What's on the menu in a crisis

– Nutritional consequences in the population

Vad står på menyn när krisen kommer? - Näringsmässiga konsekvenser hos befolkningen

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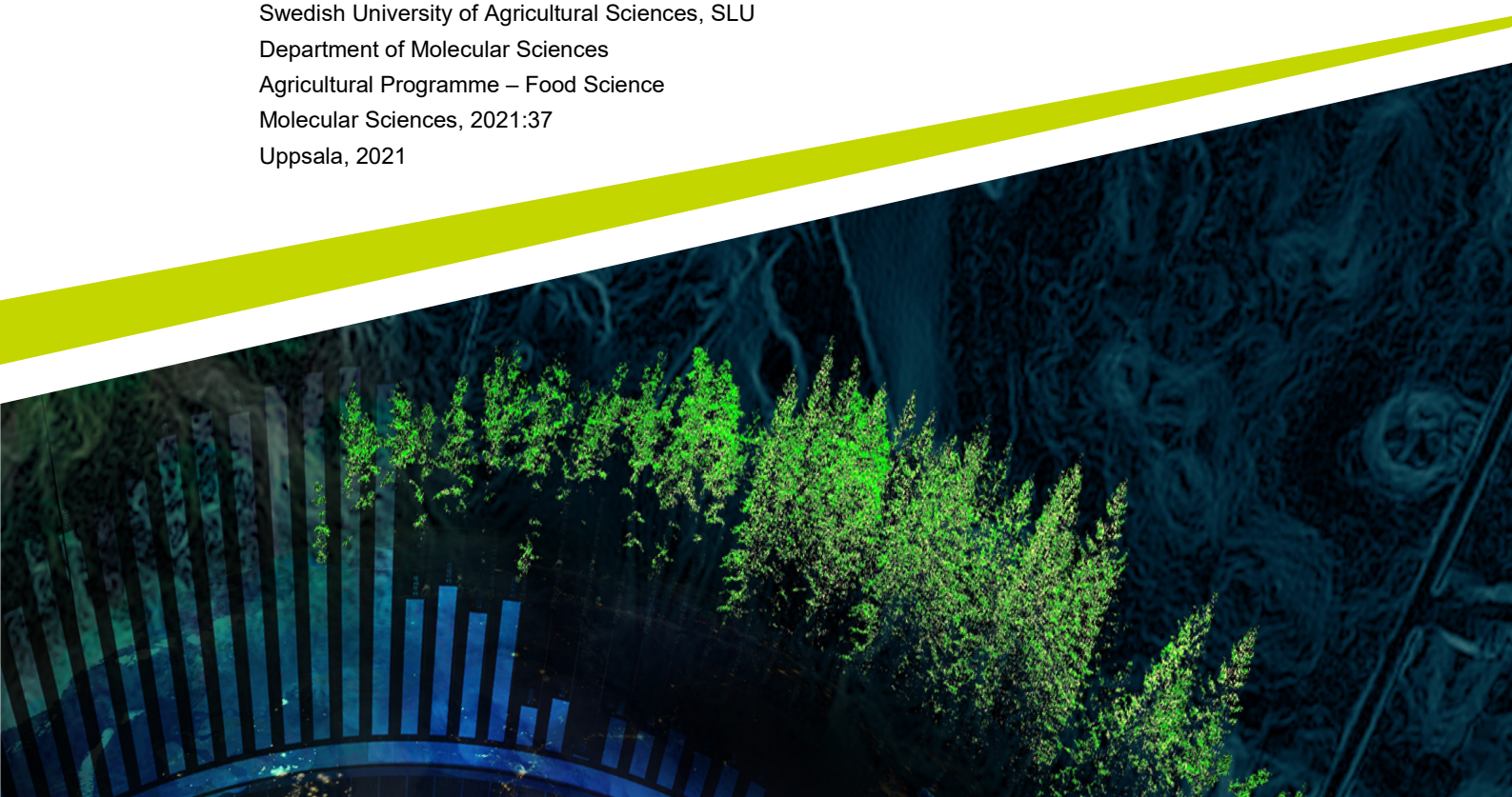

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Abstract

Sweden's ability to be food self-sufficient has long been questioned, and in recent years it has become an increasingly important issue on the political agenda. In 2017, the Swedish Government presented a national food strategy which stated the importance of domestic food production in terms of crisis preparedness. The latest defence bill presented by the Government also emphasized the importance of domestic food production to heighten Sweden’s preparedness. This included having relevant government agencies to investigate the domestic supply of food and drinking water.

