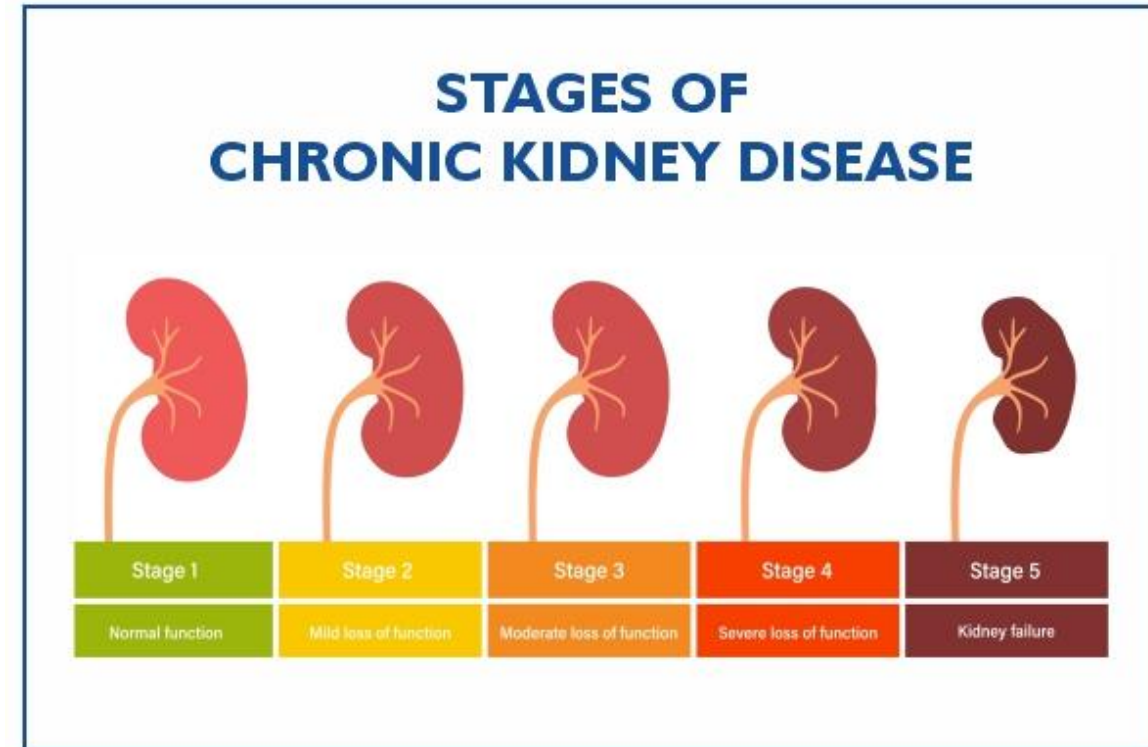


- **Diabetes** is inextricably linked to obesity rates since a high body mass index (BMI) is the most critical risk factor.
- Various studies have found that vegetarians and vegans generally have a lower BMI than otherwise comparable non-vegetarians.
- Research suggests that low meat and non-meat eaters have a lower risk of diabetes, largely because of their lower BMI. However, it should be noted that non-meat eaters generally have healthier lifestyles than meat eaters.



# Non-communicable Diseases prevention and plant-based diets

- For more than a century, the quantitative reduction of dietary protein intake has been recognized as a therapeutic measure in **chronic kidney disease (CKD)**.
- Numerous studies have shown that plant-based diets are associated with a decrease in many risk factors associated with CKD progression, such as hypertension, uraemic toxins, inflammation and oxidative stress, preventing the development of some metabolic disorders.



# Non-communicable Diseases prevention and plant-based diets

- The beneficial effects of plant-based diets, including the protection they offer against premature mortality, provide strong evidence for public health guidelines recommending healthful plant-based diets as a means to prevent and control NCDs.
- Use of vegetarian diets might be associated with decreasing blood pressure, blood sugar, and blood lipid levels, and such changes may actually require drug therapy adjustments. However, this would require trained and experienced health care providers who are knowledgeable about special diets and their impact on human health, and whose advice is trusted by patients.
- A vegetarian diet for health reasons is associated with other **health behaviors**, including not smoking and regular physical activity, which indicates that vegetarian and vegan diets may be part of an overall **healthy lifestyle**.
- In terms of risk factors for health in general and cardiovascular in particular, not smoking, eating a balanced and healthy diet, and following a physically active lifestyle are among the most important and effective strategies to decreasing the risk of lifestyle related conditions, and are regularly recommended.
- Growing number of clinical and epidemiological research studies showed health benefits associated with vegetarian and vegan diets, especially regarding cardiovascular health and cancer, which makes vegetarian and vegan diets an important method to improve health and well-being and prevent chronic lifestyle-associated diseases.



