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Swedish dietary guidelines

– *risk and benefit management report*

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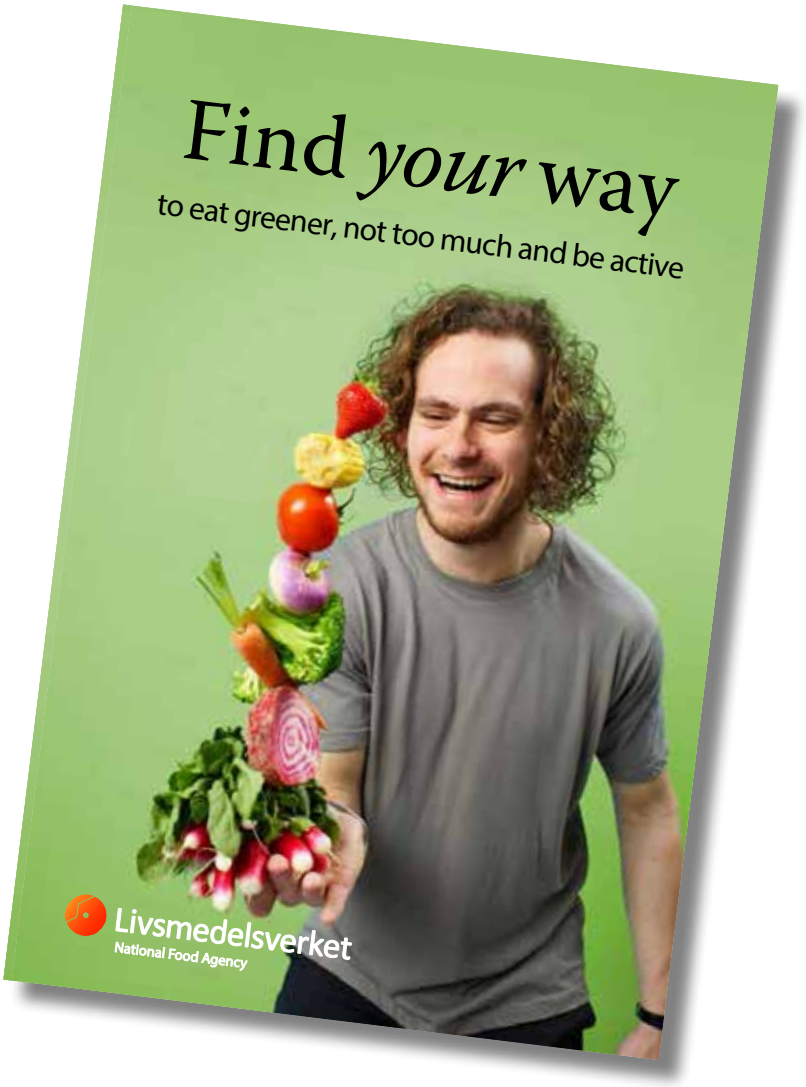

Livsmedelsverket
National Food Agency

Contents

Summary

The Swedish National Food Agency (Livsmedelsverket) has updated the national dietary guidelines. The updated advice is about how to eat healthily and at the same time take into account environmental aspects. To integrate health and environment in the work regarding nutritional advice is a new and important step for a sustainable future food consumption. This report describes, in short, the scientific base of knowledge and the considerations that led to the recommendations.

The recommendations regarding healthy eating are based on the Nordic nutritional recommendations (NNR 2012), knowledge of the population's dietary habits and scientific knowledge of the environmental impact of various food groups. The conclusion is that, for the sake of both health and environment, we need a change of the consumption, from a large amount of foods of animal origin, to more plant-based foods. Food patterns based on vegetables, whole grains, lean dairy products, fish and oil decrease the risk of the common population diseases in Sweden – cardiovascular disease, overweight/obesity, type 2 diabetes and certain types of cancer. This has been focused on in previous dietary guidelines, and has been further strengthened by current research. Basing your foods on plant-based foods is also a good choice for the environment, since plant-based foods generally have a lower impact on the environment than foods of animal origin.

Today, half of all adults in Sweden are overweight. One deciding cause for overweight is when the calorie intake exceeds the need for energy. Therefore, in the updated recommendations, we emphasise the importance of an energy balance, which means to eat a reasonable amount. What is a reasonable amount is individual, and largely depends on how active a person is.

Physical activity has a large effect on weight stability, but also contributes to prevent cardiovascular diseases, osteoporosis and certain types of cancer. Therefore, the recommendation of the Swedish National Food Agency is to exercise regularly, for example by walking briskly for at least 30 minutes every day. New research also shows that sitting still in itself increases the risk for disease. It is therefore important to decrease the sitting still by taking regular and short breaks from this position.

As a whole, the recommendations include ten food groups and advice regarding energy balance and physical activity. But it is also important not just to look at separate food groups or nutrients, but to also look at the overall picture, as in the overall dietary habits. Recent investigations have supported the view that healthy dietary habits are based on a lot of vegetables, fruit, whole grains, fish, vegetable oils and lean dairy products, while a lot of red meat and processed meat, sugar and other energy-dense foods, and also foods containing a lot of salt increases the risk of diet-related diseases.

An important message is that even small improvements of unhealthy dietary habits lead to health benefits. This includes both dietary habits and physical activity.

The national guidelines regarding good dietary habits are aimed at adults, adolescents and children, and can be adjusted for different food cultures. For children under two years of age, pregnant women and vegetarians there are specially targeted advices and information. People with certain diseases and food allergies may need individually tailored nutritional advice or dietary treatments from their healthcare provider.

Background

In the Swedish National Food Agency's instruction it is stated that the authority should inform consumers, companies and other interested parties in the food chain regarding current rules and regulations, dietary guidelines and other important issues in the food area. The agency should also promote the consumers', and particularly children's and adolescents', ability to make conscious decisions regarding healthy and safe foods[1].

The Swedish National Food Agency is also charged with working towards achieving the generational goal for the environmental work and the environmental quality objectives that the Parliament has established, and if needed suggest measures to develop this environmental work. The regulation regarding environmental management also states that environmental aspects should be integrated into the work of the agency[2].

Based on this, one of the Swedish National Food Agency's three main areas is to promote healthy dietary habits in the population. As part of this work, the agency gives out dietary guidelines, both in the shape of specific recommendations for different groups, for example infants, toddlers, pregnant women and breastfeeding women, and as general recommendations aimed at the general population. This report concerns recommendations given to the general population.

In 2005, the Swedish National Food Agency presented the so called "Five dietary guidelines". The aim with this was to, in a simple way, show the most important changes in dietary habits that were needed to improve the general state of health of the Swedish citizens. Apart from these five recommendations, the Swedish National Food Agency also gives advice regarding sugar, salt and physical activity. These dietary guidelines are now being revised. One important piece of news has been to integrate the impact of food on the environment when these guidelines are being developed. The dietary guidelines point to dietary habits that are sustainable, both for the individual and for our planet.

The most important basis for the dietary guidelines is the Nordic nutritional recommendations (NNR 2012) [1]. These have recently been revised and were presented during the autumn of 2013. In NNR 2012 there are recommendations regarding intake of nutrients and physical activity, but it also emphasises the types of dietary habits that give us a lot of nutrients while also contributing to a decrease of the risk of cardiovascular disease, obesity, type 2 diabetes and cancer. During the project, leading scientists and experts from the Nordic countries reviewed and summarised scientific studies about how nutrients, foods and dietary habits impact our health. Within some important areas, systematic literature reviews were carried out. This means that a search, review and evaluation of studies with a certain set of queries was carried out, according to predetermined criteria. In NNR 2012 we have a current, quality-controlled document about nutrition

[1] Swedish statute-book 2009:1426.
[2] Regulation (2009:907) regarding environmental management within governmental authorities.

and health in the Nordic countries, as a basis for recommendations regarding healthy dietary habits. New scientific studies are continuously published. Systematic investigations performed by organisations, expert panels and other countries are important bases for our recommendations, and which we always keep up to date with. The Swedish National Food Agency will, when needed, make new evaluations in line with the principles in the NNR body of work.

The nutritional aspects have been in focus for the revision, but we have also weighed in toxicological aspects. However, microbiological aspects have not been included, since microbial risks can be alleviated through cooking and good hygiene.

For meat and processed meats and for nuts, the Swedish National Food Agency has done its own risk and benefit evaluations, which form a basis for the recommendations for these types of foods. Here we have also weighed in studies published after NNR 2012.

Apart from nutritional recommendations, knowledge of the dietary habits of the population form an important basis for giving dietary advice. During 2010-11, the Swedish National Food Agency performed a national survey of the dietary habits of the Swedes - Riksmaten - Adults 2010-11. Certain information was gathered from the Swedish Board of Agriculture's (Jordbruksverkets) consumption statistics. The report “Good food choices in Sweden based on Nordic nutritional recommendations” [2] summarises NNR 2012 from a foods perspective, and presents how the consumption of various food groups is represented throughout the population.

The Swedish National Food Agency is one of 25 national agencies who has special responsibility for the environmental objectives. This means that the Swedish National Food Agency should work to achieve the generational goal for the environmental work and the environmental quality objectives that the Parliament has established. If needed, the Swedish National Food Agency should suggest measures to be taken to develop the environmental work.

There are sixteen national environmental quality objectives that describe the environmental conditions the environmental work should lead to. They include issues from air without pollution and lakes without problems with over-fertilisation or acidification, to functioning ecosystems in forests and agricultural land. The food sector is more or less affected by all these objectives, but some are particularly relevant, and it is mainly on these that the Swedish National Food Agency bases its description of the environmental impact of different foods. Since a quarter of the household impact on the climate are caused by foods, the environmental quality objective Reduced Climate Impact is one of these. Other objectives are A Non-Toxic Environment, Zero Eutrophication, A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos, A Varied Agricultural Landscape and A Rich Diversity of Plant and Animal Life.

Within the environmental area, the Swedish National Food Agency has previously requested a number of reports, which form the basis for the description of the environmental impact of various foods, for example På väg mot miljöanpassade kostråd (On the road to environmentally adjusted nutritional advice), report no. 9, 2008, På väg mot

miljöanpassade kostråd - Delrapport fisk (On the road to environmentally adjusted nutritional advice - subreport fish), report no. 10, 2008 and Miljöpåverkan från animalieprodukter - kött, mjölk och ägg (Environmental impact of animal-based products - meat, milk and eggs), report no. 17, 2013. The report Hur liten kan livsmedelskonsumtionens klimatpåverkan vara år 2050? (How small can the climate impact of food consumption be in 2050?), jointly created by the Swedish Board of Agriculture (Jordbruksverket), the Swedish National Food Agency and the Environmental Protection Agency (Naturvårdsverket), has also contributed with important information. The information in the area of food and environment is based on existing research and knowledge of national and international analyses of environmental systems and life cycles, in order to give a comprehensive overview of the environmental impact of various foods. Due to changes in production systems and new knowledge in this area, the information needs to be constantly updated.

The Swedish National Food Agency works together with the Environmental Protection Agency and the Swedish Board of Agriculture to reduce food waste[3]. This work has been done in parallel with the creation of new nutritional advice . In the nutritional advice and in this report we only mention the waste issue briefly.

Before starting to revise the nutritional advice, we did a survey of consumers' and advisors'/informers' knowledge of and acceptance of advice regarding healthy dietary habits. We also investigated their knowledge of healthy dietary habits, how they use the information from the Swedish National Food Agency and the target groups' need for and expectations of advice regarding healthy dietary habits. The results from that survey are presented in the report "Synen på bra matvanor och kostråd - en utvärdering av Livsmedelverkets råd" (The perception of healthy dietary habits and nutritional advice - an evaluation of the Swedish National Food Agency's advice). The evaluation showed that the Swedes' knowledge of how to eat to be healthy is high. More fruit and vegetables, whole grains, fish, less sweets and sugar, and to have a varied and balanced diet are nutritional advice they themselves would give. Just over half agreed with the advice to use keyhole-labeled (Nyckelhålsmärkt) (a label given to healthy foods) margarine on their sandwiches and to choose lean dairy products. 87 percent also think it's a good thing that the authorities give nutritional advice. [3].

During the development of the new suggestions for advice regarding healthy dietary habits, the Swedish National Food Agency has been supported by a reference group with representatives from other authorities, industry associations, researchers and organisations. The Swedish National Food Agency has also been in contact with the Public Health Agency (Folkhälsomyndigheten) and the Swedish Board of Agriculture, for expert support during this work. In November 2014 an open hearing was arranged, with various professionals working with healthy dietary habits, and participants from the food industry, consumer organisations, patient organisations and other interested parties. After that, suggestions for consumer texts and drafts of a management report were pre-

[3] /www.the Swedish National Food Agency.se/matvanor-halsa--miljo/miljo/ta-hand-om-maten-minska-svinnet/

sented for open consultation on the Swedish National Food Agency's website. About fifty referrals came in and have been processed.

As an aid to create target group-adjusted material for the nutritional advice, we created focus groups of consumers. In the survey we tested understandability, tonality and approach, idiom and choice of images.

In this report we present the Swedish National Food Agency's conclusions regarding the scientific information and the considerations that have been taken, where other relevant factors also have weighed in, which together form the basis for the new advice regarding healthy dietary habits. Other relevant factors are, for example, the environmental impact of foods, Swedish food culture and tradition, and the ability of consumers to follow this advice.

Energy balance and weight stability

Advice

- Balance between energy intake and energy consumption

Health aspects

- We need energy to maintain basic life functions, for physical activity and, when it comes to children and adolescents, also for growth. Over- and under-consumption of energy lead to negative health consequences in the long term. Energy balance means that the energy intake through food and drink corresponds to the energy consumption, which leads to weight stability.
- Due to large variations in rest metabolism, body type and degree of physical activity, the need for energy can vary greatly from person to person. By being more active, you can increase the energy consumption.
- Being of a normal weight means a reduced risk for illness and disease, as well as an increased quality of life. In Sweden just over half of all adult males, just under half of all women, and one child in five are overweight or obese [4].
- Obesity is linked to a range of health risks. To avoid becoming overweight and maintaining a normal body weight is the first advice that is emphasised in the report "Diet and Cancer report" from World Cancer Research Fund (WCRF) [5]. The report summarises the research regarding the ties between food and cancer, and gives advice about how you can reduce the risk of cancer. It also gives advice about limiting the consumption of energy-dense foods, that is foods containing a lot of sugar and fat and little fibre.
- In connection with NNR 2012, we performed a systematic literature overview, with focus on long-term weight stability. The overview shows that the division between protein, fat and carbohydrates doesn't seem to play in important role in preventing weight gain. However, there is scientific evidence showing that foods that are rich in fibre, that is green vegetables, root vegetables, legumes, fruit, berries, whole grain products, nuts and seeds, and possibly also dairy products, are connected with a reduced risk of weight gain. Processed grain products, sugar-rich foods and sugar-rich drinks, red meat and processed meats are connected with a higher weight gain in long-term studies. Diets based on naturally fibre-rich plant-based foods have a lower energy density than diets rich in foods of animal origin and foods containing a lot of fat and sugar [6].
- Physical activity is also important for the nutritional intake. Physically active individuals need more energy than non-active individuals, and thus cover their need for vitamins and minerals more easily.

Other factors that have been considered

Environmental aspects

- Over-consumption of foods unnecessarily contribute to the environmental impact.
- Foods that do not contribute important nutrients, such as sweets and soft drinks, can be considered unnecessary consumption and thus also an unnecessary environmental impact.

Advice before 2015

The Swedish National Food Agency considers energy balance as a criteria for good health, in many instances.

Conclusion

Energy in a reasonable amount is necessary for us to be healthy, and both underweight and overweight have negative consequences for our health. Today half of all adult Swedes and every fifth child overweight or obese, which is a great public health problem. For most people it is very hard to lose weight. Therefore we should take measures to reduce the risk of becoming overweight. One such measure is advice about healthy dietary habits. Therefore, the Swedish National Food Agency has established that we need advice that emphasise the importance of energy balance and weight stability. The choice of foods is important for energy balance and weight stability. This is dealt with in the advice about the different food groups.

Physical activity

Advice

- Movement in everyday life, for example through at least 30 minutes brisk walking per day.
- Reduced time spent sitting down through regular short breaks.

Health aspects

- Physical activity, together with healthy dietary habits, form a healthy lifestyle and helps prevent diseases such as cardiovascular disease, osteoporosis and certain types of cancer [7]. Physical activity is also very important for weight stability.
- Physical activity is also important for the nutritional intake. Physically active individuals need more energy than non-active individuals, and therefore cover their need for vitamins and minerals more easily, through eating larger amounts of food.
- Long periods of inactivity per day (sitting still or lying down for several hours during the day) also increase the risk for chronic diseases. Even if you are active during a short period of the day, your health can be further improved by shortening the inactive periods [7].
- NNR 2012 recommends at least 150 minutes of moderate to intense physical activity per week, or 75 minutes high-intensity physical activity per week, or a combination of the two. For further positive health effects, the activity is increased to 300 minutes a week or 150 minutes high-intensity physical activity per week, or a combination of the two [7].