This thesis aimed to investigate effects on the Swedish population's nutrient supply in the event of reduced imports. To find out, this thesis examines from which foods important nutrients come, clarifies the relationship with imported food and how human health can be affected by changes in imports. Three fictional scenarios form the basis for reduced intake of different product groups, which ultimately results in three results. The effect of energy, dietary fiber and five micronutrients is investigated and discussed. One of the important results of this study is that reduced imports, which result in reduced intake of vegetables and fruits, contribute to very low levels of vitamin C intake, which can have consequences for public health. This study also shows that dietary fiber is generally consumed in insufficient amounts, both during normal conditions and during a crisis, despite recommendations for increased intake from public authorities.

Keywords: Food import, micronutrients, energy supply, nutritional consequences, deficiency symptom

Sammanfattning

Sveriges förmåga att vara självförsörjande har länge ifrågasatts och de senaste åren har det blivit en allt viktigare fråga på den politiska agendan. År 2017 presenterade den svenska regeringen en nationell livsmedelsstrategi som framhöll vikten av inhemsk matproduktion i samband med krisberedskap. Även i den senaste försvarspropositionen som regeringen presenterade betonades vikten av inhemsk matproduktion för att öka Sveriges beredskap. Detta inkluderade att låta relevanta myndigheter undersöka den inhemska livsmedel- och dricksvattenförsörjningen.

I denna rapport undersöks hur befolkningens näringstillgång påverkas av minskad import. För att ta reda på det undersöks från vilka livsmedel specifika näringsämnen härstammar. Därefter utgör tre scenarier av minskad import grunden till minskat intag av olika varugrupper. Detta resulterar slutligen i tre utfall. Effekten av energi, kostfiber samt fem mikronäringsämnen undersöks och diskuteras. Denna undersökning visar bland annat att ett reducerat intag av grönsaker och frukt, till följd av minskad import, bidrar till mycket låga nivåer av vitamin C, vilket kan ge hälsomässiga konsekvenser hos befolkningen. Det står också klart att kostfiber generellt intas i för liten mängd, i normalläge liksom vid en eventuell kris, trots att myndigheterna rekommenderar ett ökat intag.

Nyckelord: Livsmedelsimport, mikronäringsämnen, energtillförsel, nutritionella konsekvenser, bristsymptom.

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Abbreviations

SCB	Central bureau of statistics
AR	Average recommendations
RI	Recommended intake
BMR	Basal metabolic rate
REE	Resting energy expenditure
DF	Dietary fibre
NSP	Non-starch polysaccharides
SCFA	Short chain fatty acids
PAL	Physical activity level
NNR	Nordic nutrition recommendations
SITC	Standard international trade classification

1. Introduction

The purpose of this thesis is to investigate how the nutrient intake of the Swedish population is affected by a limited diet that is based on domestically produced raw materials. The scenario is a situation of increased preparedness in Sweden and impossibility of importing food. This scenario will examine the differences that arise in nutrient availability based on production capacity. Which nutritional needs are covered by eating domestically produced food, and it is possible to cover the populations energy needs with this food?

In this thesis raw materials are examined and mapped by their nutrient density. The report should clarify the extent to which the population's nutritional needs can be met during the mentioned scenarios. Providing that input of fuel, seeds, fertilizers etc. is available, the thesis will examine the quantities of raw materials for basic food that can be produced in Sweden and if these will cover the population's nutritional needs.

Moreover, the thesis will investigate what the differences will be in these periods in terms of covering the nutritional needs. Also, which micronutrients could possibly be deficient in a diet based on Swedish raw materials in the event of the mentioned scenario. By mapping the micronutrients that are at risk of being taken in inadequate amounts and depending how the nutritional adequacy changes over time, it's possible to suggest a supplementation of those specific micronutrients.

The aim of the study is to investigate the nutritional consequences of Sweden's population if the availability of imported foods decreases due to a crisis. More specifically, the study will answer to the following research questions:

1. What supply of energy and nutrients does Sweden have today and how does it fulfill the nutritional needs of the Swedish population?
2. Will there be a shortage of certain food as a result of a crisis when the import of food is reduced?
3. Can a lack of energy or nutrients of the Swedish population be expected and what can be the possible consequences in the event of a crisis?

2. Background

2.1. A relevant topic

In the event of a crisis in Sweden, food supply will be an important issue since Sweden is more dependent on imports than ever. In addition to food products themselves, Swedish agriculture is also dependent on inputs such as diesel, fertilizers and pesticides to maintain food production. In 2014, the Swedish government released the defence bill "Försvarspolitisk inriktning – Sveriges försvar 2016-2020" (Regeringskansliet 2015). In this document, the defence policy direction changed, for the first time in a long time, from a main operational defence to a greater focus on a national repository. This includes a significant augmentation of the civil defence, of which food security is one part. In the following defence bill "Totalförsvaret 2021-2025" that came in 2020, the priorities for civil defence are even greater than in the previous defence bill (Regeringskansliet 2020). In fact, there is a budget increase of SEK 3.8 billion by 2025 for the Swedish civil defence. An armed attack on Sweden is an extreme scenario, but uncertainty in other countries would also affect many parts of our livelihood due to disturbances in imports. Therefore, it is of great importance that the whole society has the ability to handle and recover from different kinds of crises.