# Health benefits

- Well-balanced vegetarian diets are appropriate for all stages of the life cycle, including children, adolescents, pregnant and lactating women, the elderly and competitive athletes.
- In most cases, vegetarian diets are beneficial in the prevention and treatment of certain diseases, such as cardiovascular disease, hypertension, diabetes, cancer, osteoporosis, renal disease and dementia, as well as diverticular disease, gallstones and rheumatoid arthritis. The reasons for choosing a vegetarian diet often go beyond health and well-being and include among others economical, ecological and social concerns.
- Moreover, vegetarian diets have been associated with reduced mortality.
- Food patterns (FPs) that are based on plant-derived foods are purportedly healthier than those in which meat, especially red and processed meat, are the main sources of macronutrients. When most foods are derived from vegetable sources (ie, a vegetarian diet is adopted), health benefits are apparent. Thus, coronary artery disease (CAD) mortality was reported to be significantly lower by 24% among vegetarians compared with nonvegetarians.



## PLANT-BASED DIETS & HEALTH



a vegetarian diet lowers your risk of heart disease by **20%**

vegetarians tend to live an average of **8 YEARS** longer than non-vegetarians



the average cholesterol level of a vegetarian is **161** compared to 210 in non-vegetarians

vegetarians have a lower risk of death related to cancers, heart problems, & obesity.

men: **50%** reduced

women: **30%** reduced

source: foodielovesfitness.com





# Health benefits

- The benefits of vegetarian diets arise from lower intakes of saturated fat, cholesterol and animal protein as well as higher intakes of complex carbohydrates, dietary fiber, magnesium, folic acid, vitamin C and E, carotenoids and other phytochemicals.
- Accumulating evidences suggest the positive impact plant-based diet can have on biometric outcomes like body mass index, blood pressure, diabetes, and lipid profile.
- The American Dietetic Association endorsed the concept by mentioning that appropriately planned vegetarian diets may provide health benefits including prevention of obesity. Vegetarian diets may be better for weight management and recommended without compromising diet quality. Weight loss in vegetarians is not dependent on exercise.



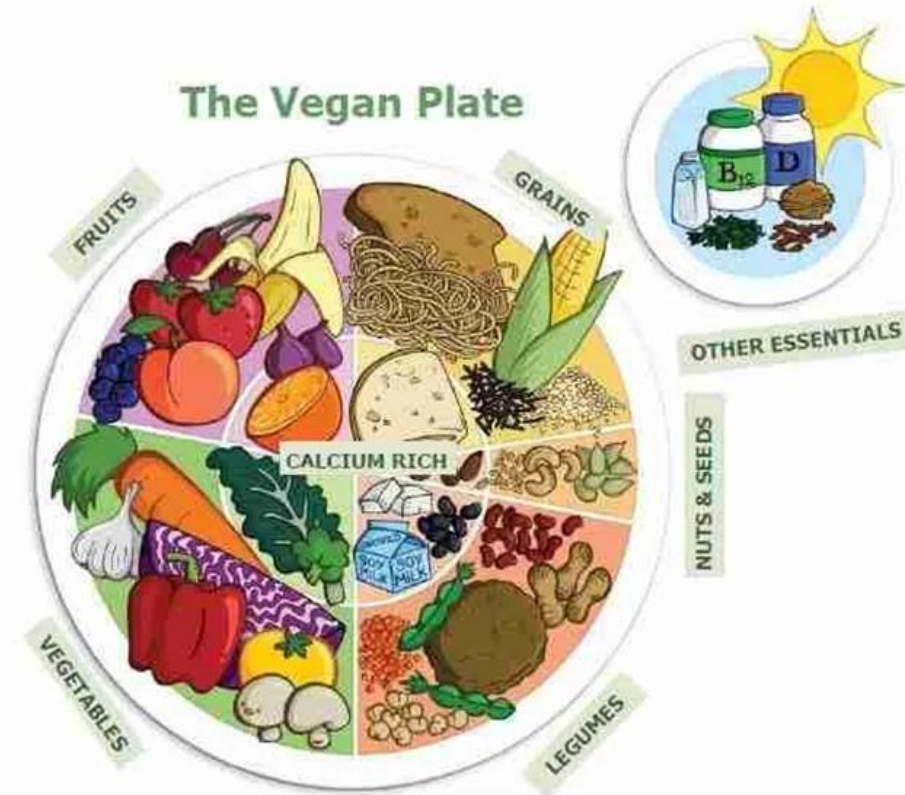
# International Guidelines for Vegetarian and Vegan Diets

