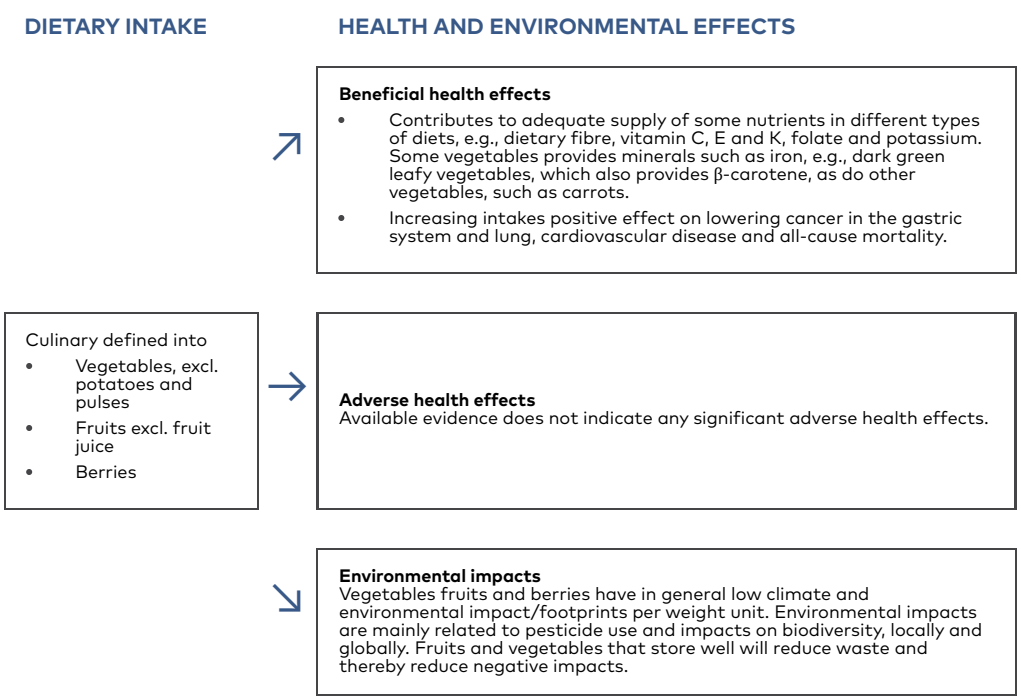
Vegetables, fruits, and berries



Science advice: **It is recommended to consume a variety of vegetables, fruits, and berries, 500-800 grams, or more, per day in total. A variety of different types of both vegetables and fruits (including berries) should be consumed, with emphasis on dietary fibre contribution (potatoes and pulses are not included). Limit intake of products prepared with added/free sugars. For recommendation on fruit juice consumption, please refer to separate summary on fruit juice.**

For more information about the health effects, please refer to the background paper by Magdalena Rosell and Lars. T Fadnes (Rosell & Fadnes, 2023). For more information about the environmental impacts, please refer to the following background papers (Benton et al., 2024; Harwatt et al., 2024; Meltzer et al., 2024; Trolle et al., 2024)

Products within this food group are culinary defined as vegetables, fruits and berries. Potatoes and pulses are not included as vegetables in the NNR2023 report. Green beans and peas may be included in the vegetable food group.

Fruit juices derived from fruits and berries also constitute a separate food group.

Vegetables include cruciferous vegetables, leafy green vegetables, yellow/orange/red vegetables, allium vegetables, and non-starchy root vegetables, such as carrots, beets, parsnips, turnips, and swedes. Fruit subgroups are citrus fruits (e.g., oranges, lemon, lime, grapefruit), stone fruits (e.g., cherries, plums) and pome fruit (e.g., apples, pears). Vegetables, fruits and berries are commonly high in water, low in energy, contain numerous nutrients, and good sources of dietary fibre, vitamin C, vitamin E, vitamin K, folate, and potassium. They also contain other bioactive compounds, or phytochemicals, and the synergistic effects of these are still not fully understood. Cruciferous vegetables (Brassica), including broccoli, Brussels sprouts, cabbage, cauliflower, kale, and turnips, are sources of calcium. Additionally, leafy green vegetables such as spinach, Swiss chard, and lettuce offer iron, zinc, calcium, magnesium, and carotenoids, with dark green vegetables particularly rich in carotenoids. Berries are small, juicy and pulpy fruits (Rosell & Fadnes, 2023).

Dietary sources and intake. The average intake of vegetables, fruits, and berries ranges between 200 and 400 g/d. The average intake of vegetables ranges approximately between 120 and 200 g/d, while fruits and berries approximately between 100 and 230 g/d. The intake of fruits and berries is higher in females than in males in all countries (Lemming & Pitsi, 2022).

Health effects. Three qSRs are available on the role of vegetables and fruits and health outcomes (Fogelholm et al., 2012; Stanaway et al., 2022; WCRF/AICR, 2018j). The qSR from WCRF/AICR found strong (probable) evidence for lower risk of aerodigestive cancers with higher intake of non-starchy vegetables and fruit. Numerous qSRs on dietary patterns in which fruits and vegetables are a major component are also available, demonstrating beneficial health effects, including lower risk of cardiovascular disease (2020 Dietary Guidelines Advisory Committee, 2020), breast and colorectal cancer (Boushey et al., 2020c) and favourable body weight outcomes (Boushey et al., 2020a).