Social disturbances in our society can occur in a variety of ways except from armed attacks. Weather related disasters like abundance or lack of rainfall affect agriculture and forestry as well as energy supply to a great extent. Such possible scenarios are also reasons for Sweden to improve its robustness and resilience. The latest defence bill therefore states the importance of increased preparedness for a variety of scenarios and in a broad spectrum. Thus, authorities, businesses, municipalities and voluntary organizations are important parts of this process.

In the defence Bill (Regeringskansliet 2020) for 2021 – 2025, Sweden's plan for a secure food supply is described in detail. Sweden's food preparedness was largely phased out 20 years ago and thus great efforts are needed from both the public and private sector in the construction work. The food preparedness that the government

aims to build up has the objective to secure the supply of food for at least three months in a crisis. This includes conditions where the logistical flow is limited.

According to the Government, Sweden's food preparedness should include stockpiling of necessary foods and certain strategic goods should be in sales warehouses, in particular such goods that cannot be produced in Sweden. The budget for actions to secure the supply of food and drinking water is proposed to increase significantly during the period 2021-2025. In 2021, SEK 70 million is proposed to go to this category, which is an increase of SEK 30 million from 2018. In 2025, the allocated annual budget for food and drinking water is proposed to be SEK 500 million (Regeringskansliet 2020).

The National Food Agency has the main responsibility to plan and form recommendations to ensure that the Swedish population has access to clean water, safe and sufficient food. With the defence bill for 2021-2025, the National Food Agency, National Veterinary Institute and Swedish Board of Agriculture have received large budget supplements and hence been assigned additional tasks in this area (Regeringskansliet 2020). One part of this major task involves investigating which foods that must be available in various crisis situations. By 1 December 2021, the National Food Agency will present to the Government (Ministry of Enterprise and Innovation) "which diet satisfies nutritional physiological requirements in the event of increased preparedness" (Livsmedelsverket 2021b).

2.2. Nutritional needs

To meet nutritional needs, the general recommendation is a varied diet, thereby increasing the chances of a sufficient intake of essential nutrients. It is not necessary to get all the vitamins and minerals at every single meal since a deficiency usually develops over longer time. By eating a varied diet over time, the risk of deficiency is thus eliminated if this diet contains various protein sources, mono- and polyunsaturated fatty acids, fibre and a large intake of vegetables (Nordic Council of Ministers 2014).

The Basal Metabolic Rate, BMR, and resting energy expenditure, REE, vary and depend on an individual's age, gender, weight, length and body composition. Based on an individual's physical activity level, PAL, the total energy consumption can be calculated. This means that within a population, the energy needs vary widely between individuals and it is therefore challenging to provide general recommendations. (Kreymann et al. 2009). The Nordic Nutrition Recommendations, NNR:s reference values for weight, age, gender and physical activity are used to estimate the population's nutritional needs

2.2.1. Energy and macronutrients

The human body gets energy from three main groups of macronutrients; carbohydrates, fat and protein. These energizing nutrients are needed in considerably larger amounts than micronutrients where minerals and vitamins are included. Except for alcohol, which is not included in the calculations but provides energy, fat provides the largest amount of energy, as much as 37 kJ/g. Carbohydrates and protein both generate 17 kJ/g and dietary fibre, fibre being classified both as a separate category and as carbohydrate, generate 8 kJ/g (Nordic Council of Ministers 2014).

2.2.2. Micronutrient functions and consequences of deficiency

The reference values for vitamins and minerals come from the Nordic nutritional recommendations, NNR. Vitamins have the function as co-enzymes in important processes in the body. Minerals are included in the enzyme system as well but are also necessary components for the body function. Vitamins that cannot be synthesized in the human body are essential and must be ingested through the diet (Drouin et al. 2011). The five selected micronutrients are essential for the human body and the same five are presented in the Swedish Board of Agriculture's statistics database. These are important for maintaining good health and have been selected since NNR considers that there is a sufficient scientific basis for formulating recommendations for these in particular.

Vitamin A

Vitamin A is an essential fat-soluble vitamin of great importance for the visual system, maintenance of epithelial integrity, red blood cell production, growth and development, immune and reproductive function (Soares et al. 2019). Vitamin A is mainly found in food from animal origin, e.g. meat, eggs, dairy products and liver, as shown in figure 1. Also, yellow, green and red fruits are a common sources of vitamin A (Sommerburg et al. 2013).