- According to the Academy of Nutrition and Dietetics a well planned plant-based eating pattern could be appropriate for all stages of life if adequate and healthy recommendations are followed.
- The normal intake of protein is 0.8 g/kg/day for an adult woman who follows diets containing high quality protein such as egg, meat, milk, or fish. If dairy products, whole grains, beans, nuts, and seeds are the primary protein sources in the diet, the protein digestibility falls, so the **recommendation for dietary protein should increase 20%** for vegetarian adult woman until **1 g/kg/day**.
- According to Messina's guide for North American vegetarians, this population have to consume more legumes, nuts, tofu, beans, seeds, fortified breakfast cereals, milk, cheese or yogurt, and fortified soymilk, which are good sources of vitamin B<sub>12</sub>, vitamin D, iron, and **calcium** (the recommendation is the intake of 1200 to 1500 mg/day of calcium, **20% more** than omnivores).
- People who adhere to vegan diets would have to intake **daily supplements of vitamin D, vitamin B<sub>12</sub>, and calcium** because the average of these nutrients is insufficient.



# International Guidelines for Vegetarian and Vegan Diets

- Moreover vegetarian diets have been associated with iron deficiency but not to iron deficiency anemia so the recommendation for vegetarians is to enrich the diet with **iron-fortified breads and cereals, beans and lentils, raisins, and blackstrap molasses, as well as sources of vitamin C, like tomatoes and citrus fruits** for optimal iron absorption. The iron from vegetarian diets is less available for absorption because these diets contain nonheme iron from plants that is worst absorbed than heme iron contained in animal food like meat.
- Zinc deficiency is also common in people who adhere to vegetarian diets due to the inhibition of zinc absorption from plant food with phytic acid, an inhibitor of zinc bioavailability, so the recommendation is a **50% greater intake of zinc.**



# VEGETARIAN & VEGAN DIET PYRAMID

Putting More Plants on Your Plate



Multivitamin 1x/day of  $\geq 5$  mcg



Supplement 2x/week of  $\geq 500$  mcg

## 3 VEGAN OPTIONS FOR GETTING ENOUGH Vitamin B12



Fortified Foods 2x/day of  $\geq 1.2$  mcg



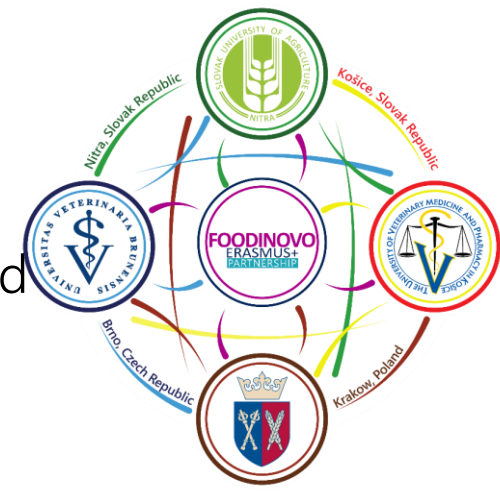
# Ultra-processed plant-based foods

- Notwithstanding the health benefits of a diet rich in plant-based foods, not all plant-based diets are healthy.
- Modern plant-based diets may also include ultra-processed foods. These include imitation processed “meats” (including products marketed as sausages, nuggets and burgers), beverages (for example, almond and oat “milk”), and plant-based “cheese” and “yoghurt”.
- Ultra-processed foods, as defined by the NOVA classification system, are formulations of substances derived from whole foods, such as starches, sugars, fats and protein isolates, with little, if any, whole food, and often with added flavours, colours, emulsifiers and other cosmetic additives to improve shelf-life, palatability and visual appeal.
- A 2020 study found that plant-based meals produced in the out-of-home sector can contain high amounts of salt.