Other factors that have been considered

Environmental aspects

- Everyday exercise, such as taking a walk or ride a bike instead of using the car, or to take the stairs rather than the lift, is also positive from an environmental perspective, since the alternatives lead to greenhouse gas emissions and use up natural resources.

The Public Health Agency's recommendations regarding physical activity

The Public Health Agency recommends all adults 18 years and over to be active for a total of at least 150 minutes a week. The intensity should be at least moderate. At high intensity, at least 75 minutes per week are recommended. Moderate and high-intensity

activity can also be combined. The activity should be spread over several days a week and be done in periods of at least 10 minutes[4].

A need to simplify and give consistent advice

The recommendation given in the Nordic nutritional recommendations is relatively complicated and difficult to communicate. Therefore we have simplified the message in the advice currently being suggested. It has also been important to find advice which coincides with advice given by the Swedish Public Health Agency.

Advice before 2015

The Swedish National Food Agency's advice for adults before 2015 was at least 30 minutes physical activity per day, at moderate or high intensity.

Conclusion

Physical activity has many positive effects on our health, and decreases the risk of developing chronic diseases such as type 2 diabetes, cardiovascular disease and certain types of cancer. New research also shows that inactivity in itself increases the risk for chronic diseases. Physical activity is also important for energy balance and nutritional intake. The Swedish National Food Agency therefore suggests that there is a need for advice regarding physical activity and reduced inactivity. The advice has been formulated to coincide with advice from the Swedish Public Health Agency.

[4] www.folkhalsomyndigheten.se/amnesomraden/livsvillkor-och-levnadsvanor/fysisk-aktivitet/rekommendationer/.

Green vegetables, root vegetables, legumes, fruit and berries

Advice

- A total of at least 500 grams vegetables and fruit per day.
- Different kinds
- A lot of brassicas, onions, legumes and root vegetables

Health aspects

- In general, fruit, berries, green vegetables, root vegetables and legumes contain a lot of fibres, vitamins, minerals and antioxidants. The contents of minerals and vitamins vary significantly between different vegetables, legumes, root vegetables and fruits. Since some of them contain large amounts of for example Vitamin C, folate, carotenoids and potassium, while others contain large amounts of Vitamin E, Vitamin K and magnesium, it is good to eat a variety of these foods, in order to take in all the different nutrients. Practically all vegetables, legumes, root vegetables and fruit contain a lot of fibre. Legumes and green leafy vegetables are also sources of iron. In addition, legumes are a good source of protein [2].
- Apart from nutrients green vegetables, legumes, fruit and berries also contain other bio-active components that can affect the body, positively or negatively, in a variety of ways. Examples of these components are polyphenols, lycopene, lectins and phytoestrogens. Antioxidants are a group of bio-active substances that can contribute to the body's protection against harmful oxidative stress.
- The energy content is relatively low, which means they have a high nutritional density, i.e. a lot of vitamins and minerals per kilocalorie.
- Epidemiological studies show a link between a low consumption of fruit and vegetables and an increased risk of cancer (5).
- The organisation World Cancer Research Fund (WCRF) has done a systematic investigation of various epidemiological studies. The investigation shows a link between a diet high in vegetables and/or fruit and a decreased risk for cancer of the mouth, larynx, oesophagus, lungs, stomach and bowels (6).
- In NNR 2012, it is established that dietary patterns with a large component of plant-based foods, i.e. a lot of green vegetables, root vegetables, legumes, fruits, berries, nuts and seeds, lead to a decreased risk for diet-related diseases such as cardiovascular disease, certain cancers and obesity. Brassicas, onions, legumes and root vegetables are emphasised as particularly important for healthy dietary habits [8, 9].

- The health effects associated with vegetables, fruit and berries could be caused by a beneficial combination of nutrients and bio-active substances. However, it has not been established to what degree the antioxidants contribute to the positive effects, and there is no scientific basis for recommending vegetables or fruits with a high amount of antioxidants before other fruit and vegetables [10].
- Positive health effects can be achieved even with small increases, from a low consumption of fruit and vegetables [11, 12].
- During conventional growing of fruits and vegetables, synthetically created plant protection products are commonly used. All allowed plant protection products go through a comprehensive risk assessment? before they are approved. The limits that are in place for the maximum amount of plant protection product that can be left in the product when it's to be eaten are set with good margins to the level which could cause health risks. The EU's and the Swedish National Food Agency's controls of residues show that the amounts normally are much lower than the set limits [13].
- There is nitrate in vegetables, particularly certain leafy vegetables such as lettuce leaves, spinach and rocket. Beetroot and radish can also contain nitrate, but in lower amounts. About 5 percent of the nitrate absorbed by the body is converted to nitrite, primarily through nitrate-reducing bacteria in the mouth. Nitrite can cause tissue changes in the lungs and heart, and methemoglobinemia. The risk for methemoglobinemia only concerns infants [14].
- Lectines are a group of proteins present in all legumes, such as beans, lentils, peas, green beans and wax beans. The amounts vary. Correct cooking of the legumes before eating removes the risks caused by lectines. Many legumes must be both soaked and boiled. Poisoning due to intake of raw and insufficiently cooked/treated beans can lead to nausea, vomiting, diarrhea and stomach pains [14]. There is not much research about the possible effect of lectines in humans in the long term.

Consumption

- According to Riksmaten - Adults 2010-11, women eat on average 350 grams of fruit and vegetables per day, while men eat less, on average 300 grams per day. Only 17 percent of the population eat the recommended 500 grams per day (21 percent of the women and 13 percent of the men). Many men only eat vegetables, fruit and berries once or twice a week.

Other factors that have been considered

Environmental aspects

- Green vegetables, root vegetables, legumes, fruit and berries have, together with other plant-based foods, a small environmental impact, compared with products of animal origin. From an environmental perspective, it is desirable to increase the consumption of plant-based foods and decrease the consumption of products of animal origin.
- Fruit, berries, vegetables and legumes have very different environmental impacts, depending on how and where they are cultivated, and how fragile they are. Sturdy and resilient vegetables - such as root vegetables, white cabbage, cauliflower and onions - are often grown outside and therefore affect the climate to a lesser extent than vegetables cultivated in greenhouses. Greenhouses that are heated with fossil fuels have a larger environmental impact than those heated with waste heat or bio-fuels. Legumes such as beans, peas and lentils have a relatively low climate impact, especially if you compare them with other sources of protein, such as meat and dairy products [15].
- There are some climate-certified products. For climate-certification there are requirements to take measures which limit the impact on the climate during production and distribution of foods, and thus decrease emissions of carbon dioxide, methane and nitrous oxide. For, as an example, climate-certified products grown in greenhouses, the impact on the climate can decrease significantly.
- The cultivation causes the biggest impact on the climate, but the transports are also important. The amount of emissions depend on how the product has been transported, i.e. how far, how efficiently and with what type of transport. Train and boat transports cause less emissions than plane transports and long transports by lorry. Vegetables, fruits and berries with a short shelf-life are most often those needing to be transported by plane, if they are to be transported far. They can also require cold storage, which further increases the emission of greenhouse gases. [15]
- Cold storage and freezing also have an impact on the climate, but a relatively low climate contribution per kg of product. Generally, you could say that cold storage is less efficient the closer to the consumer the storage takes place, but it's still just a small part of the total climate impact of the product [16].

- Pesticides[5] against insects and mould are common in all cultivation systems. During conventional cultivation of fruits and vegetables, chemical pesticides are used as a complement to, for example, choice of type, crop succession and mechanical methods for control of weeds and pests. The use, and how the environment is affected by this, depend on amount, handling and type of pesticide. This in turn depend on, amongst other things, cultivation technique and climate factors [15].
- During ecological cultivation, no chemical pesticides are used, which decreases the total usage of chemicals and the spreading of these to the surrounding environment. This contributes to a poison-free environment and is positive for biological diversity, especially in large-scale agricultural landscapes. Certain aids are allowed, such as sulphur, soap water and lime[6]. Further, weeds and pests are controlled through for example choice of type, crop succession, mechanical processing and a longer distance between plants. Mineral fertiliser is not used during ecological cultivation, which leads to a lower consumption of phosphorus. The harvest is often smaller for ecological production, and thus, for example, the use of land is often larger per kilo of product [15].
- Fruit and vegetables have a relatively short shelf-life and is the food group causing the most food waste. This is especially true for products with a large surface or a high breathing-intensity, such as lettuce, broccoli, fresh corn and asparagus. In order to avoid wasting vegetables and fruit you should not buy more of these products than what you will eat over the next few days. By replacing some of the consumption of green vegetables with a higher amount of more storable vegetables, such as root vegetables, brassicas and dried legumes, the total waste from this category could decrease [17].

Potatoes

Potatoes are not included in the amount of vegetables and are not included in the advice. Potatoes are a nutritious food, and are included as a basic food in the Swedish diet. Some eat rather a lot of potatoes. If a large part of 500 grams of vegetables and fruit would consist of potatoes, the variation in the vegetable and fruit group becomes too small. To have a certain amount of potatoes as a part of the recommended amount complicates the message. This is why potatoes have not been included in the amount. Even if potatoes are not included in the advice regarding vegetables and fruit, it is a food which contributes to healthy dietary habits and is also a good choice from an environmental perspective [15].

[5] Pesticides are the same as plant protection products. The Swedish National Food Agency normally uses the name pesticides.
[6] EU Regulation 834/2007.

Juices and smoothies

Juices are not included in the 500-gram amount. Juice contributes nutrients, for example Vitamin C. However, juice gives less fibres and feels less filling than whole fruits and berries, but contributes the same amount of calories. Therefore juice is not included in the advice regarding 500 grams of vegetables and fruit a day. Smoothies, where you haven't filtered away the fibres, could constitute part of the recommended amount of vegetables and fruit.

Advice before 2015

Since 1999, the Swedish National Food Agency has given the recommendation to adults to eat a lot of fruit and vegetables, - preferably 500 grams a day. This amount is based on a number of epidemiological studies [18]. In this advice, a maximum of one decilitre of juice was recommended. Potatoes were not included.

Several international organisations have come to similar conclusions. The World Health Organisation (WHO) recommends at least 400 grams of fruit and vegetables per day, based on epidemiological studies of, amongst other things, links between a low consumption of fruit and vegetables and an increased risk of cancer (5). The organisation World Cancer Research Fund (WCRF) recommends that adults eat 400-800 grams of vegetables per day, corresponding to at least five portions per day (6). The background for the recommendations is formed by proof that a diet including a lot of vegetables and/or fruit protects against cancer of the mouth, larynx, oesophagus, lungs, stomach and bowels.

Conclusion

There is convincing proof that including green vegetables, brassicas, root vegetables, legumes, fruit and berries in your diet can contribute to lessening the risk of diet-related diseases. Based on the scientific evidence, we cannot determine an optimal amount, but the Nordic nutritional recommendations have established that an increase in consumption, compared with the current average consumption of 300-350 grams a day, would be beneficial to health. The current advice about eating at least 500 grams of vegetables and fruit a day remains, but is modified so that juice is no longer added to the total amount of 500 grams, which in practical terms means that the recommendation has been increased.

Since vegetables and fruit have a relatively low environmental impact compared to animal products, is it also desirable to increase the consumption of vegetables and fruit from an environmental point of view. For both health and environmental reasons it would be good if the consumption of robust vegetables such as root vegetables, cabbages and onions increased from the level it is today.

The Swedish National Food Agency's evaluation is that pesticide residues from fruit and vegetables do not pose a health threat to Swedish consumers. This is also true for particularly sensitive groups such as pregnant women and children. However, choosing ecological fruits and vegetables decreases the use of chemicals and promotes biological diversity.

Nuts and seeds

Advice

- A couple of tablespoons of nuts and seeds a day.
- Maximum two tablespoons of linseeds a day.
- Crushed linseeds should not be eaten unless they are heated.

Health aspects

- Nuts and seeds contain many important nutrients, such as monounsaturated and polyunsaturated fats, protein, magnesium, zinc, copper, potassium, phosphorus, iron, Vitamin E, tiamine, Vitamin B6, folate and niacin. Certain nuts, like Brazil nuts, can also contain very high amounts of selenium. Nuts and seeds also contain several bio-active substances with a potential antioxidant effect.
- Nuts and seeds can play a particularly important role in a vegetarian diet, where they contribute, among other things, zinc, selenium, iron, calcium and Vitamin B6, which can otherwise be difficult to get enough of.
- In spite of a high energy content, there is a link between intake of nuts and seeds and the ability to maintain weight [19].
- In the Nordic nutritional recommendations 2012 [9], nuts and seeds were identified as one of the foods we in Scandinavia should eat more of, in order to achieve healthy dietary habits and decrease the risk of chronic diseases.
- In many studies, nuts have been shown to decrease the risk of cardiovascular disease. The EU Commission has, after an evaluation by Efsa, decided that a health declaration for effects related to cardiovascular function can be made for 30 grams of walnuts a day [20]. The Swedish National Food Agency's investigation of the positive and negative health effects of nuts shows that nuts can contribute to a decrease in the risk of cardiovascular disease [20]. Since the report was written, data has been published which reaffirm the positive health effects of nuts. This includes systematic literature overviews, where a decrease in the risk of cardiovascular disease with about 20-30 percent when consuming nuts has been reported, compared with no consumption of nuts [21-23]. The amounts where health benefits have been observed are about 30 grams, from a few times a week up to every day. There is evidence of a reduced risk for cardiovascular disease, even in an interventional study of a high-risk group, which reaffirms that it is the nuts themselves that decrease the risk [24].
- Nuts and peanuts belong to the food groups that are the most common causes of allergic reactions in Europe [25]. In Europe, the hazel nut is the nut causing the most allergic reactions. About 4.2 percent of the population is estimated to experience symptoms and have IgE-antibodies against hazel nuts, but the figures differ between different studies and population groups. In Sweden, many people with an allergy against birch pollen experience milder symptoms when they eat hazel nuts, and these individuals are included in the figures above. However, two studies from A&E departments in Stockholm and Uppsala show that nuts and peanuts are the

most common reasons for severe allergic reactions in children and adolescents [26, 27]. Walnuts, cashew nuts and almonds are other nuts that commonly cause allergic reactions in Europe [25].

- In Sweden we consume smaller amounts of nuts than the average for Europe [25]. However, the import? of peanuts and nuts has increased and from 2001 to 2010, the import? of cashew nuts increased twentyfold [27]. A study from the children's A&E department at Akademiska Sjukhuset shows that during that same period, the number of severe allergic reactions to cashew nuts has increased. This could mean that an increased consumption of nuts in the population also increases the risk for developing an allergy. On the other hand, more peanuts are consumed in Israel than in the UK, but the prevalence of peanut allergy is lower in Israel than in the UK [28]. These studies are examples of ecological studies on a population level. We need interventional studies to establish if there are optimal doses of allergens and the timings for administering allergens, to lessen the risk of developing allergies. Today there isn't enough knowledge to give nutritional advice to the population regarding decreasing the risk of developing allergies (the exception is type of baby formula for high-risk babies who need baby formula) [29]. Thus, there isn't enough evidence to limit the consumption of any food group in order to avoid developing allergies [30].
- There is no cure for allergies. What an allergic person can do to avoid having an allergic reaction is to avoid whatever is causing the reaction. In spite of allergic persons trying to avoid what they are allergic to, they still have unexpected allergic reactions. A study by the Swedish National Food Agency shows that 6 percent of adults had experienced an unexpected allergic reaction over the previous year [31], either in themselves or in their children. The Swedish National Food Agency's registers show that 20 percent of unexpected reactions against foods are caused by hazel nuts, peanuts and other nuts.
- The mould poison aflatoxin is present, to various degrees, in nuts, and causes an increased risk for liver cancer. Consumption of 30 to 65 grams of nuts a day is however estimated to possibly lead to only a few more cases of liver cancer in Sweden. For persons with hepatitis or persons with a decreased liver function, these risks are higher. Single very high amounts of aflatoxin can be present in some nuts, which is more significant for the exposure to aflatoxin than the total amount of consumed nuts. A high consumption increases the probability of eating a nut with a very high amount of aflatoxin. The nuts with the highest amounts of aflatoxin has been showed to be Brazil nuts and cashew nuts. If the intake of these is limited, the risk of ingesting high doses of aflatoxins will be considerably lower [20].
- Linseeds may contain cyanogenic glycosides/hydrocyanic acid. Exposure to high concentrations of cyanide can have very serious consequences, such as respiratory failure, paralysis, unconsciousness and death. The amounts of hydrocyanic acid in linseeds is reported to be between 100 and 1,000 mg/kg. Crushed or ground linseeds create a higher exposure to cyanide than whole seeds. No toxic effects are known through traditional uses of whole linseeds, that is 1-2 table spoons for adults, as a laxative. An intake of 3-10 table spoons of *crushed* linseeds creates a significant exposure to cyanide, which can be harmful if done for a long time, but is not considered to create any risk of acute poisoning. The cyanide content of crushed linseeds seem to significantly reduce when baked.