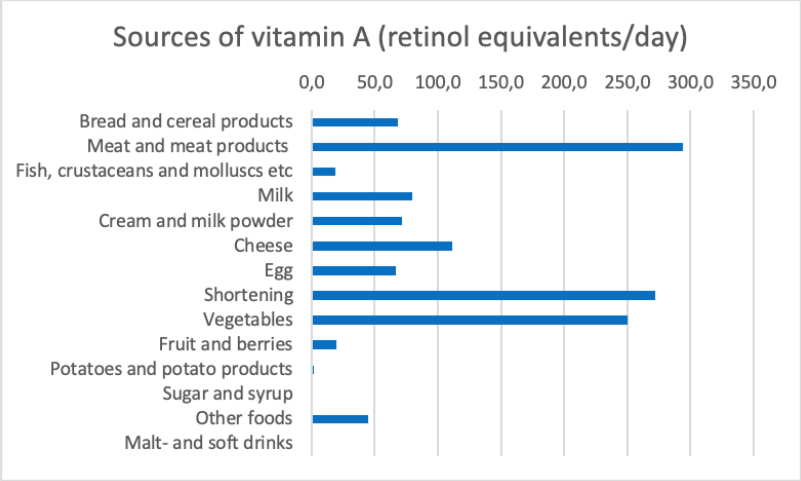

Figure 1. The origin of vitamin A in foods consumed in Sweden 2019, divided into food categories. Division is based on Standard International Trade Classification, SITC. The values are based on the Swedish Board of Agriculture's statistics on nutrient intake. https://statistik.sjv.se/.

(Jordbruksverket 2021)

Retinol is absorbed in the small intestine and transported by lipoproteins in the body. Approximately 50% of digested vitamin A is converted to retinol of which 70-90% is absorbed. Retinol is mainly stored in the liver and in adipose tissue. Adequate uptake requires a diet which includes normal fat intake. Therefore, a low-fat diet will cause vitamin A deficiency. Recommended intake is based on maintaining a certain concentration in the liver to keep a stable retinol level in the blood plasma. A person with a sufficient amount of retinol stored in the liver can maintain normal health status without vitamin A in the diet for many months. (Frayn 2010)

Carotenoids are fat-soluble antioxidants found in fruits, some of which are precursors for and can be converted to vitamin A in the body (Grune et al. 2010). Moderate cooking of some vegetables increases the release of carotenoids, allowing for increased uptake (Hornero-Méndez & Mínguez-Mosquera 2007). However, herbal foods containing carotenes are not always sufficient, since the conversion of carotene to vitamin A is not sufficiently efficient. The bioavailability of carotenoids varies between 5 - 60% (Frayn 2010). Thus, a lot of beta-carotene is required to cover the need for vitamin A. In low-income countries where vitamin A rich diets such as milk, liver, and other meat products are less available, deficiencies are common, and this is a well-known global health problem (Sommer 2008).

Vitamin A deficiencies generally cause a weakened immune system and deterioration of mucosal epithelial generation, resulting in dehydrated and impaired mucous membranes. A common condition is xerophthalmia, where the eyes are affected, the vision is impaired, and blindness can occur. The negative impact on

mucous membranes is also life-threatening for pregnant women and can cause infant death (Stephensen 2001).

High doses of vitamin A, e.g. 7500ug - 9000 ug/day, can cause liver damage, headaches, nausea and calcification of soft tissues. High intakes during pregnancy are not recommended as it can cause malformations of the fetus. To avoid teratogenic effects, a vitamin A intake of less than 3300 ug/day is recommended by the UK Department of Health (Public Health England 2021). This is especially important in cases where vitamin A is used as a dermatological drug. After completion of treatment, women are advised not to become pregnant within 12 months (Frayn 2010).

Vitamin C

Vitamin C, or ascorbic acid, is an antioxidant and a cofactor in many enzymatic functions. It protects living organisms against oxidative stress by acting as a free radical scavenger and having the ability to donate its electrons (Drouin et al. 2011). Ascorbic acid is involved in collagen synthesis and has a crucial function in reducing $Fe3^{+}$ to the more absorbable $Fe2^{+}$, which enables higher absorption of iron from the diet (Linster & Schaftingen 2007).

Ascorbic acid is mainly found in vegetables such as fruits and potatoes (figure 2), which is a particularly important source for Sweden's population. Humans and some other vertebrates have lost the ability to synthesize ascorbic acid during evolution, while most other animals still can, as do plants (Linster & Schaftingen 2007).