# Position statement - conclusion

- It is the position of the Academy of Nutrition and Dietetics that appropriately planned vegetarian, including vegan, diets are healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases.
- These diets are appropriate for all stages of the life cycle, including pregnancy, lactation, infancy, childhood, adolescence, older adulthood, and for athletes.
- Plant-based diets are more environmentally sustainable than diets rich in animal products because they use fewer natural resources and are associated with much less environmental damage.
- Vegetarians and vegans are at reduced risk of certain health conditions, including ischemic heart disease, type 2 diabetes, hypertension, certain types of cancer, and obesity.
- Low intake of saturated fat and high intakes of vegetables, fruits, whole grains, legumes, soy products, nuts, and seeds (all rich in fiber and phytochemicals) are characteristics of vegetarian and vegan diets that produce lower total and low-density lipoprotein cholesterol levels and better serum glucose control. These factors contribute to reduction of chronic disease.
- Vegans need reliable sources of vitamin B<sub>12</sub>, such as fortified foods or supplements.






# Concerns

- The percentage of vegetarians and vegans in the general population has increased over the last years partly due to evidence that vegetarianism is linked to improved health.
- Nevertheless, some data suggest that vegetarians and vegans may be at greater risk of increased plasma **homocysteine levels**, an arising risk factor for cardiovascular disease, and of **low bone mineral density**, which predisposes to osteoporosis.
- Plant-based diets have a low content of essential micronutrients such as iron, zinc, vitamin B12, vitamin D, omega-3 (n-3) fatty acids, calcium, and iodine.
- Consequently, the risk of adverse effects due to **micronutrient deficiencies** that lead to the risk of malnutrition should not be underestimated.




## The long-term health impacts of plant-based diets

### Reduced risk of:

-  **Cancer**
-  **Obesity**
-  **Diabetes**
-  **Heart disease**

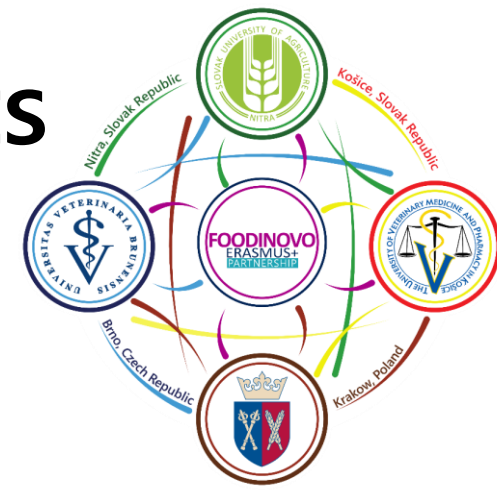


### Increased risk of:

-  **Fractures**
-  **Nutrient deficiency**

# Additional benefits of plant-based diets

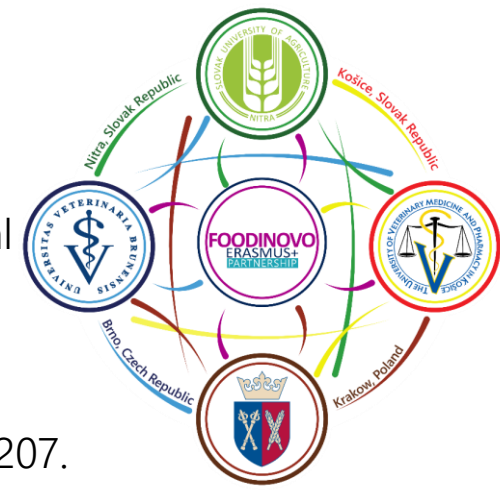
- Plant-based diets have the potential not only to improve human health but also to reduce the environmental impacts associated with high consumption of animal-sourced foods such as meat and dairy products.
- The production of plant foods, such as fruits and vegetables, grains, legumes, nuts and seeds, produces lower greenhouse gas emissions than that of animal foods.
- Foods associated with the greatest negative environmental impacts – unprocessed and processed red meat – are consistently associated with the largest increases in disease risk.
- Shifting towards plant-based diets can also help prevent biodiversity loss. This shift in dietary patterns could significantly reduce global land use for agriculture, by reducing the amount of land required for grazing and growing crops.
- Alongside the benefits to human health, the adoption of plant-based diets could translate into savings of billions of euros across Europe in health-care costs.
- Excessive meat consumption places a burden on health-care systems; for example, it has been estimated that in 2020 there were 2.4 million deaths worldwide, and approximately €240 million in health-care costs, attributable to excessive red and processed meat consumption.