Consumption

- Riksmaten adults 2010-11 showed that the average consumption of nuts and seeds was 5 grams a day [4]. Of those who had eaten nuts and seeds during the registration period (four days), the average consumption was just under 20 grams a day. According to statistics from the Swedish Board of Agriculture, the consumption of nuts has increased significantly over the last ten years.

Other factors that have been considered

Environmental aspects

The Swedish National Food Agency does not have information about environmental aspects when it comes to nuts and seeds.

Advice before 2015

The Swedish National Food Agency has previously not given any advice regarding nuts, other than avoiding eating discoloured or shrunken nuts. There is also a recommendation about limiting the intake of whole linseeds to 1-2 tablespoons a day and to avoid crushed linseeds that have not been heated.

Conclusion

Nuts and seeds belong to the foods where the consumption, according to the Nordic nutritional recommendations, should increase. They contain healthy fats and important vitamins and minerals. In spite of a high energy content, nuts and seeds, as a part of a healthy diet, seem to contribute to making it easier to maintain weight. However, nuts can contain varying amounts of the mould poison aflatoxin, and therefore an increased consumption carries the risk of a somewhat increased risk of liver cancer. The risk of severe allergic reactions is also increased by a general increased consumption of nuts and peanuts, mainly in those who are already allergic. It is possible that there is also a risk of more people developing allergies.

The Swedish National Food Agency's conclusion is that there is a need for advice regarding increased consumption of nuts and seed, at a moderate level. The amount where positive health benefits have been observed is about 30 grams, from a few times a week up to every day, which corresponds to a couple of tablespoons a day.

Bread, grains, pasta, rice

Advice

- Whole grain products of pasta, bread, grains and rice instead of processed products.
- Keyhole-marked products.

Health aspects

- Cereal products, that is bread, cereals, grains, pasta and rice, are the only sources of whole grain[7]. Whole grain amounts to, together with other plant-based foods, a large part of the diet in the dietary patterns that are associated with a reduced risk of diet-related diseases. These healthy diet patterns are also noted for a low consumption of processed cereals, i.e. white flour [8].
- Several studies show that individuals who eat a lot of whole grains have a lower risk of contracting type 2 diabetes. Whole grains probably also have a protective effect against cardiovascular disease, and there are suggestions that whole grains also contribute to decreasing the risk of bowel cancer. How often and how much whole grains that have been shown to decrease the risk in various studies vary significantly, and health benefits can be achieved through increased consumption of whole grains, both from a low level and from an already high intake [32].
- Whole grain products are rich in fibres and thus contribute to good bowel function [33].
- There are also studies that seem to show that whole grains protect against weight gain and obesity. Whole grain products contain more dietary fibre than processed products, and there might be a protective effect against weight gain from dietary fibres from various sources. There is some evidence that there is a link between a too-high intake of processed cereals and an increased risk of weight gain [19].
- Whole grain products are sources of fibres and nutrients that can be difficult to get enough of, for example iron and folate, but also a range of other nutrients, such as tiamine, niacine, phosphorous, potassium, copper, magnesium, manganate, molybden and zinc, as well as antioxidants and other bio-active substances.-Cereals that have been processed so that they contain less amounts of cereal germs and bran also contain less nutrients than whole grain products. For example, the amount of iron in whole grain wheat is four to six times higher than in processed white flour.

[7] Whole grain is defined as the whole kernel of the cereal. The kernel can be ground, crushed or similar, but the components should be included, in their original proportions, for each type of cereal. With cereals we mean wheat, including spelt and durum wheat, rye, oats, barley, corn, rice, millet, durra and other types of sorghum.

- There isn't enough scientific evidence to give advice about exactly how much whole grains to optimally consume. An intake corresponding to 75 grams of whole grains per 10 MJ is considered an appropriate amount. This means about 70 grams of whole grains a day for women and about 90 grams for men. 75 grams/10 MJ is suggested in a Danish report, based on the highest intakes in Nordic populations [34].
- The presence of fytic acid in whole grains can affect the uptake of minerals such as iron and zinc. Fytic acid is partly broken down when preparing the whole grains, for example by soaking, germinating and fermenting, or for example when letting rise for a long time when baking with sourdough.
- Whole grains contain higher amounts of cadmium than processed products. Cadmium stays in the body for a long time and is stored in the kidneys, which could cause harm to kidney function if you ingest a lot of cadmium during a long period of time. Such cadmium intakes have also shown effects on the bones. However, the Swedish National Food Agency considers that the total cadmium intake from prepared foods in everyday life is maintained at an acceptable level, even if you consistently choose the whole grain alternatives [35].
- Whole grain products often contain a higher level of acrylamide than white bread. Acrylamide is classed as a carcinogen, and if you ingest a lot of acrylamide for a long period of time, this could increase the risk of cancer. However, the Swedish National Food Agency considers that the healthy effects of eating whole grains are greater than the risks with acrylamide [35].
- Rice is a plant that absorbs relatively high levels of arsenic. Arsenic can mainly be found in two forms, organic and non-organic. Non-organic arsenic is the form that is poisonous to humans. WHO has classified non-organic arsenic as a carcinogen in humans, and it is suspected that it causes cancer in the bladder, lungs and skin, amongst others. Arsenic can also affect development of the nervous system and the immune system, and small children are particularly sensitive to this since their brains are developing. Today the Swedish National Food Agency is therefore giving the advice not to give rice drinks to children under six. When it comes to adults, the Swedish National Food Agency does not consider it necessary to give particular advice regarding the consumption of rice due to arsenic, apart from advice about eating a varied diet [36].

Table 1. Examples of whole grain content in some foods. Recommended amount per day is 70 grams for women and 90 grams for men.

Foods	**Amount of whole grains**
1 portion of oatmeal porridge, 100% whole grains (35 grams of grains = 1 dl)	35 grams of whole grains
1 portion of rye flake porridge, 100% whole grains (35 grams of grains = 1 dl)	35 grams of whole grains
1 portion whole grain pasta, 55 % whole grains (70 grams of uncooked pasta)	40 grams of whole grains
1 portion of whole grain bulgar wheat, 100 % whole grains (55 grams of grains = 0.75 dl)	55 grams of whole grains
1 portion of whole grain rice or wild rice, 100 % whole grains (45 grams = 0.5 dl)	45 grams of whole grains
1 slice of crispbread (12 grams), 100% whole grains	12 grams of whole grains
1 slice (30 grams) of soft white bread	0 grams of whole grains
1 slice (30 grams) of keyhole-marked bread, at least 25 % whole grains	At least 5 grams of whole grains
1 portion (40 grams) of muesli (keyhole-marked), 50 % whole grains	18 grams of whole grains

Consumption

- Riksmaten - adults 2010-11 showed that nine out of ten individuals ate less than the recommended amount of whole grains. The average intake of whole grains was 42 grams per day, which is about half of the recommended amount. Younger people ate less whole grains than older people. Bread was the biggest source of whole grains and contributed to 51 percent of the intake. [4].

Other factors that have been considered

Environmental aspects

- Cereal products in general have a low environmental impact, compared to products of an animal origin [15]. Breeding animals requires a large amount of cereal products. The feed conversion in chickens is considerably more efficient than in cereal-fed cattle [37].
- Direct consumption of cereals, even processed to pasta and bread, has a significantly lower climate impact than any type of meat products and fish [15].
- Compared to meat and other products of animal origin, cereal products have a low climate impact, from a life cycle perspective. The emissions of greenhouse gases are mainly derived from cultivation and transports. During cultivation it's the use of fertiliser, particularly mineral fertiliser, and the plowing of the fields that cause emissions of greenhouse gases. The impact, from cultivation to preparation, is smallest for relatively unprocessed products such as food wheat and rye grains [15]. Processed products such as pasta and bread have an approximately 50-100 percent higher climate impact than the grains they derive from, but it's still a low climate impact compared to meat products [38].
- Use of plant protection products is lower in cereal cultivation than in cultivation of fruits and vegetables [15]. Pesticides against insects and mould are common in all cultivation systems. The effect on the environment of this depends on amount, handling and type of pesticide. This in turn depends, amongst other factors, on cultivation technique and climactic factors.
- In ecological cultivation, mineral fertiliser and synthetic plant protection products are replaced with other measures. Certain cultivation aids, which are regarded as "natural", may be used, such as soap water and lime. In ecological cultivation no chemical pesticides are used, which promotes a poison-free environment and is positive for biological diversity, especially in large-scale agricultural landscapes. Mineral fertiliser is not used during ecological cultivation, which leads to a lower consumption of phosphorus. The harvest is often smaller for ecological production, and thus, for example, the use of land is often larger per kilo of product[8].
- Rice that is cultivated on water-drenched land emits quite a large amount of greenhouse gases. This is because bacteria in the root system produce methane in anaerobic conditions. Therefore, rice impacts the climate more than other cereals [15].

[8] The Swedish National Food Agency has requested a knowledge summary of the environmental impact of ecologically and conventionally produced foods from SP Food and Bioscience. The report will be published on the Swedish National Food Agency's website.

Advice before 2015

The Swedish National Food Agency's advice before 2015 was to primarily choose whole grain products when you eat bread, cereals, grains, pasta and rice. The Swedish National Food Agency further recommends an intake corresponding to 75 grams of whole grains per 10 MJ, which translates to about 70 grams whole grains per day for women and about 90 grams for men.

Conclusion

Whole grains amount to, together with other plant-based foods, a large part of the diet in the dietary patterns that are associated with a reduced risk of diet-related diseases, and cereals are the only sources of whole grains. Whole grains decrease the risk of type 2 diabetes, cardiovascular disease and possibly also cancer of the bowels. Whole grain flours contain more fibres and nutrients than white flours, such as for example iron and folate. These are substances that particularly women have difficulties getting enough of. Dietary fibres can contribute to decreasing the risk of weight gain and obesity. It is possible that whole grains in themselves can make it easier to maintain a normal weight. There are therefore several reasons for an advice regarding changing to whole grain products. The basis for establishing an exact recommendation is weak, but the Swedish National Food Agency's earlier recommendation about 70 grams per day for women and 90 grams for men upholds. Even a small increase in consumption is beneficial to health.

Cereals have a comparatively low impact on the environment, which means that from an environmental point of view, it is also beneficial to make cereals a large part of the diet. In spite of whole grain products in general containing slightly higher rates of cadmium and acrylamide, it's the overall evaluation by the Swedish National Food Agency that the benefits of whole grains clearly outweigh the risks.

Food fats

Advice

- Healthy oils, for example rapeseed oil or liquid fats made from rapeseed oil in the cooking.
- Keyhole-marked spreadable fats.

Health aspects

- Food fats contribute essential fatty acids and Vitamin E. Enriched products also contribute Vitamin A and D[9].
- Vegetable oils can also contain bio-active substances such as antioxidants. This mainly includes non-processed oils. There is Vitamin E in all vegetable oils, including processed oils, and it protects the polyunsaturated fatty acids from being broken down in body tissue.
- The total intake of fat in the diet does not affect the risk of contracting cardiovascular disease. However, a change in the composition of the fatty acids can contribute to decreasing the risk of cardiovascular disease. Replacing some of the saturated fatty acids in the diet with the same amount of polyunsaturated fatty acids can contribute to decreasing the risk of cardiovascular disease. The evidence for this has been considered as convincing in NNR 2012. A corresponding link is also seen for polyunsaturated fatty acids from plant sources. When it comes to the monounsaturated fatty acids, however, no clear link has been shown in epidemiological studies, which could be due to the fact that the study participants eating a lot of monounsaturated fat also ate a lot of saturated fat. Many types of foods that contain a relatively high amount of monounsaturated fat, for example hard food fats and meat, also contain a large amount of saturated fatty acids [39]. Olive oil and rapeseed oil are examples of food fats that contain a lot of monounsaturated fatty acids without also containing a lot of saturated fatty acids. Rapeseed oil also contributes polyunsaturated fatty acids, of which a comparatively large part is Omega-3. Sunflower oil is rich in polyunsaturated fatty acids, mainly Omega-6. Certain plant fats, such as coconut fat and fat from the oil palm, contain a large amount of saturated fatty acids [40, 41].

[9] A review of the regulations for obligatory Vitamin D-enriching, with the aim of increasing enrichment levels and the number of product groups included in the enrichment is being performed during 2015.

- According to Riksmaten Adults 2010-11, the reported intake was at a level with the recommendation regarding the total amount. The intake of saturated fat was 13 energy percent, which is higher than recommended, while the intake of monounsaturated fat and polyunsaturated fat was within the recommended range. However, the average intake of polyunsaturated fat was close to the lower part of the range, and it was a relatively large part of the participants who had a too-low intake of polyunsaturated fatty acids, particularly Omega-3 fats, in relation to the recommendation.
- Total cholesterol and LDL cholesterol in serum or plasma decreases when the amount of saturated fatty acids in the diet decreases and the amount of polyunsaturated or monounsaturated fatty acids increase correspondingly. Since LDL cholesterol and the ratio between LDL and HDL cholesterol are important markers for the risk of contracting cardiovascular disease, this means that such a change, even if indirectly, contributes to decreasing the risk of cardiovascular disease. An increased concentration of LDL cholesterol in serum increases the risk of hardening of the arteries. There is no evidence that the concentration of HDL cholesterol is affected by a change in the intake of saturated and polyunsaturated fatty acids. Neither does an increase in HDL cholesterol alone contribute to decreasing the risk of cardiovascular disease [42].
- Butter and food fat mixed with butter contain a relatively high amount of saturated fat and also contribute small amounts of trans fats. However, these days the content of industrially produced trans fats in margarines is very low. The intake of both industrially produced and natural trans fats should be as low as possible, since they increase the risk of cardiovascular disease [6, 43].
- Swedish diets are above the recommended maximum intake of saturated fat and on the level with the recommendations for polyunsaturated fat and total fat. Food fats contribute to 18 percent of the fat intake, of which spreadable fats contribute 8 percent. Therefore, the choice of food fat is important for the quality of fat in the diet.
- Since some consumers expressed concern that margarines contain harmful substances, in the spring of 2014 the Swedish National Food Agency carried out an investigation into residues of solvents in butter, food fat mixtures and margarines. Solvents are sometimes used as a process aid for the extraction of oil. Pectin, sometimes used as a texture agent in some food fats, is also extracted with the aid of solvents. The result showed that all tested products, including butter and butter-based food fats, contained small amounts of the analysed substances. The detected content of acetone and methanol in butter and butter-based food fats is probably derived from the metabolism of the cow, the bacteria in the rumen and the activity of the acidification culture, while the detected chloroform was probably created from

chlorine-containing cleaning solutions used in dairies. However, all amounts were so low that they did not present any harm to the health[10].

Consumption

- In Riksmaten – Adults 2010-11, 29 percent of the participants said they used liquid margarine in their food, 17 percent used butter, 16 percent used olive oil, 14 percent rapeseed oil and 13 percent cooking and baking margarine [4]. Information about how much food fats were used during cooking are missing, since the participants only reported what types of meals they'd had, and not the individual ingredients. The average consumption of spreadable food fats was just over 10 grams per day.

Other factors that have been considered

Environmental aspects

- Different food fats have different impacts on the environment. Rapeseed oil, food fats with a lot of rapeseed oil, and olive oil generally have less impact on the environment than butter and uncertified palm oil [15].
- The climate impact from rapeseed and olive oil production is about the same, but the impact of butter is about six times higher. This is because butter comes from cows, who let out large amounts of methane gas. At the same time, in Sweden cows and other grazing animals often contribute to a rich cultivated landscape and a plentiful flora and fauna. This is particularly true for young animals, who help keeping natural grazing lands open, which benefits many threatened species that are dependent on these lands not being overgrown. Thus the variation in the landscape is maintained, as well as biological diversity [15].
- Rapeseed cultivation is an important succession crop in cereal-dominated crop successions, which contributes to a varied landscape. Pollinating insects like bees and bumblebees can benefit from rapeseed cultivation, if the rapeseed is not sprayed with pesticides during flowering, which is prohibited in Sweden. In these cases, rapeseed cultivation can contribute to a rich flora and fauna [15].
- Using rainforest lands to cultivate oil palms signifies a great loss of biological diversity, since the diversity of species living in the rainforest is lost. When rainforest is felled to cultivate the land it stood on, large amounts of greenhouse gases are released. When this happens, palm oil has a significantly higher impact on the climate than rapeseed and olive oil. However, the oil palm is several times more productive per surface unit than for example rapeseed. Older plantations that have continuously been rejuvenated give a palm oil with a lower climate impact [15]. Today just

[10] Analysis of food fats, Swedish National Food Agency 2014

less than a fifth of the palm oil in the world is certified, which means that the cultivation is done in a more sustainable way. Within the swedish food industry there is a current initiative with the purpose of starting to use only certified palm oil.