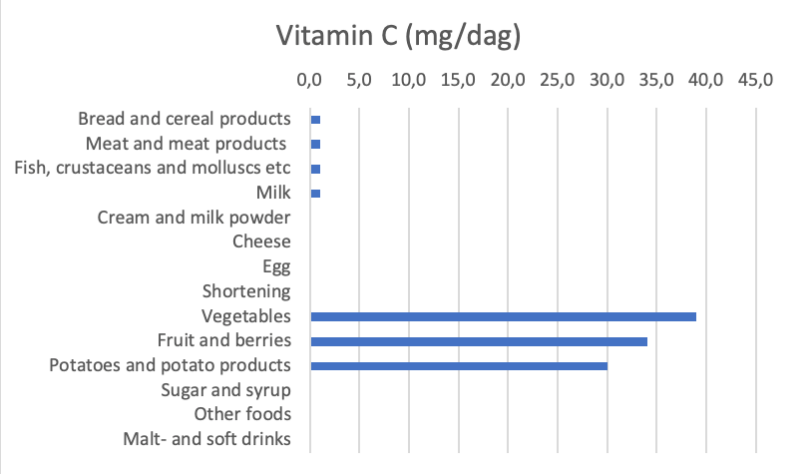

Figure 2. The origin of vitamin C in foods consumed in Sweden 2019, divided into food categories. Division is based on Standard International Trade Classification, SITC. The values are based on the Swedish Board of Agriculture's statistics on nutrient intake. https://statistik.sjv.se/.

Large losses of vitamin C occur during cooking, through leaking into the boiling water and trough atmospheric oxidation, which continues when the food is allowed to stand before being served (Frayn 2010). Thus, the phrase "eat your green fresh" is a good motto, since fresh fruits, vegetables and berries are the ones that contain the most ascorbic acid (Maxfield & Crane 2021).

Insufficient intake of ascorbic acid leads to underhydroxylation of proline and lysine residues where ascorbic acid acts as a cofactor in the reaction. This leads to the synthesis of collagen protein being disturbed, which in turn affects different types of connective tissue, e.g. skin, hair and blood vessels (Arrigoni & De Tullio 2002). The deficiency condition is called scurvy and early symptoms are general fatigue and skin changes (National Health Service 2020). Formation of a horn-like material in hair follicles that makes them plugged can give rise to corkscrew hair that also is an early symptom of scurvy. Petechiae can also occur, which is caused by leaky capillaries. In more severe cases, sponginess and bleeding in the gums can occur, which then can develop into bleeding and infected gums. In worst case, this can lead to tooth loss (Frayn 2010).

The body has limited opportunities to store ascorbic acid as it is water soluble and it takes 4-12 weeks before the body's stock of the vitamin runs out. Other factors that increase the risk of deficiency include alcohol intake, tobacco use and being of male gender (Maxfield & Crane 2021). When the plasma concentration reaches 50 - 60 mmol/L, the white blood cells are saturated with ascorbic acid, which is achieved at a daily intake of about 100 mg/day. Deficiency is defined when the ascorbic acid concentration in the blood is less than 11.4 mmol/L, which is when scurvy symptoms can occur. In order to maintain an adequate body storage, the recommended intake, RI , is set to 75 mg/day which is sufficient to maintain a concentration of 40 mmol/L in the blood (Nordic Council of Ministers 2014).

Overconsumption of ascorbic acid has been shown to have few side effects in healthy individuals except that it can interfere with the intestinal flora and cause diarrhea and stomach discomfort. For diabetics who manage their disease poorly, there is a possible connection with cardiovascular problems in connection with supplementation. Similarly, there is some evidence that high intakes may be associated with the formation of kidney stones in individuals who overconsume ascorbic acid supplementation (Nordic Council of Ministers 2014)

Iron

Foods rich in iron are found mainly in offal food like liver, in eggs, meat, some vegetables, whole grains, nuts and berries (Livsmedelsverket 2021a), as shown in figure 3. Iron is an important component in haemoglobin that transports oxygen

from the lungs to all parts in the body. Iron is an important part in myoglobin, which allows oxygen to be stored in muscles. Several enzymes also depend on iron as a component as well as many hormones (Harvard school of public health 2019).

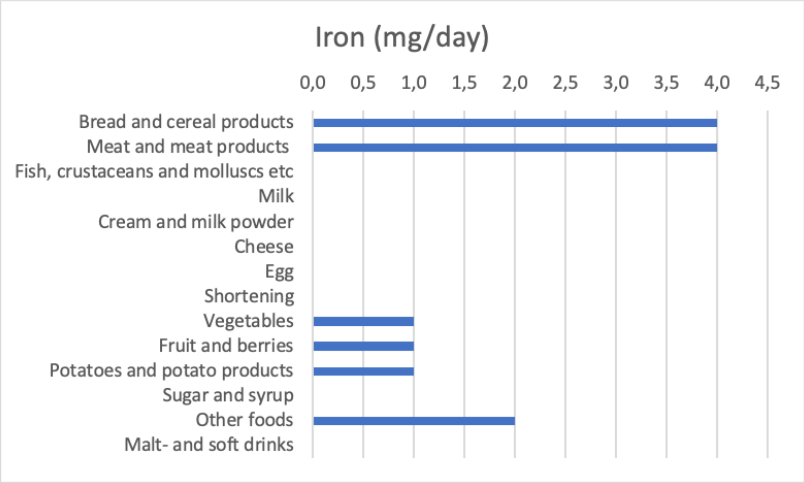

Figure 3. The origin of iron in foods consumed in Sweden 2019, divided into food categories. Division is based on Standard International Trade Classification, SITC. The values are based on the Swedish Board of Agriculture's statistics on nutrient intake. https://statistik.sjv.se/.