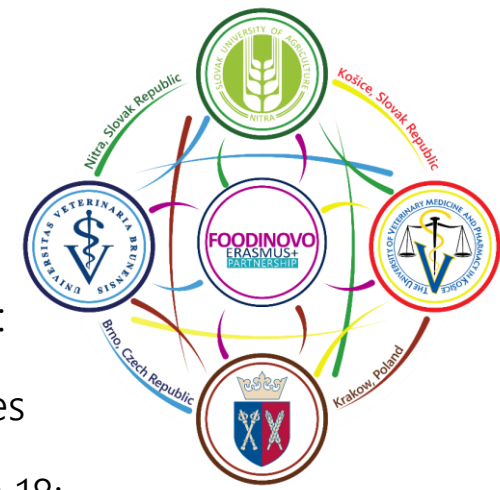
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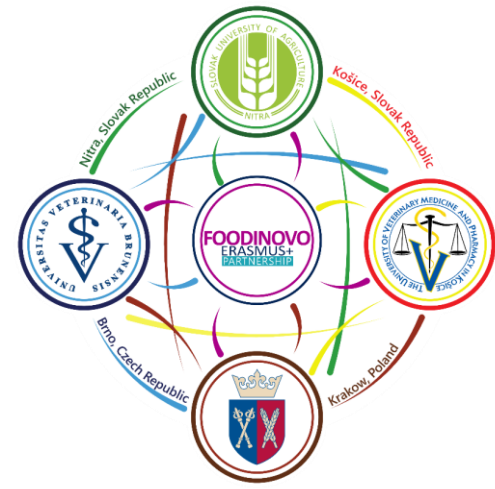
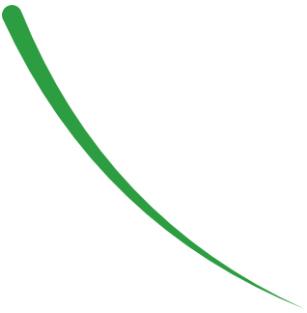
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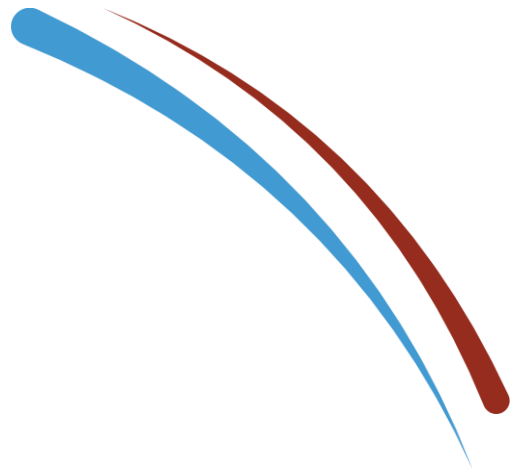