- Pesticides against insects and mould are common in all cultivation systems. The effect on the environment of this depends on amount, management and type of pesticide. This in turn depends, amongst other factors, on cultivation technique and climactic factors. In ecological cultivation no chemical pesticides are used, which promotes a poison-free environment and is positive for biological diversity, especially in large-scale agricultural landscapes. Mineral fertiliser is not used during ecological cultivation, which leads to a lower consumption of phosphorus. The harvest is often smaller for ecological production, and thus, for example, the use of land is often larger per kilo of product[11].

Advice before 2015

The Swedish National Food Agency's advice before 2015 was to switch to liquid margarine or oil for cooking, and to choose keyhole-marked spreadable food fats.

Conclusion

Food fats are important sources of energy and healthy fatty acids. Particularly healthy is rapeseed oil, contributing both monounsaturated and polyunsaturated fatty acids. Olive oil contains a lot of monounsaturated fat and is, like rapeseed oil, a part of a healthy dietary pattern. Palm oil, coconut fat and butter contain a large amount of saturated fat. There is convincing evidence that the risk of cardiac disease, the most common cause of disease and death in Sweden, can be decreased if some of the saturated fatty acids in the diet are replaced by the same amount of polyunsaturated fatty acids and monounsaturated fatty acids from plant-based sources. Therefore the Swedish National Food Agency deems that there is need for advice about how to choose food fats that contribute unsaturated fats, particularly rapeseed oil-based food fats, since they contain a large amount of Omega-3 fats. Today the intake of polyunsaturated fats, in particular Omega-3 fats, is a bit lower than what is recommended. From an environmental point of view, rapeseed oil and food fats with a high amount of rapeseed oil is a good alternative. The additives and process aids that are allowed to be used when processing vegetable oils are not considered to pose a health risk.

[11] The Swedish National Food Agency has requested a knowledge summary of the environmental impact of ecologically and conventionally produced foods from SP Food and Bioscience. The report will be published on the Swedish National Food Agency's website.

Dairy products

Advice

- Lean, unsweetened dairy products
- Keyhole-marked products.
- Vitamin D-enriched products.

Health aspects

- Dairy products are, in today's consumption pattern, the most important source of calcium, which is needed to build bones and teeth, for blood coagulation and for the function of the nervous system. Dairy products are also good sources of Vitamin A, riboflavine, Vitamin B_{12} and iodine, zinc and selenium. Enriched dairy products are important sources of Vitamin D.
- Dairy products also contain protein and essential amino acids.
- The carbohydrates in milk, curdled milk and yoghurt is mainly lactose. Fruit yoghurts and flavoured types of curdled milk also contain added sugar. One portion of fruit yoghurt of two decilitres, for example, contains as much sugar as five to six sugar lumps, and a drinking yoghurt up to eight.
- The amount of fat in dairy products varies significantly, and thus also the health effects associated with composition of fat. Since dairy products contain animal fat, with a large amount of saturated fatty acids, the consumption of fatty dairy products can lead to the intake of saturated fatty acids being too high in relation to the intake of polyunsaturated fatty acids, which can then contribute to increasing the risk of cardiovascular disease. You can also find naturally occurring small amounts of trans fat acids in fatty dairy products. The intake of both industrially produced and natural trans fats should be as low as possible, since they increase the risk of cardiovascular disease [39].
- Lean dairy products are included, together with a large portion of plant-based foods, in dietary patterns associated with a lower risk of chronic disease [8]. There is certain evidence supporting that dairy products contribute to a decreased risk of metabolic syndrome, high blood pressure, stroke and bowel cancer [9]. There are also clues pointing to a link between consumption of dairy products and a decreased risk of type 2 diabetes [9, 32].
- In Riksmaten Adults 2010-2011, dairy products was the food group which contributed most to the intake of saturated fatty acids. Since a decrease in saturated fatty acids and a corresponding increase in polyunsaturated or monounsaturated fatty acids from plant-based sources can contribute to decreasing the risk of cardiovascular

disease, the conclusion from NNR 2012 is that fatty dairy products should be replaced with lean ones. This allows for eating more food with mono and polyunsaturated fatty acids [6]. The evidence that consumption of milk contributes to a decrease in the risk of bowel cancer was considered as likely by the WCRF [5].

- Consumption of dairy products does not seem to increase the risk of obesity. On the contrary, there is some evidence that supports that fatty dairy products in the diet might make it easier to keep a natural weight. However, dairy products do not make it easier to maintain weight if you don't limit the energy intake at the same time [9].
- Nutritional calculations show that the amount of dairy products needed to satisfy the need for calcium varies between two and five decilitres a day, depending on what other foods are included in the diet. The lower figure was taken from the report "How small can the climate impact of food consumption be in 2050?". In this report less than 2 dl milk, curdled milk and yoghurt is included, see appendix 1. Those who don't eat dairy products can get calcium from other sources, such as enriched plant-based alternatives, sardines, sesame seeds, nuts and green leafy vegetables.
- There are also studies suggesting a link between an increased risk of prostate cancer and a high consumption of dairy products, but the evidence is uncertain [32]. Different definitions of dairy products in the studies make it hard to say at which level of intake and through which types of products the risk increases.
- In order to replace dairy products with plant-based drinks, in regards to vitamins and minerals, they would have to be enriched with calcium, selenium, riboflavin (Vitamin B2), Vitamin B_{12} and Vitamin D. The vitamins used for enrichment often, but not always, have a high bio-availability. Vitamin D is found both in products of animal origin, as Vitamin D_3, extracted from the fat in sheeps' wool, and in plant form, Vitamin D_2, derived from fungus and yeast. The latter has a somewhat lower bio-availability than D_3. One advantage of enriched foods over food supplements is that there is no risk of overdosing.

Consumption

- According to Riksmaten - Adults 2010-11, the population drank on average about 2.5 dl milk, curdled milk and yoghurt per day, apart from the dairy products used for cooking. However, the individual variations were very large [4]. Half drank semi-skimmed milk, while a fifth each drank skimmed milk and milk with three percent fat. Nine out of ten ate cheese, on average 25 grams a day, which corresponds to just about two slices. Hard cheese with a fat content of 20-40 percent was the most common cheese.

Other factors that have been considered

Environmental aspects

- Dairy products come from cows who let out methane gas, which is negative for the climate. At the same time, grazing animals contribute to a rich cultivated landscape and a plentiful flora and fauna in Sweden. This is particularly true for young animals, who help keeping natural grazing lands open, which benefits many threatened species that are dependent on these lands not being overgrown. Thus the variation in the landscape is maintained, as well as biological diversity. Milk cows often eat a large amount of hay, and ley farming for several years is positive for crop succession, the fertility of the fields and to keep down the use of pesticides in the cultivated landscape. National production of fodder contributes to keeping the Swedish landscape open. Cheese is the dairy product with the highest climate impact, with about 10 times the impact of milk. This is because one kilo of hard cheese is made out of 10 litres of milk [44].
- Today there are a few climate-certified dairy products. For climate-certification there are requirements to take measures which limit the impact on the climate during production and distribution of foods, and thus decrease emissions of carbon dioxide, methane and nitrous oxide.
- From a global perspective, the biological diversity decreases due to today's animal production, through use of plant protection products when cultivating natural lands for fodder production. Due to an increased demand for soy as a protein feed, the soy production in the world has seen a significant increase. If the soy production is done on deforested new lands or if grass lands are cultivated, this releases carbon that was bound in the ground and in the trees. This causes large emissions of greenhouse gases. It can also contribute to decreased biological diversity. In conventional soy cultivation, large amounts of plant protection products are used [40]. Certain industries and companies are actively working towards using responsibly produced soy in their production, within the framework of the Swedish soy dialogue [45].
- Milk and cheese from animals who have been given fodder that has been lightly sprayed or not at all, for example ecological alternatives, contribute to a poison-free environment [44].
- Enriched plant-based drinks made of wheat and soy have a lower climate impact than dairy products [46].

Animal protection

- In Sweden we have stricter requirements regarding animal protection than many other member states within the EU do, which means that food-producing animals in Sweden have a relatively good environment up to the slaughter, from an animal husbandry perspective[12].
- In Sweden, the use of antibiotics for animals is the lowest in the EU. This decreases the risk of occurrence and spreading of multi-resistant bacteria, which also is important for public health in the long term [47].
- Sweden is one of the countries in Europe with the lowest occurrence of multi-resistant bacteria in food-producing animal husbandry [48]. The low use of antibiotics is, amongst other things, a result of animal care and subsequent low incidences of disease.

[12] Information from the Swedish Board of Agriculture.

Enrichment regulations

The Swedish National Food Agency is currently carrying out a review of the regulations for obligatory enrichment with Vitamin D, with the aim of increasing enrichment levels and the number of product groups that are included in the enrichment.

Advice before 2015

The Swedish National Food Agency's advice before 2015 was to choose keyhole-marked products, i.e. dairy products with a lower amount of fat and, in certain cases, a limited amount of added sugar.

Conclusion

Dairy products are important sources of calcium and other important nutrients. Lean dairy products are included, together with a large portion of plant-based foods, in dietary patterns associated with a lower risk of diseases such as metabolic syndrome, high blood pressure and stroke [9]. There are also clues pointing to a link between consumption of dairy products and a decreased risk of type 2 diabetes [9, 32] and bowel cancer [5].

The conclusions drawn by separate studies of consumtion of different types of dairy products such as milk, cheese and yoghurt, and negative health outcomes such as cardiovascular disease and cancer, have varied. Therefore we need more research about the health effects of different types of dairy products and the mechanisms behind these effects.

Enriched plant-based drinks can replace milk products with regard to the minerals and vitamins they have been enriched with. They also have a completely different composition than dairy products and have not been studied to the same extent as dairy products, which is why we cannot draw any general conclusions regarding the health effects of plant-based drinks in studies of dietary patterns. In such studies we do see a positive effect of a large portion of plant-based foods in the diet.

The Swedish National Food Agency consider it appropriate with an advice about eating lean, unsweetened dairy products. In order to satisfy the need for calcium, 2-5 dl milk, curdled milk and yoghurt per day, or enriched plant-based drinks, is enough, depending on the composition of the remainder of the diet. Like other foods of animal origin, milk products have a relatively large climate impact and should, for environmental reasons, therefore not increase compared to today's consumption.

Eggs

No advice

Health aspects

- Eggs contain all essential amino acids. The yolk contains, amongst other things, polyunsaturated fatty acids, fat-soluble vitamins like A, D and E, and water-soluble vitamins such as B_{12}, riboflavin and folate. Egg yolk also contains minerals like iodine, iron, calcium, zinc and selenium. One egg contributes about a third of the recommended intake of selenium for an adult woman.
- In NNR there are no recommendations regarding limiting the intake of cholesterol. One egg gives about 200 mg cholesterol. In healthy individuals, the creation of intrinsic cholesterol is regulated so that any excess cholesterol in food reduces the body's production of cholesterol. There are large individual variations in the absorption of cholesterol and how it affects the serum cholesterol. In individuals with a disturbed cholesterol metabolism, there might be a need to limit cholesterol from foods. For healthy individuals, the NNR conclusion is that an increased consumption of plant-based foods and a decreased consumption of meat and fatty dairy products would give a sufficient reduction of the cholesterol intake in the Nordic population [39].
- NNR 2012 has not studied any specific health effects of eggs. The reason is that this does not give a result when comparing different dietary patterns. So, eggs are not included in the dietary patterns that increase or decrease the risk of chronic diseases, which could be partly due to that it's difficult to measure how much egg is in a diet.

Consumption

- According to Riksmaten - Adults 2010-11, the average consumption of egg is 14 grams a day, but in that figure egg from composed dishes such as pancakes and omelettes is not included. According to statistic from the Swedish Board of Agriculture, the consumption of egg corresponds to half an egg per person per day.

Other factors that have been considered

Environmental aspects

- The environmental impact of eggs is low compared to other foods of animal origin, and it is a climate-smart source of protein. The largest environmental impact of eggs comes from the chicken feed, especially soy feed. Due to an increased demand

for soy as a protein feed, the soy production in the world has seen a significant increase. If the soy production is done on deforested new lands or if grass lands are cultivated, this releases carbon that was bound in the ground and in the trees. This causes large emissions of greenhouse gases and can contribute to a decreased biological diversity. In conventional soy cultivation, large amounts of plant protection products are used. There is also ecological soy production, where no chemical plant protection products are used [44]. Certain industries and companies are actively working towards using responsibly produced soy in their production, within the framework of the Swedish soy dialogue [45].

Animal protection aspects

- In Sweden we have stricter requirements regarding animal protection than many other member states within the EU do, which means that food-producing animals in Sweden have a relatively good environment up to the slaughter, from an animal husbandry perspective[13].
- In Sweden, the use of antibiotics for animals is the lowest in the EU. This decreases the risk for occurrence and spreading of multi-resistant bacteria, which also is important for public health in the long term [47].
- Sweden is one of the countries in Europe with the lowest occurrence of multi-resistant bacteria in food-producing animal husbandry [48]. The low use of antibiotics is, amongst other things, a result of animal care and subsequent low incidences of disease.
- Thanks to a national program for salmonella control, Sweden has a very low occurrence of salmonella.

Advice before 2015

The Swedish National Food Agency has previously not given any advice regarding eggs.

Conclusion

Eggs contribute, amongst other things, with selenium and Vitamin D, nutrients that many in Sweden have difficulty getting enough of. From an environmental perspective it's a good thing to replace meat with eggs. Eggs can play a beneficial part in a healthy diet, but since eggs, unlike for example fish, don't show positive or negative results in comparisons between different dietary patterns, the Swedish National Food Agency does not deem it necessary giving any particular advice regarding eggs.

[13] Information from the Swedish Board of Agriculture

Fish and shellfish

Advice

- Fish 2-3 times a week, of which one a fatty fish.
- Choose fish that have been fished or cultivated in a sustainable way and come from sustainable stocks, for example labelled eco-friendly.
- Limit consumption of fish with high amounts of dioxins and PCB or mercury. Particularly relevant for certain risk groups. See separate advice.

Health aspects

- Fish and shellfish contain, amongst other things, essential fatty acids, protein, Vitamin D, Vitamin B_{12}, iodine and selenium. Fatty fish also contain Vitamin A. The amount of fat and the content of other nutrients vary between different species of fish, particularly between fatty and lean kinds, but also depend on the fish's diet and when in the year the fish have been caught. In spite of the consumption of fish not being very high, a third of the intake of Vitamin D in Riksmaten - Adults 2010-11 is derived from fish and fish dishes. Fish was also the food that gave the largest contribution to the intake of selenium and Vitamin B_{12}. Fish and eggs are the foods that contain most iodine.
- A large portion of fish in the diet makes it easy to reach the recommended intake of several nutrients, such as Vitamin D, iodine and selenium, which otherwise are hard to get enough of. But even with a relatively limited consumption, it is possible to achieve the recommended intake.
- The fat in fish is largely unsaturated. The presence of long Omega-3 fatty acids correlates strongly to the fat content of the fish. Fish like salmon, herring and mackerel contain the Omega-3 fatty acids DHA and EPA. Lean codfish have a higher amount of long Omega-3 fatty acids, but since the amount of fat is so low, the content of for example DHA becomes relatively low (approx. 200 µg per 100 grams compared with approx. 1,500-1,800 µg per 100 grams salmon). In NNR it was established that there might be a link between intake of the long Omega-3 fatty acids and a decreased risk of cardiovascular disease [39].
- Fish and shellfish are found in the dietary patterns associated with a lower risk of chronic disease such as cardiovascular disease, obesity and certain forms of cancer [8].
- The association between intake of fish and cardiovascular health primarily concerns the comparison from a low level (up to one portion a week) to about 2-4 portions a week. Those who eat more than that only experience a very small further positive effect [49].