The iron homeostasis is regulated by its uptake which depends on the individual's needs (Frayn 2010). With higher needs, the uptake increases and vice versa. The absorption capacity also depends on the form of the iron in the diet. Heme iron is mainly found in meat products and is generally more efficiently absorbed than non-heme iron which is plant derived (Nordic Council of Ministers 2014). The composition of the whole meal will also affect the uptake in different ways. When consuming non-heme iron, the uptake is markedly affected depending on the composition of other foods, since some substances can inhibit or promote uptake. Ascorbic acid has effects that enhance the non-heme uptake while components like phytates and tannins decrease the uptake. Calcium has an inhibitory effect on both heme and non-heme iron uptake. Therefore, some foods should be avoided by people who have a high need for iron. Overall, the need for iron varies depending on age and gender, where children and young people in particular have a higher need, as well as menstruating woman and women during pregnancy (Nordic Council of Ministers 2014).

Absorbed iron is stored mainly in the liver and bone marrow, but also in the majority of cells, in small amounts. Iron is stored in the form of ferritin to be used when needed (Tidehag 1995) Iron deficiency is most common in children, adolescents and women of childbearing age. Deficiency is often due either increased needs or to insufficient intake. Common symptoms of iron deficiency are fatigue, feeling of weakness, palpitations and disorders of the gastrointestinal tract

(Tidehag 1995). Iron deficiency can lead to anaemia which is a harmful consequence of deficiency and is often treated with supplementation. Toxic levels of iron for generally healthy people is rare and if it occurs its mostly caused by overconsumption of iron supplementation. This can cause vomiting, stomach problems like constipation and pain (Harvard school of public health 2019)

Some people absorb more iron than others and and these people instead risk being exposed to too high iron levels, a hereditary condition called haemochromatosis and is hereditary (Nordic Council of Ministers 2014). This includes problems with the disposal of iron. This usually happens by iron being contained in the mucous membranes of the intestinal lumen in the form of ferritin and then excreted in the feces (Frayn 2010). People suffering from haemochromatosis, are recommended to avoid foods rich in iron as well as ascorbic acid. They are in some cases also treated with blood removal.

Calcium

More than 99% of the body's calcium is found in bones and teeth, the remaining is dissolved in blood plasma and is available when needed in many of the body's mechanisms. Calcium is necessary for a well-functioning glandular secretion maintenance of nerve conduction, muscle contractions, and in enzymatic reactions (Nordic Council of Ministers 2014). Not least, calcium is an important component in the formation of bone mass. Three important hormones, parathyroid hormone, vitamin D, and calcitonin play a major role in regulating the use of calcium in the body. These hormones regulate intestinal absorption, bone resorption and renal reabsorption, and also regulate the use of the calcium stored in bone mass (Bass & Chan 2006).

Absorption of calcium takes place in the upper part of the small intestine and vitamin D is particularly involved in calcium homeostasis. Insufficient intake of vitamin D therefore has a negative effect on the uptake of calcium, and can cause the same symptoms as insufficient intake of the calcium itself (Frayn 2010). Intake of phytic and oxalic acid, present in certain vegetables, will inhibit the uptake of calcium. However, this is only relevant if the diet consists mostly of vegetables, in combination with low calcium intake. In the Nordic countries, the diet is generally rich in calcium (Nordic Council of Ministers 2014).

Dairy products such as yoghurt, whole milk and cheese, are main sources of calcium in the diet. Calcium is also found in some vegetables, such as broccoli, and in cereals. These calcium sources can also be also recognised in Figure 4, illustrating the intake of Ca among the Swedish population via different food commodities.

Some cereal products such as breakfast cereals are fortified with calcium (National Institutes of Health 2021).