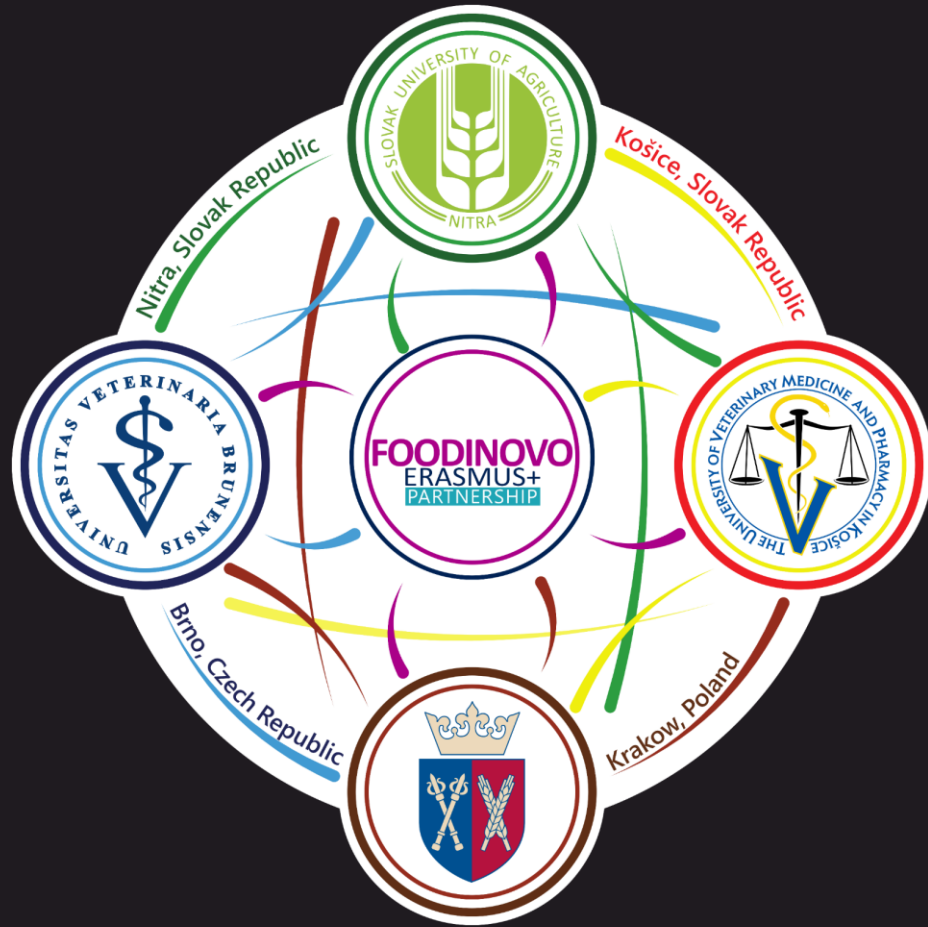
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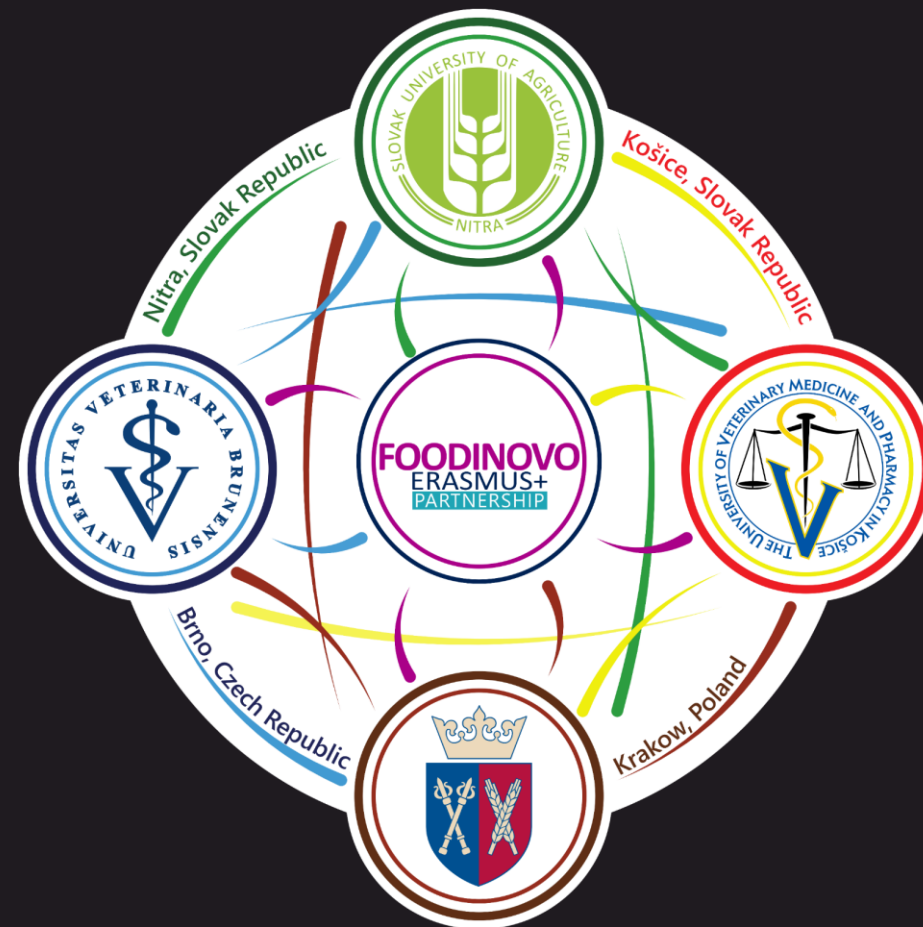
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