- Herring and Baltic herring from the Baltic Sea, wild salmon and brown trout from the Baltic Sea, Vänern and Vättern, whitefish from Vänern and Vättern and Arctic char from Vättern often contain elevated levels of dioxins and PCBs. Cultivated fatty fish, for example cultivated salmon, contain considerably lower amounts of dioxins and PCB, regardless of where it's been cultivated. The reason for this is that cultivated fish is fed feed with restrictive limits for dioxins and PCBs [50].
- High exposure for dioxins and PCB can increase the risk of effects on the development of the brain and the nervous system. At high levels of exposure, these substances have also been shown to affect the immune system, reproduction, the hormone system and to cause cancer. Foetuses and infants are particularly sensitive to dioxins and PCB. The substances are stored in the body fat and transferred to foetuses and breast-fed infants through the placenta and the mother's milk [51, 52].
- The tolerable daily intake (TDI) that has so far been used by most international food agencies is 2 pg/kg body weight and day, presented by WHO and the EU's Scientific Committee on Foods (SCF) just after year 2000. This TDI was based on knowledge derived from animal testing [53].
- A tolerable daily intake is established for an exposure that has been considered to be safe to be exposed to every day for the rest of a person's life.
- The US Environmental Protection Agency (US EPA) carried out a new risk assessment in 2012, where they considered that the tolerable daily intake was lower, 0.7 pg/kg body weight and day [54]. This lower TDI is based on knowledge derived from studies of humans who were exposed during a dioxin accident. Another difference between US EPA and SCF/WHO is that US EPA used a larger safety margin to protect the population from increased risks of negative effects on health. If this TDI is used in the risk assessment of dioxins in fatty fish, there is an increased risk that small children exceed TDI during a limited period of the lifetime exposure TDI is supposed to protect from. For women of childbearing age and pregnant women, this risk is small.
- With the starting point of a tolerable intake of between 0.7-2 pg/kg body weight, a scenario calculation for children (4, 8 and 11-12 years of age) carried out by the Swedish National Food Agency that the proportional contribution from cultivated salmon is on average approx. 10-25 percent, see appendix 2. At intakes over 2 pg/kg body weight, the contribution from cultivated salmon is on average approx. 40-50 percent. For women of child-bearing age, the corresponding contribution from cultivated salmon is approx. 70 percent of the total intake. For this group the consumption of cultivated salmon can be between 2-7 times a week, without exceeding TDI.
- The population's intake of dioxins from foods have been decreasing continuously for a long time, with about 6 percent per year, which seems to be a trend that will continue in the future [55].
- The Swedish National Food Agency considers that it is relevant to use the established TDI of 2 pg/kg body weight/day (SCF/WHO) as an upper max limit for acceptable dioxin intake, with the goal that the intake in the longer term will be below 0.7 pg/kg body weight/day (US EPA).

- The completely dominating source of the population's exposure to methyl mercury is fish. High doses can be found in perch, pike, pike-perch and burbot, and in large predatory fish such as fresh and frozen tuna, swordfish, Atlantic halibut, shark and skate [56]. The critical effect at exposure to methyl mercury is effects on the central nervous system during the gestation period. The effects observed are lowered cognitive ability [57, 58]. The effects are so small they cannot be distinguished on an individual level. In adults, a high exposure to methyl mercury can also affect the nervous system, but higher levels than in foetuses are required before these effects present.
- Epidemiological studies also suggest that there is a link between a high exposure to methyl mercury in adults and the occurrence of cardiovascular diseases.

Consumption

- According to Riksmaten - Adults 2010-11, the average consumption of fish and shellfish was just over 250 grams a week, which corresponds to two portions. Older people ate almost twice as much fish and shellfish as younger people. Just under a third of the population ate fish two to three times a week. One out of ten never or very rarely ate fish.

Other factors that have been considered

Environmental aspects

- Fish and shellfish are in large part a wild resource that we must use sparingly. Today, many fish stocks are overfished, and to be able to eat fish and shellfish in the long term, it is important that the outtake is adjusted to how much fish there is in the sea. When one species decreases, the balance of the ecosystem can change, which could affect other species. Some species are severely threatened and should be avoided completely. To these belong ocean perch and monkfish, because they are sensitive, slow-growing deep-sea species where we know little about the size of stock, and eel and Atlantic halibut because they are overfished [59].
- Some fishing methods damage the ocean environment and other marine species more than others, for example seabed trawling and scraping. Selective equipment that only catches what you are allowed to fish and bring ashore, is better than equipment that gives rise to a lot of so-called by-catch. Nets, hook, longline and cages are examples of selective equipment that doesn't damage the seabed.
- Half of all food fish in the world are cultivated [60]. Fish and shellfish farms can cause local over-fertilisation and damage sensitive coastal environments, depending on where and how the cultivation is done. This concerns for example cultivation of giant prawns/tropical prawns. However, there are fish farms in closed systems, where over-fertilising substances are not released into the sea, but these are still few in numbers. Cultivation of predatory fish like salmon and cod requires a lot of fish

for fodder. This can contribute to overfishing of wild fish species and is also less resource-efficient than eating the species lower down in the food chain directly. Certain shellfish, like mussels and oysters, extract plankton from the water and don't need fodder. When harvesting these you remove nutrients from the sea, which is a positive for decreased over-fertilisation [59].

- The most important environmental aspect when it comes to fish is that it comes from sustainable stocks. The climate impact of fishing varies and becomes higher the smaller the stocks are, since the harvest of fish decreases. The climate impact of caught or cultivated fish is on average lower than that of beef and pig, but higher than that of chicken [59].
- Today there are three common labels to help consumers find fish and shellfish that come from stable stocks and that have been fished or cultivated in a sustainable way. These are the labels MSC (Marine Stewardship Council), ASC (Aquaculture Stewardship council), and Krav-labelled. There are also various guides, for example WWF's fish guide.

Advice before 2015

The advice of the Swedish National Food Agency before 2015, for both children and adults, was to eat fish 2-3 times a week. The Swedish National Food Agency also gives the advice that children and women of child-bearing age should not eat fish with high amounts of dioxin and PCB, i.e. herring and Baltic herring from the Baltic Sea, wild salmon and brown trout from the Baltic Sea, Vänern and Vättern, whitefish from Vänern and Vättern and Arctic char from Vättern, more than 2-3 times a year. For the rest of the population it is fine to eat this kind of fish up to 1 time a week. Women who are, or are trying to be, pregnant or who are breast-feeding shouldn't eat fish that could contain mercury more than 2-3 times a year. This includes perch, pike, pike-perch and burbot, and large predatory fish such as fresh and frozen tuna, swordfish, Atlantic halibut, shark and skate. For the rest of the population it is fine to eat this kind of fish up to 1 time a week. Tinned tuna belongs to another species than the tuna that is sold fresh and does not contain high amounts of mercury.

Conclusion

Fish and shellfish are very nutritious foods that are included in the dietary patterns associated with a lower risk of chronic disease. An increased consumption of fish and shellfish is one way of increasing the intake of several vitamins and minerals that many people don't get enough of today, such as Vitamin D, selenium and iodine. Fatty fish also contribute essential fatty acids. However, fatty fish contain varying amounts of dioxins and PCB. Therefore, the previous advice to some groups to limit the consumption of fatty fish from the Baltic Sea, as well as fish with high amounts of mercury, remains the same.

The consumption of fish must be adjusted to the amount of fish in the sea. When environmental aspects are weighed against health aspects, the Swedish National Food Agency's concluding evaluation is that it is acceptable with an advice to eat fish two to three times a week, on the condition that the consumers choose fish that have been fished or cultivated in a sustainable way and come from sustainable stocks. It is important to vary the types of fish in order to decrease the intake of the environmental pollutants that can be present in certain species of fish. Choosing eco-friendly products contributes to a more sustainable fishing and cultivation.

Meat from cows, pigs, lambs, reindeer and game, and processed meats

Advice

- No more than in total 500 grams of meat from cows, pigs, lambs, reindeer and game a week (corresponds to 600-750 grams raw meat). A smaller part of 500 grams can be made up of processed meats.
- Keyhole-marked products.
- With care, i.e. meats that have been produced in a sustainable manner, and where care has been taken regarding animal welfare.

Health aspects

- Meat contains many nutrients. According to the Swedish National Food Agency's latest survey of the dietary habits of adult Swedes (Riksmaten - Adults 2010-11), (red) meat and meat dishes contributed to over 20 percent of the intake of zinc and 13 percent of the intake of iron in the population. They also contributed to 10-20 percent of the intake of several Vitamin Bs, and 16 percent of the intake of protein [4]. Even a low consumption can give a relevant contribution of minerals such as iron, which is critical for certain groups of the population.
- Offal and liver pâté are particularly rich in iron and can therefore be important to fulfil the iron needs of certain groups, such as children, pregnant women and women of child-bearing age.
- What in the literature is called "Western dietary patterns" are associated with cardiovascular diseases, metabolic diseases and bowel cancer. This dietary pattern includes a large portion of meat from cows, pigs and sheep, and processed meats from various types of meat [8].
- Consumption of red meat and processed meats exceeding 500 grams per week is a risk factor for colorectal cancer. See the reports from the Swedish National Food Agency, 3/2014 and 20/2014 [61, 62]. This amount of maximum 500 grams means the recommended maximum intake for a person. For the population on average, the recommendation from the World Cancer Research Fund (WCRF) is that the average intake should be at most 300 grams per week.
- It is probable that the cancer process requires several factors to act together in a sequence of events, through initiation, promotion and progression. Possible factors and mechanisms behind all these steps can be assumed to be present in red meat and processed meats, but probably in a varying amount. The most discussed and investigated suggested specific risk factors in the scientific literature are associated

with heme iron, fat, heterocyclic amines, nitrite, nitrosamines, cholesterol, salt, protein and virus. Other factors that can be linked to an increased risk of cancer are for example alcohol, a high energy intake and a low vegetable intake. These and other lifestyle factors are adjusted for in the studies, but in spite of this the association between red meat and processed meats and colorectal cancer remains [61].

- The literature review shows that there is a relatively larger increase in risk for processed meats compared to red meat [61, 62]
- In population studies, meat and processed food have been associated with an increased risk of type 2 diabetes [9]
- Processed meats often contain a high amount of salt and high intakes of salt are associated with high blood pressure and cardiovascular diseases [63].
- Fatty processed meats contain a high amount of saturated fat, which can contribute to a composition of fats in the diet which increases the risk of cardiovascular diseases [39].
- A high consumption of meat is probably associated with an increased risk of weight gain [19]. It is possible that this is not due to meat as a food, but to a higher energy intake in those who eat a lot of meat, or that the meat intake is a marker for other factors that contribute to the weight gain.
- Based on consumption data and scenario calculations, we made an estimate of if a reduced meat consumption to WCRF's level (500 grams per week) and an exclusion of processed meats would have negative nutritional consequences. The general conclusion was that a decrease in the meat consumption according to the WCRF recommendation will not have any negative nutritional consequences for the population [64]. To further decrease the consumption of red meat can lead to that the need for specific nutrients, such as iron, zinc, and selenium are not fulfilled. This is particularly important for children and women of child-bearing age. A well-composed diet without red meat can, however, fulfil the nutritional needs even for these groups.

Consumption

- According to Riksmaten - Adults 2010-11 the average consumption of cooked red meat and processed meats was just over 600 grams a week. Men ate on average closer to 800 grams a week and women just under 500 grams. Younger people ate more red meat and processed meats than older people. The consumption varied from zero to over 1.5 kilo a week. 42 percent of Swedish women and 72 percent of Swedish men consume more than 500 grams of red meat and processed meats per week.

Other factors that have been considered

Environmental aspects

- From an environmental perspective it is desirable to decrease the consumption of meat and switch to plant-based foods, since meat is the food that has the biggest environmental impact [44].
- Fifteen percent of the world's total climate impact is associated with meat production. The emissions primarily come from feed production, the feed digestion of the animals, fertiliser and conversion of natural lands such as rain forests to land for grazing and fodder production. Cows and sheep, who are ruminating animals, cause particularly large emissions of greenhouse gases due to their feed digestion [44].
- All production of foods of animal origin in Sweden contributes to the use of agricultural land. Particularly cattle and sheep are present in forested areas, and thus contribute the most to the avoidance of decommissioning of agricultural land. In Sweden, grazing animals help keeping natural grazing lands open, which benefits many threatened species that are dependent on these lands not being overgrown. The ruminants create a need for ley farming, which is positive for the fertility of the land. The manure from the animals contributes to the farmlands' mulch content and land structure. From a global perspective, the biological diversity is lessened due to today's production of foods of animal origin, through use of plant protection products in fodder cultivation, release of fertiliser and cultivation of natural lands for the cultivation of fodder or for grazing [44].
- A large amount of plant protection products are often used during the cultivation of soy fodder. Due to an increased demand for soy as a protein feed, the soy production in the world has seen a significant increase. Soy fodder is commonly used for pigs and is used to a less extent for cows and lambs. If the soy production is done on deforested new lands or if grass lands are cultivated, this releases carbon that was bound in the ground and in the trees. This causes large emissions of greenhouse gases. It can also contribute to decreased biological diversity. In conventional soy cultivation, large amounts of plant protection products are used. There is also ecological soy production, where no chemical plant protection products are used [44]. Certain industries and companies are actively working towards using responsibly produced soy in their production, within the framework of the Swedish soy dialogue [45].
- There are a number of eco-friendly labels used in the Swedish market, that can be used for meat that has been produced in a more sustainable way.
- Over-fertilisation is due to, amongst other things, the leakage of nitrogen and phosphorous, which are fertilising substances, from the agricultural lands. To what extent the meat production contributes to the over-fertilisation is due to, amongst other things, where production takes place, how the fertiliser is handled and how it is

spread, which fodder is used and how much the animals eat. The risk of over-fertilising emissions from animal husbandry is great, above all where the husbandry is concentrated and intensive, in sensitive areas where the problem with over-fertilisation is significant. Over-fertilising emissions from agriculture would decrease if the number of animals bred with cultivated fodder would decrease. If the animal husbandry is based on fodder from natural grazing areas, i.e. that the animals are grazing, this could be a positive from an over-fertilisation perspective. Today, the fodder grown on natural grazing lands only constitutes a small part [44].

- From both an environmental and a waste point of view, it is good to use the whole animal after slaughter, which means that processed meats produced by by-products of the meat production are beneficial.
- There is no information to evaluate the climate and environmental impact of wild animals. Ruminating wild animals (elk, deer, roebuck) and reindeer contribute, like cows and lambs, to the emission of methane gas during the digestion of their fodder. [44].

Animal protection aspects

- In Sweden we have stricter requirements regarding animal protection than many other member states within the EU do, which means that food-producing animals in Sweden have a relatively good environment up to the slaughter, from an animal husbandry perspective[14]. In Sweden it is also required that all animals should be anaesthetised during the slaughter, while several other EU countries allow un-anaesthetised slaughter, referring to religious exceptions.
- Tail docking, to cut off the tail of pigs, is prohibited according to the common rules of the EU and is only allowed in exceptional cases. Tail docking is, however, performed on a large number of pigs born within the EU, apart from in Sweden[15].
- In Sweden, the use of antibiotics for animals is the lowest in the EU. A decreased use of antibiotics decreases the risk for occurrence and spreading of multi-resistant bacteria, which also is important for public health in the long term[47].
- Sweden is one of the countries in Europe with the lowest occurrence of multi-resistant bacteria in food-producing animal husbandry [48].

Advice before 2015

Since June 2014, the Swedish National Food Agency has given advice regarding cutting down the consumption of red meat and processed meats to approximately 500 grams per week (cooked weight), and particularly consumption of processed meats, and to choose the meat you eat based on care about the environment and the welfare of the animals.

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[14] [21] Information from the Swedish Board of Agriculture.

Conclusion

Meat from cows, pigs, sheep and game are nutritionally dense foods that contribute nutrients such as iron, selenium and Vitamins B. However, there is convincing evidence that a consumption of more than 500 grams cooked meat per week, including processed meats, can contribute to an increased risk of colorectal cancer. 42 percent of the women and 72 percent of the men in Riksmaten - Adults 2010-11 had a consumption that exceeded 500 grams of cooked red meat and processed meats per week. In the population, the average should not exceed 300 grams cooked red meat and processed meats per person, per week. At the same time, studies of dietary patterns show that a large portion of plant-based foods and a small portion of red meat and processed meats in the diet is associated with a lower risk of chronic diseases. Therefore the Swedish National Food Board considers it appropriate with an advice regarding limiting the consumption of red meat and processed meats. Particularly the consumption of processed meats should be limited, since they to a larger extent increase the risk of colorectal cancer, as well as often containing large amounts of salt and saturated fat. Decreasing meat consumption and replacing it with an increased consumption of plant-based foods is also the singularily most important measure to decrease the negative environmental impact of food consumption.

Poultry

No advice

Health aspects

- The nutritional value of poultry varies between different species and different parts of the bird. Chicken meat without the skin is lean and has a high protein content. Chicken is also a source of selenium, phosphorous, Vitamin B6, niacin and tiamine. The content of iron and zinc is often lower than in other types of meat.
- The consumption of poultry is, unlike red meat and processed meats, not associated with an increased risk of bowel cancer.

Consumption

According to Riksmaten - Adults 2010-11, the average consumption of chicken, turkey and other poultry was 140 grams a week. Younger people ate more poultry than older people.

Other factors that have been considered

Advice before 2015

The Swedish National Food Agency have no advice regarding the consumption of poultry.