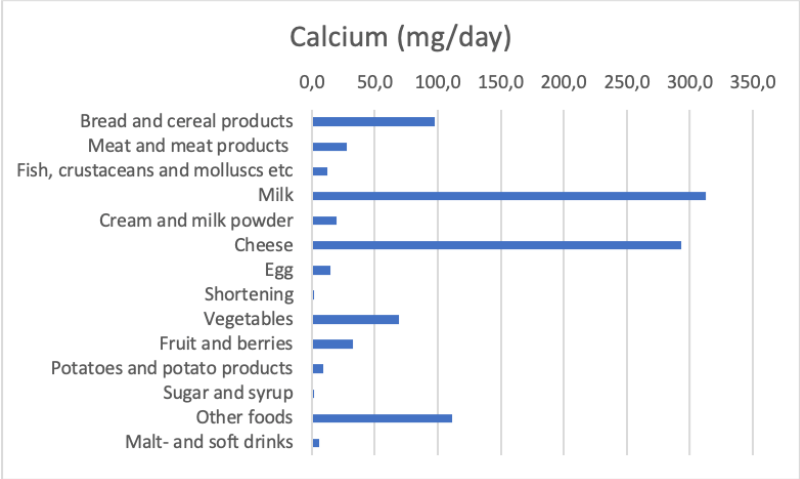

Figure 4. The origin of calcium in foods consumed in Sweden 2019, divided into food categories. Division is based on Standard International Trade Classification, SITC. The values are based on the Swedish Board of Agriculture's statistics on nutrient intake. https://statistik.sjv.se/.

In case of insufficient calcium intake, the body regulates the available metabolic calcium in the blood by breaking down bone tissue, which acts as a calcium reserve. With prolonged low intake and a continued bone degradation, the skeletal mass becomes weaker, which causes osteoporosis, and the risk of fractures increases (Frayn 2010).

The need for calcium changes with age. Children have greater needs because the formation of bone mass is paramount at a young age. Insufficient intake by children inhibits growth and can cause rickets. In elderly, bone breakdown increases, which means more fragile bones, thus the risk of getting osteoporosis increases with age and especially in menopausal women (National Institutes of Health 2021).

At very high intakes of calcium, disorders such as kidney stones and hypercalcemia have been observed, mainly in case of supplementations (Frayn 2010) Hypercalcemia can give neurological, gastrointestinal, and renal symptoms like weakness, fatigue, depression, nausea and constipation (Bushinsky & Monk 1998). It is, however, unusual to achieve the levels required for hypercalcemia through consumption of a normal diet (National Institutes of Health 2021).

Thiamine

Thiamine, also known as Vitamin B1, is found in meat products and in germ and bran fraction of cereals (Figure 5). Products made from white sifted wheat flour, such as pasta and many breads and polished rice, rarely contain thiamine.

Therefore, consumption of whole grains is necessary to ensure intake if thiamine. Thiamine is also produced endogenously by intestinal bacteria in the colon (Nordic Council of Ministers 2014). However, it is not certain whether the bacterial derived thiamine can be taken up as a source of vitamin A or if it is exclusively used by the epithelial cells in the colon. Whole grains have an important function by promoting probiotic growth in the colon, hence they are classified as probiotics, which in turn increases the wellbeing of the colon.

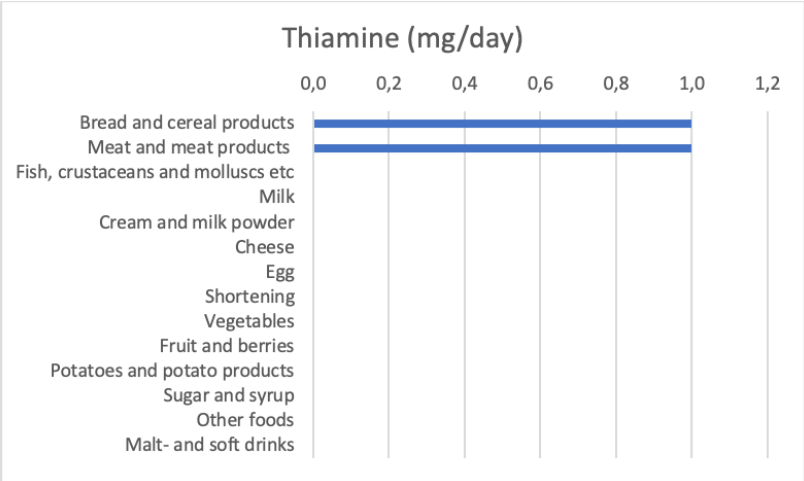

Figure 5. The origin of thiamine in foods consumed in Sweden 2019, divided into food categories. Division is based on Standard International Trade Classification, SITC. The values are based on the Swedish Board of Agriculture's statistics on nutrient intake. https://statistik.sjv.se/.

Thiamine is a water-soluble vitamin which can be stored in the body, but not to a high extent. This allows deficiency symptoms to be detected after just a few days without thiamine intake. Absorption of thiamine occurs in the duodenum and proximal small intestine and is driven by active transport. Transport of thiamine can be inhibited by alcohol (Frayn 2010), which means that high alcohol consumption may be associated with thiamine deficiency, as well as deficiency of magnesium, vitamin D and ascorbic acid (Nordic Council of Ministers 2014). Alcohol and drug abuse is thought to be the leading cause of thiamine deficiency in the Western world (EFSA et al. 2016).