In addition, as discussed by Rosell and Fadnes (Rosell & Fadnes, 2023), several recent high-quality systematic reviews support the role of consuming vegetables, fruits, and berries for preventing chronic diseases, including several other types of cancer (WCRF/AICR, 2018j), cardiovascular disease, and all-cause mortality (Rosell & Fadnes, 2023). The largest reductions in risk are generally seen at the lower intake ranges, but for cardiovascular disease, reductions have been observed up to 800 g of fruits and vegetables per day.

Recent meta-analyses also show inverse associations with all-cause mortality, levelling off at 5-6 servings of fruits and vegetables per day, or 2-3 servings of fruits per day and 3-4 servings of vegetables per day (Rosell & Fadnes, 2023). Also relevant for intake of vegetables and fruits is the evidence that consumption of foods containing dietary fibre probably lowers all-cause mortality, coronary heart disease and colorectal cancer (Reynolds et al., 2019; WCRF/AICR, 2018j). Regarding risk of type 2 diabetes, the results are mixed, associations are weaker and further studies are needed to reach conclusive results. The beneficial effects may be attributed to several mechanisms and constituents, such as dietary fibre, antioxidant nutrients and a range of other bioactive components (Rosell & Fadnes, 2023).

As described in the collaboration between the Global Burden of Disease project and the NNR2023 project, a diet low in fruit is the third-highest dietary-related contributor to disease burden in the Nordic and Baltic countries. The Baltic countries have the most to gain from increasing fruit intake because the Baltic countries have higher rates of ischemic heart disease and stroke, which are both linked to low fruit consumption (Knudsen et al, 2024).

Environmental impacts. Vegetables, fruits and berries have in general low environmental impacts per weight unit, although impacts vary between products (Harwatt et al., 2024). Estimates of the impacts of the whole diets also show low impacts from the food group "vegetables, fruits and berries" in the current diets as well as in modelled plant-based diets (Harwatt et al., 2024; Trolle et al., 2024).

The supply of vegetables, fruits and berries in the Nordic and Baltic countries is based on a combination of locally grown products and imported products from different regions of the world. The impacts of individual types of vegetables, fruits, and berries vary mainly due to different horticultural production practices, but also mode of transportation, transportation length and processing have climate impacts. Products locally grown in Nordic countries seem to be among the products with the lower impact, due to less waste during transport and storing. This is the case for salad vegetables and for berries. The more robust types of fruits and vegetables, like apples, pears and citrus fruits, root vegetables, onions and leeks, and brassica can be most easily stored, with relatively small energy use and little waste. These also seem to be the types with the lower impact when imported. Apples, pears, cherries, currants and plums may provide additional benefits, such as carbon sequestration and storage through photosynthesis during tree growth.

Climate and environmental impact of greenhouse grown vegetables depends on the heating source. Greenhouse production in general might lower the land use and the pesticide use.

In general, more plant protection products (e.g. pesticides) are used in the production of fruits and vegetables than in other types of agricultural production (in terms of per hectare and kg of harvested product) and tends to be higher in intensive fruit and berry production (e.g., large scale cropping systems with low diversity) compared to vegetables (Harwatt et al., 2024). In organic production of vegetables, fruits and berries within the Nordic and Baltic countries, less chemicals are used. However, organic production often requires higher land use and has similar GHG emissions compared with conventional production (Harwatt et al., 2024; Meltzer et al., 2024; Trolle et al., 2024).

Overall water stress is not a major issue in the Nordic and Baltic countries but can, however, appear locally. Many fruits, vegetables and berries are imported, some from water-scarce regions and regions likely to become water-stressed (Harwatt et al., 2024; Meltzer et al., 2024; Trolle et al., 2024).

Main data gaps. Possible health effects of different subgroups of fruit and vegetables need further investigation, including the role of phytochemicals. Nutrient and phytochemical bioavailability and interactions, including effects of different preparation methods, might also be an area for further research. There is a lack of data on the production systems and their environmental impacts for imported fruits and vegetables.

Risk groups. People with specific allergies within the food group

Science advice:

- **Based on health outcomes:** It is recommended to consume 500–800 grams, or more, per day of vegetables, fruits and berries in total. A variety of different types of both vegetables and fruits (including berries) should be consumed, with emphasis on dietary fibre contribution (potatoes and pulses are not included). Limit intake of products prepared with high content of added free sugar. A low to moderate amount of fruit juice may be a part of the fruit recommendations (see summary for fruit juice).
- **Based on environmental impacts**: Vegetables fruits and berries have in general low climate and environmental impact/impacts per weight unit. Environmental impacts are mainly related to pesticide use and impacts on biodiversity, locally and globally. Fruits and vegetables that store well will reduce waste and thereby reduce negative impacts.

- **Overall science advice:** It is recommended to consume a variety of vegetables, fruits, and berries, 500-800 grams, or more, per day in total. A variety of different types of both vegetables and fruits (incl. berries) should be consumed, with emphasis on dietary fibre contribution (potatoes and pulses are not included). Limit intake of products prepared with added/free sugars. For recommendation on fruit juice consumption, please refer to separate summary on fruit juice.