Environmental aspects

- Poultry breeders use a lot of feed concentrate, which contributes to the use of chemicals and over-fertilisation. Soy has a particularly large environmental impact, and the amount of soy is larger in poultry feed than for ruminants. Due to an increased demand for soy as a protein feed, the soy production in the world has seen a significant increase. If the soy production is done on deforested new lands or if grass lands are cultivated, this releases carbon that was bound in the ground and in the trees. This causes large emissions of greenhouse gases. It can also contribute to decreased biological diversity. In conventional soy cultivation, large amounts of plant protection products are used. There is also ecological soy production, where no chemical plant protection products are used [44]. Certain industries and companies are actively working towards using responsibly produced soy in their production, within the framework of the Swedish soy dialogue [45].

- However, ecological chicken can cause larger emissions of greenhouse gases than conventional chickens, since the chickens are kept alive for longer and therefore need more feed. [44].
- The cultivation of feed contributes to open landscapes, but poultry breeding does not contribute to cultivated landscapes with a high biological diversity [44] as it doesn't contribute to maintaining natural grazing lands or ley farming.
- Chicken has a low climate impact compared to other meats, since chickens grow fast and have an effective feed metabolism [44].

Animal protection aspects

- In Sweden we have stricter requirements regarding animal protection than many other member states within the EU do, which means that food-producing animals in Sweden have a relatively good environment up to the slaughter, from an animal husbandry perspective[16].
- In Sweden, the use of antibiotics for animals is the lowest in the EU. This decreases the risk of occurrence and spreading of multi-resistant bacteria, which also is important for public health in the long term [47].
- Sweden is one of the countries in Europe with the lowest occurrence of multi-resistant bacteria in food-producing animal husbandry [48]. The low use of antibiotics is, amongst other things, a result of animal care and subsequent low incidences of disease.
- Thanks to a national program for salmonella control, Sweden has a very low occurrence of salmonella.

Conclusion

Poultry is a nutritional food which, unlike red meat (beef, lamb, pork, reindeer and game) is not associated with an increased risk of bowel cancer. Compared to other meats, chicken has a low impact on the climate. However, poultry breeding contributes to use of pesticides and to over-fertilisation. Neither does poultry breeding contribute to open landscapes. From a health perspective it is good to replace some red meat with poultry, but from an environmental perspective it's even better to replace the meat with plant-based foods. The Swedish National Food Agency's conclusion is that there is no need for a specific advice regarding a desired consumption of poultry.

[16] Information from the Swedish Board of Agriculture.

Salt

Advice

- Products with a lower salt content, for example keyhole-marked.
- Less salt.
- Iodized salt.

Health aspects

- Sodium is needed to maintain the osmotic pressure in blood plasma and tissue fluid, and for the blood volume. Sodium is also needed for the normal function of the nervous system and for the uptake of glucose and certain amino acids. 1.5 grams of salt (corresponding to 0.6 grams of sodium) per day is set as the lowest intake in NNR 2012. Since there is sodium in many foods and the need is small, sodium deficiency is not a problem among the Swedish population.
- In Sweden, a quarter of the adult population has high blood pressure, and over half of adults over 65. The link between salt intake and the risk of high systolic and diastolic blood pressure is well established. High blood pressure is one of the main risk factors for cardiac diseases, and hence gives indirect evidence of the effect of salt intake on cardiovascular health. The link between salt intake and blood pressure is direct and continuous, and we have not been able to establish a lower limit under which the effect on blood pressure can be dismissed. So, the blood pressure is lowered in most individuals who decrease the salt intake, not just among those who eat large amounts of salt. The greatest effect on the blood pressure due to a decreased salt intake can be expected in those with a high blood pressure, advanced age and less healthy dietary habits. A high intake of salt can also lead to negative effects on kidney function [63].
- According to the NNR 2012, the intake of salt should be decreased to 6 grams a day for the adult population. That population goal is primarily based on the effect of salt on blood pressure. The Swedish population's intake is on average about twice as high as the goal.
- Iodised salt is an important source of iodine, which is needed for the metabolism and for the body's growth and development. Iodisation is voluntary and many speciality salts, herbal salts and sea salts have generally lower amounts of iodine, unless they have been iodised.
- The largest intake of salt comes from prefabricated foods such as processed meats, bread, cheese and ready-made meals; foods that normally contains non-iodised salt.

Consumption

- It is difficult to measure the salt intake of the population since choice of products, recipes and the person's own addition of salt varies widely and is rarely stated in a sufficiently precise way. According to Riksmaten - Adults 2010-11, the average intake of salt was approximately 8 grams per day. In these calculations, salt that was added at the table was not included. The actual intake is higher and has been estimated at around 10-12 grams per day [63].

Other factors that have been considered

Environmental aspects

It is possible to decrease the intake of salt without compromising shelf life, if it is done at the same time as a decrease of the cool storage temperature [65]. A cooler temperature of 4-5 degrees also leads to less waste of other foods being kept in the same refrigerator, which compensates for the increased energy consumption that a lowering of the temperature brings [17].

Opportunity for the consumer to decrease salt intake

- 70-80 percent of the salt intake of the Swedes is calculated to come from processed products such as bread, cheese, meat and processed meat products, soups, sauces and ready-meals. This is why it is hard for the consumers to lower their salt consumption to a recommended level if you don't cook everything yourself from scratch. For this reason, other parallel measures are required to decrease the amounts of salt in common foods. The keyhole-mark, which amongst other things have conditions for salt content, is one such measure, but we need more.
- The regulations regarding information mean that it will be obligatory to state the amount of salt in all foods.

Advice before 2015

The Swedish National Food Agency's advice before 2015 has been to decrease the amount of salt, but to choose iodised salt. To choose products labelled with the keyhole is one way of finding products with less salt.

Conclusion

Too much salt can be a cause of high blood pressure, which in turn increases the risk for heart attacks, heart failure, stroke and kidney damage. In Sweden, 25 percent of the adult population has high blood pressure, and over half of adults over 65. The main part of the salt intake comes from prefabricated foods like bread, cheese, meat and processed meats and ready-meals, which makes it hard, as a consumer, to decrease the salt intake. Therefore, the Swedish National Food Agency deems it appropriate to give advice about choosing keyhole-marked foods to limit the salt intake, and to put less salt on the food you cook yourself, as well as using iodised salt.

Sweets, ice cream, pastries and sweet drinks

Advice

- A limited consumption of sugar, particularly from sweet drinks.

Health aspects

- In the dietary patterns associated with a low risk of chronic disease, only small amounts of sugar-rich products and processed cereals are included [8].
- Sweets, ice cream, pastries and sweet drinks are sugar-rich and energy-dense, i.e. they contain a lot of energy per gram. However, the content of important vitamins and minerals is low. If a large portion of the energy intake consists of energy-dense and sugar-rich foods, the quality of the diet is lowered, since the nutritional density is low. According to NNR 2012, the intake of added sugar should only contribute to at the most 10 percent of the energy intake, since otherwise it will be difficult to cover the need for nutrients. This is especially true for persons with a low energy intake.
- In preparation for NNR 2012, a systematic literature overview of studies of sugar intake and chronic diseases was carried out [66]. This overview showed that the consumption of sugar-rich drinks such as soft drinks probably increase the risk of type 2 diabetes. The increased risk was seen at a consumption of two portions of sugar-sweetened drinks per week or more, where a portion was a bottle, a can or a glass. It is possible that there is a link between a high intake of sugar-sweetened drinks such as soft drinks and an elevated blood pressure, as well as a negative effect on blood fats. However, it was not possible to draw any conclusions about any link between *other* foods with added sugar, apart from soft drinks, and type 2 diabetes or metabolic risk factors like elevated blood fats and blood pressure, cardiovascular diseases and total mortality rate [33].
- Long-term studies show that sweet and fatty foods, sugar-rich drinks and processed cereal products are associated with an increased risk of weight gain [6].
- Several foods in this group, such a pastries and ice cream, often contain a lot of saturated fat. Replacing some of the saturated fat in the diet with polyunsaturated fast and monounsaturated fat from plant-based vegetables can contribute to decreasing the risk of cardiovascular disease, see the section about food fats.
- Imported biscuits and crackers can contain high amounts of trans fats [43]. In Sweden, the intake of trans fats have decreased since the industry have reduced the use of trans fats and use palm oil instead. In total, the intake of the population is low,

but groups who eat a lot of imported pastries might have an intake which contributes to the risk of cardiovascular disease. According to NNR 2012, the intake of trans fats should be as low as possible.

- Caries occurs when the bacteria in the mouth breaks down carbohydrates, which makes the pH level sink. Easily breakdownable carbohydrates in foods rich in sugar and starch therefore play a key role in the development of caries. Many other factors, like preventative use of fluoride, meal patterns and composition of the meals, also play a role in the development of caries. A limitation of how often you eat can also contribute to decreasing the risk of caries, and a limitation on sugar-rich foods are particularly important [33].
- Sweeteners are food additives that give a sweet taste without adding calories, so from the perspective of energy and tooth health, they are better than normal sugar. All additives, including sweeteners, that are used in foods in the EU have undergone a comprehensive scientific evaluation and are therefore safe to use. The process for this safety evaluation of additives can be found briefly described on pages 113-116 of the Swedish National Food Agency's report 21/2011 [14].

Consumption

- According to Riksmaten - Adults 2010-11, 40 percent of participants had a sugar intake exceeding 10 percent of the energy intake, which is the highest recommended intake. Sweets, soft drinks and snacks contributed to 15 percent of the energy intake, which is almost as much as the contribution from meat, fish and eggs [4].
- The consumption of sweets, ice cream, pastries and sweet drinks varies a lot between different groups and individuals. According to Riksmaten - Adults 2010-11, young people consume the most sweets and drink the most soft drinks and other sweet drinks. The five percent of men between the ages of 18-30 who consumed the most drank on average 670 ml per day, i.e. almost five litres a week [4]. Statistics from the Swedish Board of Agriculture show that the consumption of sweets has increased, from just below 7 to over 17 kg per person and year, from the 60s to 2012 - we do however eat less sweet desserts and pastries today. During the same period, the consumption of ice cream has doubled, and the consumption of soft drinks and mineral water has tripled [67].
- The total consumption of sugar in Sweden is, however, about as high as before [67]. But since the level of physical activity in the population is lower than before, and the need for nutrients is as large, the "allowance" for sugar is lower.

Other factors that have been considered

Environmental aspects

- Sweets and crisps have a considerably higher climate impact than for example apples, milk and bread. Since these foods mainly contribute calories and only contribute small amounts of essential nutrients, they can be considered an unnecessary consumption and thus also an unnecessary environmental impact. One 125 g bag of marshmallows has the same environmental impact as a small portion of pork meat (82 g) [68].
- Biscuits and sweets often contain palm oil. Oil palms are often cultivated on land where there used to be forests. Using rainforest lands to cultivate oil palms signifies a great loss of biological diversity, since the diversity of species living in the rainforest is lost. When rainforest is felled to cultivate the land it stood on, large amounts of greenhouse gases are released. When this happens, palm oil has a significantly higher impact on the climate than other vegetable oils, like rapeseed and olive oil. Today, there are a few certified oil palm farms where the cultivation is done in a more sustainable way, but they still only make up a relatively small part of the total production [15].

Other

In the advice, only sugar is mentioned, but it is really energy-dense foods in general that many people need to cut down on. Those who cut down on sugar automatically decrease their consumption of chocolate, pastries and ice cream. Therefore the conclusion is that the message becomes simpler, but could have the same effect if the advice is to cut down on sugar.

Advice before 2015

The Swedish National Food Agency's advice before 2015 was to limit the consumption of sweets, ice cream, pastries and sweet drinks. Moderate amounts can be included in the diet if you otherwise eat
healthily.

Conclusion

Sweets, ice cream, pastries and sweet drinks contribute a lot of energy and sugar, and in some cases also saturated fat and trans fat. However, the content of important vitamins and minerals is low. Consumption of sugar-sweetened drinks such as soft drinks probably increase the risk for type 2 diabetes and increased blood pressure, and can also have a negative effect on the blood fats. Sweets, sweet pastries and soft drinks also increase the risk of weight gain. Sugar-rich foods also increase the risk for caries. Since these foods can be considered an unnecessary consumption from a health perspective, they

also have an unnecessary environmental impact. The Swedish National Food Agency deems that there, for several reasons, is a need for advice regarding limiting the consumption of sweets, ice cream, pastries and sweet drinks. In the communication we have chosen a simplification, which means that the advice is to cut down on sugar.

Alcoholic drinks

Advice

- Limited intake of alcoholic drinks.

Health aspects

- According to NNR 2012, the intake of alcohol should be limited: max 5 percent of the energy intake should come from alcohol, or max 10 grams of alcohol per day for women and max 20 grams per day for men. Pregnant women, children and adolescents should completely abstain from alcoholic drinks.
- Alcohol contributes energy, some drinks also with sugar, but minimal amounts of other nutrients, and can therefore lessen the quality of the diet in general. In the systematic literature overview of food consumption and weight stability that was carried out in preparation for NNR 2012, we couldn't draw any conclusions regarding consumption of alcoholic drinks and weight gain or waist measurement, since available studies show conflicting results [69].
- Ethanol is a carcinogen and increases the risk for several types of cancer. There is no intake of alcohol that does not lead to an increased risk. For example there is an increased risk of breast cancer in women even at moderate levels of intake.
- There are studies suggesting that the risk of total mortality decreases for middle-aged and older persons at low and moderate intakes of alcohol, while it increases at high intakes. For those age groups, to completely abstain from alcohol could be viewed as creating a slightly higher risk of total mortality. This could, at least in part, be due to that it includes persons who avoid alcohol due to health issues, which also include other risk factors, like premature death. Amongst younger people, the lowest risk of mortality is associated with not drinking alcohol at all. Drinking a large amount at the same time is associated with an increased risk of mortality in all age groups [69].
- The risk of cardiovascular diseases probably increases at high intakes of alcohol, and could also be affected by how much alcohol is consumed at any one time. There is convincing evidence that high intakes of alcohol contribute to increasing the risk of high blood pressure [69]. There is a certain support for increased insulin sensitivity in those who drink a little, compared with those who don't drink any alcohol.

Consumption

- According to Riksmaten - Adults 2010-11, the reported average consumption of beer, wine and spirits is 1.5 dl a day. In this figure, drinks with a low alcohol content were also included. Converted to alcohol, the average intake was 7 grams/day for women and 13 grams/day for men [4]. Since under-reporting is common for this type of foodstuff, it is likely that the real consumption is higher than that shown in the report.
- According to the Swedish Board of Agriculture, almost 80 litres of beer, wine and spirit were consumed per person in Sweden in 2012. This corresponds to just over 2 dl per person and day. From the 60s, strong beer has increased from just over 1 litre to over 30 litres per person and year, wine from 3 to almost 25 litres per person and year, while spirits have decreased from just under 6 to 2.5 litres per person and year [67].

Other factors that have been considered

- Alcohol is a complex issue which not only concerns energy content and health effect of the alcohol itself, but also addiction issues and risk of abuse. This lies beyond the remit and competence of the Swedish National Food Agency, and is instead handled by the Swedish Public Health Agency.

Advice before 2015

In the Nordic nutritional recommendations there is a recommendation about limiting the intake: max 5 percent of the energy should come from alcohol, or max 10 grams per day for women, max 20 grams for men. Pregnant women, children and adolescents should completely abstain from alcoholic drinks.

Conclusion

Alcoholic drinks contribute energy, but almost no nutrients. Ethanol is a carcinogen and increases the risk for several types of cancer. There is no intake of alcohol that does not lead to an increased risk of cancer. Alcohol also creates other health risks. Consumption of alcohol is an area which also includes issues of addiction and abuse. The Swedish National Food Agency deems it appropriate with advice about limiting the consumption of alcoholic drinks. When it comes to advice about preventing abuse, we refer to the Swedish Public Health Agency.

Water

Advice

- Water instead of sweet drinks.
- Tap water rather than bottled water.

Health aspects

- Water is essential for the function of many organs, and for regulating the body's temperature. Individual factors, physical activity and climate impact the need for liquid. Adults who perform moderate physical activity and live in a Nordic climate need at least one litre of water a day, in addition to the liquid contributed by food. Healthy individuals normally drink enough water if they drink when they feel thirsty [70].
- Mineral water contributes sodium in varying amounts, about 20 mg per dl. Table water, such as Vichy water, can contain considerably higher amounts, about 110 mg/dl. Tap water only contains, on average, 2 mg sodium per dl.

Other factors that have been considered

Environmental aspects

- Most Swedes have access to good quality tap water. Therefore bottled water is often an unnecessary environmental burden. It's primarily the climate that is affected, but bottled water has a relatively low environmental impact, compared with many other foodstuffs. Compared with soft drinks, bottled water is considerably better for the health, and also for the environment [15].

Advice before 2015

The Swedish National Food Agency communicates water as the main thirst relief and mealtime drink.

Conclusion

Water is necessary for life. Compared with sweet or alcoholic drinks, water is, from a health perspective, the best drink. And from an environmental perspective, tap water is the drink with the lowest environmental impact.

Holistic sustainability, variation and balance

Nutritional research has traditionally focused on identifying mechanisms for and health effects of separate nutrients. But most foods contain many nutrients and bio-active substances that interact with each other. In the Nordic nutritional recommendations 2012 (NNR 2012), more emphasis was given to evaluating different food groups and dietary patterns, and which role they play in preventing the main diet-related diseases affecting the population.

The conclusion in NNR 2012 is that what we eat as a whole is the most important thing for health. Single nutrients are less important. The whole diet - all we eat, from morning to night, week by week and over the years.

Health aspects

Dietary patterns rich in vegetables such as legumes, cabbage, onions, root vegetables and fruits and berries, nuts and seeds, whole grain products, fish and shellfish, vegetable oils, food fats based on vegetable oils, and lean dairy products are associated with a lower risk of most of the chronic diseases. Dietary patterns with a high consumption of red meat and processed meats, and foods with a low amount of essential nutrients but with large amounts of added sugar, fat and salt, are associated with a higher risk of chronic diseases. Dietary patterns based on plant-based foods are rich in essential minerals and vitamins, while the type of fat and carbohydrates generally is beneficial, from a health perspective [6]. For maintaining a normal weight, eating lots of plant-based foods is also beneficial, since they generally contain a lot of fibre which give a feeling of being full, but not very much energy. [19].

There is no single food that contributes all the nutrients needed; different foods and food groups contribute different nutrients. So, by eating a varied diet we increase the chances of getting enough vitamins, minerals, fats, carbohydrates and proteins. By eating a varied diet, we also decrease the risk of ingesting too much of harmful substances, both naturally occurring substances and pollutants that can be found in food.

If one or some foods, or whole food groups, are excluded from the diet, is it important to make sure we get those substances we exclude from other sources.

Energy balance is a condition of weight stability. In order to avoid weight gain, it is necessary that the energy intake does not exceed the energy need. The need for energy varies among individuals, but is largely dependent on the degree of physical activity.

Physical activity also has several other positive effects on health, and contributes to preventing diseases such as cardiovascular disease, osteoporosis and certain types of cancer, while a high level of inactivity increases the risk of these diseases [7].

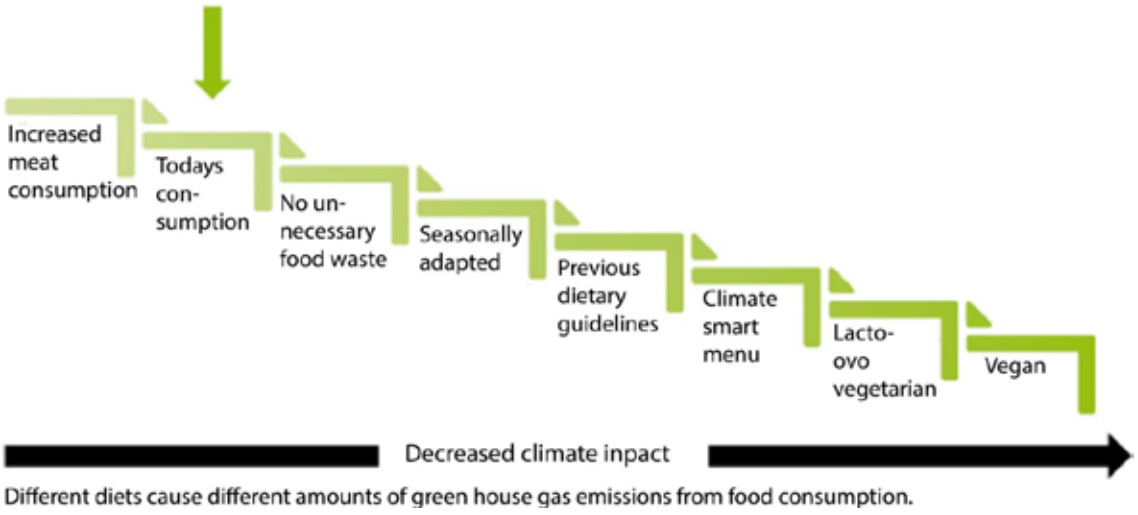
Environmental aspects

In general, plant-based foods have a lower environmental impact than foods of animal origin. By decreasing consumption of foods of animal origin and increasing the consumption of plant-based foods, the food burden on the environment can be significantly reduced [15].

Ecological foods mean less use of chemical pesticides and mineral fertiliser, which contributes to the environmental objectives A Non-Toxic Environment and A Rich Diversity of Plant and Animal Life. When it comes to climate impact, over-fertilisation, acidification and land use, it is sometimes beneficial with ecological and sometimes with conventional[17].

The figure below shows the climate burden of today's Swedish food consumption, and how this can be changed through different changes in the choice of foods. If consumers in Sweden ate according to the nutritional advice given in 2005, the greenhouse gas emissions, for example, would decrease in relation to the current consumption. With a more comprehensive change of consumption, such as those in a climate-smart menu, the climate impact would decrease to about half. The food choices are those who have been suggested in the Nordic nutritional recommendations, primarily through decreased consumption of meat, compared with today's consumption, and choosing more robust and storable plant-based foods. A vegan diet, where all foods of animal origin are excluded, has the lowest climate impact.

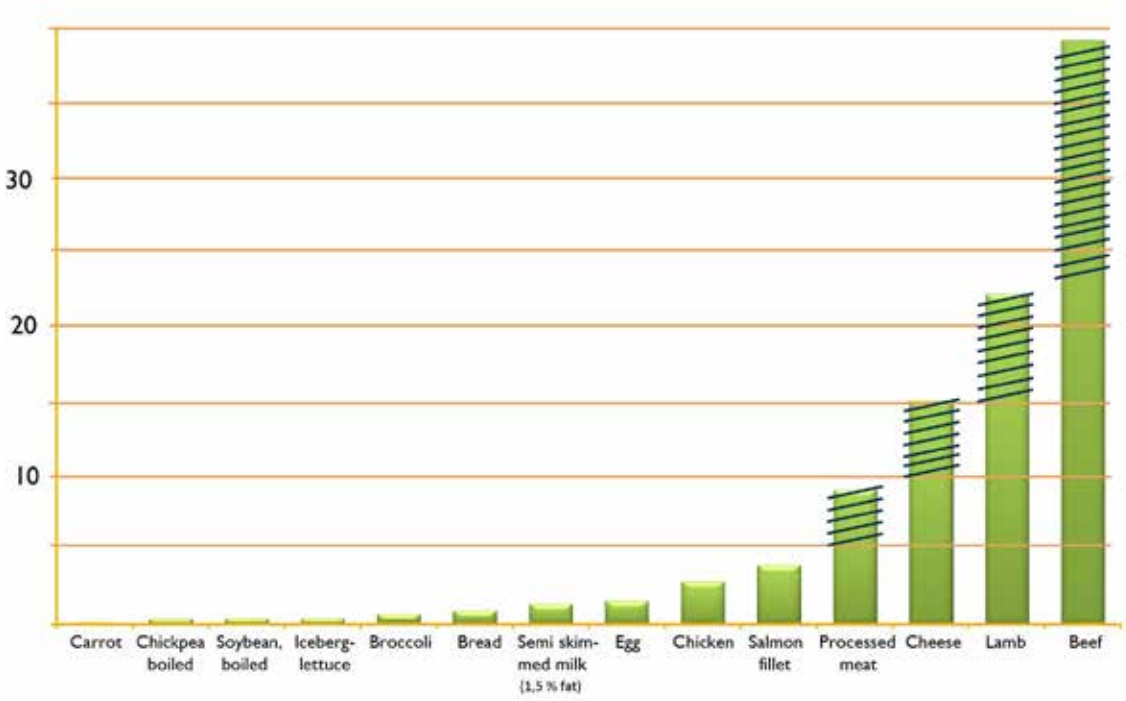
[17] The Swedish National Food Agency has requested a knowledge summary of the environmental impact of ecologically and conventionally produced foods from SP Food and Bioscience. The report will be published on the Swedish National Food Agency's website during 2015.



Different diets cause different amounts of green house gas emissions from food consumption.

Source: How small can the consumption be in 2050?) Report 2013 [71].

The figure below shows the emissions of greenhouse gases from a few different foods. The dotted part of the bars show the spread of emissions, depending on how the food in question has been produced. As we can see, vegetables, legumes and bread have a considerably lower climate impact than all foods of animal origin. The comparison below shows climate impact per kilo product. If you instead compare per amount of calories, the differences become smaller, since meat is significantly more energy-rich than vegetables. Similar comparisons can also be made with, for example, grams of protein or other nutrients.



Source: www.livsmedelsverket.se

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Appendix 1. Milk and milk products in "food in 2050"

Short summary of the report "How small can the climate impact of food consumption be in 2050?"

In 2013, the Swedish National Food Agency, together with Swedish Board of Agriculture and the Environmental Protection Agency, created the report "How small can the climate impact of food consumption be in 2050?". The report was written as a basis for a discussion about what we will be eating in the future, and can be viewed as a vision of the future.

We designed a one-week menu and adjusted it to the nutritional needs of a woman, and the choice of food was adjusted to the time of year when it's most difficult to find fresh vegetables, the spring. At that time of the year, we depend on stored and frozen vegetables. The nettles have arrived, and a few fresh vegetables, such as asparagus, have appeared. Green leafy plants, brassicas and nuts are rich in calcium. Legumes also provide a good amount of calcium.

We assumed that Swedes in 2050 still would eat meat, but the whole animal and in smaller amounts. We also assumed that we will drink milk and eat cheese and fish. Among the fish we chose sustainably caught fish and cultivated fish, and kinds of fish we don't eat today but that are edible. Foods whose production cause great amounts of greenhouse gases was avoided, as well as foods requiring transports, causing pollution. Fruits and vegetables that don't require long transportations or those that can be stored were selected.

Since milk is included in the menu, we also included beef, although it is a food with a high climate impact. In order to illustrate that we are to use the whole animal, we included tongue and tail in the menu. We should also use the blood of the animals. In a similar manner we included meat from poultry in the menu, since eggs are included.

Table 1. Daily intake of milk and milk products for a woman in Riksmaten 2010/11 and in the 2050 food.

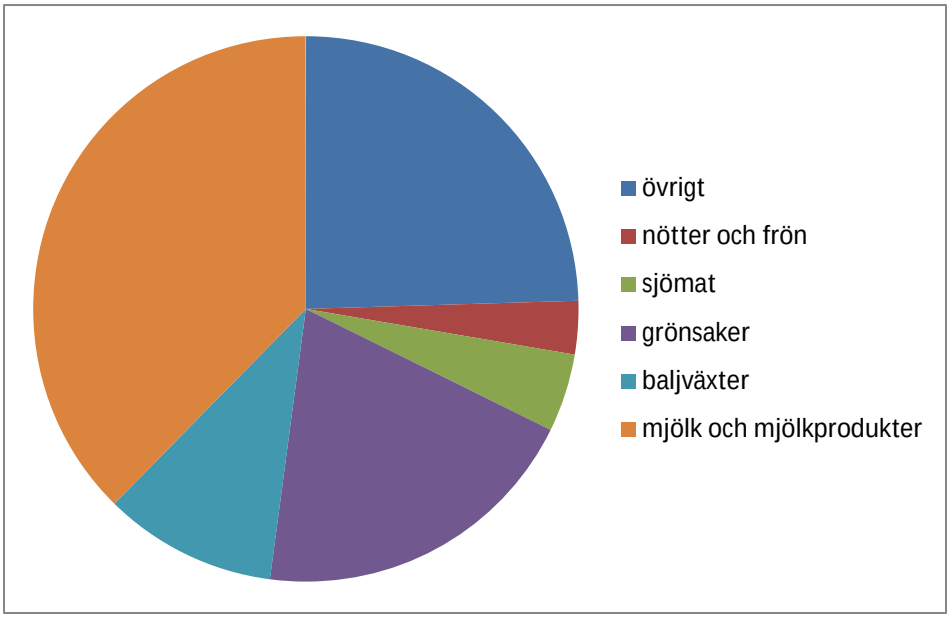
	Riksmaten 2010/11	Food 2050
Milk, curdled milk and yoghurt	227 ml	158 ml
Cream, crème fraiche, cooking yoghurt	9 g	27 g
Hard cheese	15 g	4 g
Other cheese	10 g	6 g

In Riksmaten 2010/11, 60 percent of the calcium intake was calculated to come from milk and milk products, divided into 40 percent from milk, curdled milk and yoghurt and 20 percent from cheese.
In the food for 2050, we calculated that milk and milk products would provide 38 percent of the total calcium intake (see below).

Calcium in food in 2050

The calcium intake from the 2050-food reached over 90 percent of the recommendation of 800 mg of calcium per day. 38 percent of the calcium intake came from milk and milk products (Table 1). The rest came from other food groups, illustrated in Figure 1 below.

Figure 1. Calcium intake from different food groups



Other (bread, potatoes, pasta, grains, meat, etc.)	25%
Nuts and seeds (hazel nuts, almonds, walnuts, sunflower seeds)	3%
Seafood (mussels, sardines, whitefish (instead of smelt))	5%
Vegetables (green cabbage, parsnips, nettles, broccoli, peppers, onions, etc.)	20%
Legumes	10%
Milk and milk products (see below)	38%

The report in its entirety

Jordbruksverket, L., Naturvårdsverket, *Hur liten kan livsmedelskonsumtionens klimatpåverkan vara år 2050? (How small can the climate impact of food consumption be in 2050?)* 2013. www.livsmedelsverket.se/globalassets/rapporter/2013/2013_livsmedelsverket_hur_liten_kan_livsmedelskonsumtionens_klimatpaverkan_vara_2050.pdf

Appendix 2.

Scenario calculations of consumption of cultivated salmon in relation to tolerable intake of dioxins

Question from RÅ/RG:
Create scenario calculations of how much cultivated salmon can be consumed without surpassing the health-based tolerable daily intake (TDI) of dioxins and PCB. The request should be preceded by a short dialogue with RN.

Summary
This document only includes a risk evaluation of dioxins and PCB in cultivated salmon. The health benefits of eating cultivated salmon have not been evaluated, neither has any comparison between risk and benefit been done.

The scenario calculations were based on consumption data from the participants in Riksmaten 2003 (children) and Riksmaten 2010-11 (adults), on halt data from the Swedish National Food Agency's dioxin control, studies and literary data. The intake calculations were made with a deterministic method, where each study participant's intake of relevant foods was linked to mean levels of dioxins and dioxin-like PCBs in these foods. Three scenarios were modelled. Scenario 1 is for consumers who follow the advice of the Livsmedelsverket when it comes to consumption of dioxin-contaminated fish, Scenario 2 for consumers who eat various types of lean fish but only eat cultivated salmon as fatty fish, and Scenario 3 is for consumers who only eat cultivated salmon and no other fish. We performed modellings of the consumption of cultivated salmon needed to reach a total intake of dioxins and dioxin-like PCB:s to the level of the health-based tolerable daily intakes (TDI) of dioxins and dioxin-like PCB:s (see below), as presented by SCG (2 pg/kg body weight/day; children and women, 18-45 years of age), Livsmedelsverket and IMM (2 pg/kg body weight/day; women 46-80 years of age and men), and US EPA (0.7 pg/kg body weight/day; children and women 18-45 years of age). SCFs TDI is 10 times lower than the intake that is connected to small but measurable changes of health markers in rats and humans. US EPSs TDI is 30 times lower than the "effective level".

The results show that for 4-year-old children there is really no room for any consumption of cultivated salmon if we use the US EPAs TDI, while the EUs TDI allows consumption 3-4 times/week. Based on the US EPA TDI, only children over 11 or 12 years old should consume cultivated salmon on average once a week or more. If we use the EU TDI instead, children between 4 and 12 years old can consume cultivated salmon 3-7 times a week. Women of childbearing age can consume cultivated salmon more often than

children, i.e. a salmon consumption of 2-3 times a week, even if we use the US EPAs TDI. If we use the EU TDI they can consume salmon on a daily basis, which also is the case for men och older women in relation to IMM/SLVs TDI.

Introduction

The consumption of fish has increased among adults in Sweden during the last 10 years, with on average 30 percent among women and about 60 percent for among men (Amcoff et al. 2012). Amongst other things this increased consumption is due to an increased consumption of cultivated Norwegian salmon. In Livsmedelsverkets study of food consumption habits Riksmaten 2010-11 for adults, the mean consumption of salmon (mainly cultivated) was at 8 grams a day, which corresponds to almost 2 portions per month (portion size 125 g). Amongs the 5 percent of study participants who had declared the highest consumption of salmon, the consumption was at 36 grams per day, corresponding to 2 portions per day (Amcoff et al. 2012).

In the scientific information below we present the results of the scenario calculations regarding how much cultivated salmon is safe to consume without exceeding TDI. The scientific information does not include any benefits evaluation of salmon consumption, and does not include a comparison between risk and benefit of consuming salmon.

Method

Intake calculations

The scenario calculations were based on consumption data from the participants in Riksmaten 2003 (children) and Riksmaten 2010-11 (adults). Halt data for relevant foods are presented in Appendix 1. The intake calculations were made with a deterministic method, where each study participant's intake of relevant foods was linked to mean levels of dioxins and dioxin-like PCBs in these foods. It is primarily the long-term mean intake which determines the body impact of dioxins and PCBs the individual suffers in the long term. This is due to the fact that the environmental pollutants have a long half-life in the human body, which means that they bio-accumulate for a long time. This is why individual intake during shorter periods of time is not quite so relevant.

The intake calculations only included consumption of animal foods, since plant-based foods and drinking water very probably don't affect the total intake of dioxins and PCBs in Sweden. A large part of the halt data derives from the Swedish National Food Agency's dioxin control of food-producing animals. For this control, samples of subcutaneous fat from food-producing animals and fat from milk are analysed. There are almost no halt data for different meat and milk products, such as mince, ham, cream and cheese. In order to be able to use halt data from the dioxin control, we made certain

recalculations of consumption data. As an example we present a description of how intake of dioxins from meat products from bovines was calculated: For each participant in the Riksmaten studies, consumption of beef and products containing beef were highlighted. With the help of the amount of fat in the meat or the products (Livsmedelsdatabasen, 2014), we calculated the total intake of fat from bovines for each participant. In order to calculate the intake of dioxins and dioxin-like PCBs, we then multiplied the fat intake with the mean amount of dioxins and dioxin-like PCBs in the bovine fat presented in Appendix 1.

For sausages, liver pâté, offal, fish and shellfish there were available halt data for specific products, and for these we multiplied the total consumption of the specific products with the halt data measured in the product when weighed fresh. Each participant's intake of dioxins and dioxin-like PCBs from all foods of animal origin was summarised with the help of WHO-TEF 2005 (van den Berg et al. 2006) and the total intake of TEQ was then divided with the body weight of the participant (Table 1).

Scenario calculations

Each study participant's total intake of dioxins and dioxin-like PCBs was calculated. Based on these calculations, 3 scenarios were tested, to model the connection between consumption of cultivated salmon and intake of dioxins and dioxin-like PCBs:

Scenario 1) The study participants' reported consumption of foods was used, with one exception. For the individuals who consumed more herring/wild salmon from the Baltic Sea than what the Swedish National Food Agency recommends, the consumption that exceeded this recommendation was converted into consumption of cultivated salmon. This "converted" consumption of cultivated salmon was added to the reported consumption of this kind of fish. The purpose of this scenario was to model the amount of cultivated salmon that can be consumed without exceeding TDI, in cases where the consumers do adhere to the Swedish National Food Agency's recommendations regarding consumption of fatty fish from the Baltic Sea.

Scenario 2) All consumption of fatty fish (herring, wild salmon and eels) was converted to consumption of cultivated salmon and was added to the already reported consumption of cultivated salmon. In this scenario, we examined the amount of cultivated salmon that can be consumed in cases where this type of fish is the only fatty fish that is consumed.

Scenario 3) All fish consumption was converted to consumption of cultivated salmon, in order to model the cases where cultivated salmon is the only type of fish consumed.

Scenario calculations based on the actual reported consumption of cultivated salmon could in most cases not be performed, apart from for women of 46-80 years of age, and men of 18-80 years of age. This is due to that in many cases the reported consumption of cultivated salmon wasn't high enough to significantly contribute to the total intake of dioxins and dioxin-like PCBs. Among women of 46-80 years of age and men of 18-80 years of age, there were only 4 participants, respectively 1 participant, who exceeded the Swedish National Food Agency's recommendations regarding consumption of herring and wild salmon, so Scenario 1 basically gives the same results as a model of the actual reported consumption of cultivated salmon.

We performed modellings of the consumption of cultivated salmon that is needed to reach a total intake of dioxins and dioxin-like PCBs that is on a level with the health-based TDIs for dioxins and dioxin-like PCBs (see below) that have been presented by SCF (SCF 2001) (2 pg/kg body weight/day; children and women 18-45 years of age), the Swedish National Food Agency and IMM (Hanberg et al. 2007) (2 pg/kg body weight/day; women 46-80 years of age and men) and US EPA (EPA 2012) (0.7 pg/kg body weight/day; children and women 18-45 years of age). The TDI presented by SCF is 10 times lower than the intake that is associated with small but measurable changes of health markers in rats and humans. The TDI presented by US EPA is 30 times lower than the "effect level" (see below).

The calculations of this consumption of salmon for the different age groups were made by adjusting a Hill model to data, to describe the link between consumption of cultivated salmon, according to Scenario 1-3, and the estimated total intake of dioxins and PCBs. The consumption, according to each scenario, that corresponded to TDI was then calculated from the model, see Table 2.

Health-based tolerable daily intake (TDI) - children and women of childbearing age

As early as 2001, the Scientific Committee on Food (SCF) presented a TDI for dioxins and dioxin-like PCBs (2 pg TEQ/kg body weight/day). This TDI was based on negative effects on the quality of sperm and sexual behaviour in male offspring of female rats who had been exposed to dioxin during pregnancy. TDI was reached by identifying the effect that appeared in the animals at the lowest exposure rates. This level (LOAEL) was recalculated to a corresponding intake in a human (20 pg TEQ/kg body weight/day). This intake was then divided by an uncertainty factor of 10, to include differences in sensitivity within the human population (3.2x) and the fact that it was based on an effect level (LOAEL) (3x).

In 2012, the Environmental Protection Agency in the US (USEPA) published a health-based reference dose for dioxins and dioxin-like PCBs of 0.7 pg TEQ/kg body weight/day. This reference dose, here called TDI, was

based on epidemiological data regarding health effects in children and adults who had been exposed to TCDD, the most poisonous dioxin, early in life after the chemical accident in Seveso, Italy. USEPA found two effects that appeared at almost the same exposure level - decreased quality of sperm in men who had not reached puberty at the time of the accident, and a lower level of thyroid-stimulating hormones (TSH) in 3-day-old infants who were exposed to TCDD when unborn and their expecting mothers were exposed in the accident. From the results of the study of sperm quality, a LOAEL was modelled (20 pg/kg body weight/day), which estimated the loss of number of sperm to 20%, and an 11 percent decrease in sperm motility. The exposure happened during childhood, before puberty. For the study of THS in infants, USEPA modelled an LOAEL (20 pg/kg body weight/day) in the mother, which gave a THS bloodlevel of 5 µU/ml in infants after birth. On these LOAEL was applied an uncertainty factor of 3x, to account for the possibility that the most sensitive individuals in this population were not included in the study, and a factor 10x (default EPA), because the findings were based on an effect level (LOAEL).

EPA used human data for the creation of the final reference intake, in spite of the existence of animal studies which gave a lower intake at LOAEL than the epidemiological studies did. EPA motivated this position with that two of these animal studies concerned effects that were also reported in the epidemiological studies the reference intake was based on. Since there were human data, they chose to use these data rather than data from animal testing. However, there were other animal studies where other effects than those mentioned above gave a lower LOAEL-intake than the final intake. Most of these studies were carried out on mice (7 out of 9 studies), where the low modelled intakes in humans at LOAEL according to EPA were mainly due to the uncertainty inherent in toxicokinetic extrapolation of intake in mice to intake in humans. EPA also considered the mouse studies to be lacking in quality. EPA also carried out sensitivity analyses of the reference intake, based on the epidemiological data from Sevesco and one NTP-study of rats. The conclusion was that some of the reference intakes in the sensitivity analyses were higher than the final reference intake, while others were lower. It seems that EPA chose the "middle road" when they decided which modelled intakes at LOAEL were to be used as the starting point for the reference intake.

Health-based tolerable daily intake (TDI) - woman 46-80 years of age and men

For men and older women, we used the TDI range of 2-10 pg TEQ/kg body weight/week that the Swedish National Food Agency and IMM, Karoliska Institutet, had established for exposure after birth (Hanberg et al. 2007). This TDI range was based on data from animal studies where the animals had been exposed to the most toxic dioxin, TCDD, after birth. The most sensitive effect showed to be cancer, and the lowest dioxin intake in the an-

imals which caused an increase of the cancer frequency with 5 percent was used as a starting point for TDI. Benchmark modelling was used to establish the dioxin intake which corresponded to the lower 95 percent confidence threshold (BMDL) for the intake that increased cancer with 5 percent. The TDI range was established by laying various uncertainty factors on BMDL, with 3.2 as the lowest factor and 50 as the highest factor.

Results and discussion

Raw data for intake of dioxins and dioxin-like PCBs

Based on data from the Riksmaten studies, we calculated the intake of dioxins and dioxin-like PCBs (Table 1). The results show that 95 percent of children and women of child-bearing age had intakes that were well below the EU's TDI of 2.0 pg TEQ/kg body weight/day. When comparing with the US EPA's TDI for the same risk groups, more than 50 percent of the 4-year-olds were over 0.7 pg TEQ/kg body weight/day, while the percentages of older children and women of child-bearing age were significantly lower. For older women and men, 95 percent of the participants were under the TDI established by SLV/IMM for these groups (2 pg TEQ/kg body weight/day). The higher intake amongst the children is mainly due to that they eat more food per kilo body weight than adults. The slightly higher intake amongst older women than amongst younger women is mainly due to that older women generally eat more fish, and fatty fish in particular.

Table 1. Intake of dioxins and dioxin-like PCBs (pg TEQ/kg body weight/day amongst the participants in Riksmaten 2003 (children) and Riksmaten 2010-11 (adults)

	Intake (pg TEQ/kg body weight/day)			
Group	**5th percentile**	**Median**	**95th percentile**	**Max**
Children 4 years (N=523)	0.42	0.80	1.6	19
Children 8 years (N=784)	0.29	0.63	1.3	4.4
Children 11-12 years (N=955)	0.17	0.43	0.88	4.9
Women 17-45 (N=432)	0.096	0.37	1.0	8.2
Women 46-80 years (515)	0.17	0.53	1.7	7.4
Men 18-80 years (N=710)	0.11	0.40	1.2	4.0

Scenario calculations for salmon consumption

Table 2 presents the results of the scenario calculations regarding how much cultivated salmon that can be consumed without exceeding the TDI. If we use the US EPA reference intake as a health-based guide value (Table 2), there is practically no allowance for consumption of salmon by children. If we use the EU's TDI, children could eat on average 3-7 portions of cultivated salmon per week.

For women of child-bearing age, the US EPA's reference intake allows for about 2 portions/week, while the EU's TDI allows for a daily consumption of cultivated salmon. Daily consumption of cultivated salmon also includes men and older women.

The results show that the allowance for consumption of cultivated salmon in relation to health-based guideline values depends on what level of protection you want to achieve, especially for children. For 4-year-olds there is basically no allowance for consumption of cultivated salmon if you follow the reference intake of US EPA, while the EU's TDI allows consumption 3-4 times/week. This is due to that 4-year-old children from the general population normally have intakes of dioxin and dioxin-like PCBs that are close to the US EPA's reference intake, even if they don't consume cultivated salmon. Based on the TDI established by US EPA, only 11-12-year-old children could consume cultivated salmon once a week or more. If we instead use the TDI established by the EU, 4-12-year-old children could consume cultivated salmon 3-7 times per week.

Table 2. Scenario calculations of the consumption of cultivated salmon (geometric average (95% confidence interval)) which signifies an intake of dioxins and dioxin-like PCBs on a level with TDI.

Group	Scenario	TDI (pg/kg/d)		TDI (pg/kg/d)	
		0.7	2	0.7	2
		Consumption of salmon (g/d)		Consumption of salmon (times/time period)	
Children 4 years of age	1	0.4 (0.2-0.6)	31 (25-42)	2/year	3/w
	2	0.8 (0.6-1.0)	23 (20-27)	5/year	3/w
	3	4.2 (3.6-4.7)	37 (35-39)	2/month	4/w
Children 8 years of age	1	5.0 (4.4-5.6)	51 (44-62)	2/month	4/w
	2	4.6 (4.2-5.1)	40 (36-45)	1/month	3/w
	3	12 (12-13)	68 (64-71)	4/month	5/w
Children 11-12 years of age	1	18 (15-20)	91 (74-151)	1/w	6/w
	2	18 (15-20)	91 (74-151)	1/w	6/w
	3	24 (23-25)	104 (97-112)	2/w	7/w
Women 18-45 years of age	1	34 (30-39)	132 (105-189)	2/w	7/w
	2	44 (42-48)	175 (141-248)	2/w	7/w
	3	54 (52-56)	187 (165-228)	3/w	7/w
Women 46-80 years of age	1		157 (85-740)		7/w
	2		185 (152-274)		7/w
	3		203 (181-238)		7/w
Men 18-80 years of age	1		NA		NA
	2		205 (167-293)		7/w
	3		235 (209-284)		7/w

Scenarios: 1) those who consume more herring/wild salmon than the Swedish National Food Agency recommends gets a consumption that lies above the recommendation converted to consumption of cultivated salmon, 2) all consumption of fatty fish (herring, wild salmon and eel) is converted to consumption of cultivated salmon, and 3) all fish consumption is converted to consumption of cultivated salmon.

Portion sizes: 4 years: 65 grams, 8 years: 100 grams, 11-12 years: 100 grams, adults: 125 grams

For women of child-bearing age there is a wider allowance to consume cultivated salmon than for the children, that is, consumption of salmon 2-3 times a week, even if we use the US EPAs TDI. There is allowance for daily consumption if we use the EUs TDI, which is also the case for men and older women in relation to IMM/SLVs TDI.

Uncertainties

There is a health benefit in the consumption of fish.
What level of protection should be strived for?
Consumption data for children over 10 years of age.
Halt data are lacking for some food groups.
Halt data for imported meat, dairy products and eggs are missing

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Food group	Matrix	Halt (pg TEQ/g fat)	Reference
Milk fat	Raw milk, cheese, butter 2004-2013	0.43	Median LDK
Beef fat	Fat from bovines 2004-2012	0.43	Median LDK
Pig fat	Fat from slaughtered pigs 2004-2012	0.10	Median LDK
Beef/pig fat	2/3 beef, 1/3 pig	0.41	Median LDK
Lamb fat	Fat from lambs 2012	0.39	Median LDK
Game and reindeer fat	Fat from slaughtered reindeers 2007-2009	2.1	Median LDK
Horse fat	Fat from horse 2011	3.3	Median LDK
Fat from chicken/turkey	Fat from chicken/turkey 2004-2011	0.31	Median LDK
		(pg TEQ/g fresh weight)	
Sausages	Smoked sausage, "falukorv" 2010	0.040	Median LDK
Liver/kidney	Beef liver 2004-2008	0.063	Median LDK
Liver pâté	Liver pâté 2010	0.033	Median LDK
Eggs	Egg yolk 2004-2013 (converted to whole egg)	0.043	Median LDK
Edible fat	Rapeseed and sunflower oil, margarine 2004-2005	0.14	Median LDK
Fish products (fish balls, fish fingers)	Lean ocean fish (50%)	0.046	Median LDK
Fresh/frozen lean ocean fish (cod, etc.)	Pollock, cod, haddock, Alaskan pollock	0.093	Median LDK, literature
Fresh/frozen other ocean fish (plaice, sole, etc.)	Flounder, turbot, Dover sole, European plaice, mackerel	0.65	Median LDK, literature
Cultivated salmon	Cultivated Norwegian salmon 2011-2012	0.7	Average Norwegian DK
Wild Baltic Sea salmon	Wild Baltic Sea salmon 2000-2013	9.5	Median LDK
Sweet water fish (pike, perch, etc.)	Pike, perch 2000-2012	0.35	Median LDK, environmental supervision
Herring	Pickled herring 2008	0.58	Median LDK
Atlantic herring	Atlantic herring 2000-2009	4.2	Weighted average Marine 2011
Tuna, tin	Tinned tuna 2010	0.030	Median LDK
Sardines, anchovy	Tinned mackerel, sprats 2004-2010	4.8	Median LDK
Swordfish, large tuna, shark, etc.	Swordfish, tuna	0.65	Dioxin control, literature
Eel	Eel 2000-2001	3.8	Dioxin project 2000-2001
Shellfish	Prawns, crab (white meat), mussels 2010	0.30	Median LDK
Caviar	Caviar in a tube 2009-2010	0.32	Median LDK

Appendix 1. Halt data.

LDK = the Swedish National Food Agency's dioxin control

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1. Exponeringsuppskattningar av kemiska ämnen och mikrobiologiska agens – översikt samt rekommendationer om arbetsgång och strategi av S Sand, H Eneroth, B-G Ericsson och M Lindblad.
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    Bly i viltkött – halter av bly i blod hos jägarfamiljer, del 2 av K Forsell, I Gyllenhammar, J Nilsson Sommar, N Lundberg-Hallén, T Lundh, N Kotova, I Bergdahl, B Järvholm och P O Darnerud.

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