In several countries where rice constitutes the largest staple food, thiamine deficiency disorders like beriberi has been a recurring problem historically. During the late nineteenth century in Japan there was a mysterious disease outbreak among sailors that caused loss of strength, apathetic state and oedema-like symptoms to otherwise healthy people. It turned out to be in connection with the almost exclusive consumption of polished white rice, and a diet that lacked in high-fat and high-protein food commodities. Similar situations have been reported to occurr in Sri Lanka and other colonized countries (Carpenter 2000).

Still, in countries that suffer of malnutrition, beriberi is still a major concern (Frayn 2010). In some countries in Africa and Asia, thiamine deficiency has also been linked to the intake of a diet containing high amounts of thiaminase which is an enzyme that degrades thiamine. Thiaminase is found in raw fermented fish, ferns and insects (EFSA et al. 2016).

An adequate intake of thiamine is essential since it plays an important role in the functioning of the nervous system and energy metabolism, especially the energy metabolism of carbohydrates (Frayn 2010). The most well-known condition of deficiency is beriberi, which causes neuronopathy and can also result in cardiovascular health problems. Other symptoms of deficiency is edema, constipation, difficulty in breathing and weight loss (EFSA et al. 2016).

2.2.3. Dietary fibre

The definition of resistant starch and dietary fibre, DF, has changed throughout history and is still changing. The definition may also vary in different parts of the world (Gibney et al. 2009). The definition by NNR of dietary fibre includes resistant starch, resistant oligosaccharides, lignin and non-starch polysaccharides, NSP, which includes cellulose and hemicellulose. NSP is what constitutes the major part of dietary fibre in the Nordic diet. Foods high in dietary fibre are legumes and cereals, especially whole grains cereals (Frayn 2010). The origin of dietary fibre in foods consumed among the Swedish population is illustrated in figure 6.

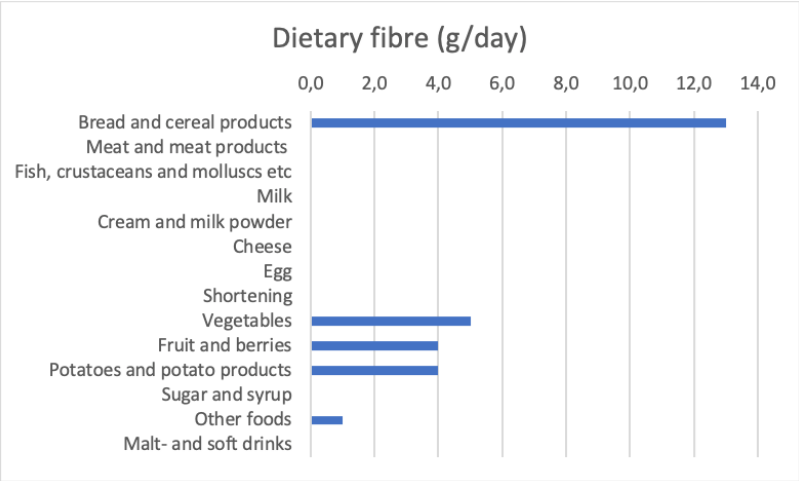

Figure 6. The origin of dietary fibre in foods consumed in Sweden 2019, divided into food categories. Division is based on Standard International Trade Classification, SITC. The values are based on the Swedish Board of Agriculture's statistics on nutrient intake. https://statistik.sjv.se/.

Despite the fact that different dietary fibres come with different properties, e.g. dissolving differently in water and being fermented with varied efficiency by the bacteria in the large intestine, they are still named dietary fibre (Nordic Council of Ministers 2014). The fact that fibre acts as a substrate for the bacteria means that they are well known as prebiotics. However, the mechanism and the relationship between microflora and dietary fibre is not yet clearly established (Hijová et al. 2019).

Dietary fibre consists of carbohydrates that cannot be broken down by enzymes in the small intestine and thus are passed on to the large intestine where they can be fermented by bacteria. These bacteria use dietary fibre as an energy source which allows them to grow and colonize. As a result of the fermentation, lactic acid as well as secondary metabolites, e.g. short chain fatty acids, SCFA, are produced but also products like acetic acid, propionic acid, butyrate, vitamin B12 and vitamin K are formed. All these metabolites have beneficial roles in the body (Hijová et al. 2019).

Sufficient intake of dietary fibre is important to maintain an overall good gut health. By giving a feeling of prolonged satiety, snacking can be reduced which leads to stabilization of blood sugar level (Livsmedelsverket 2020). Dietary fibre also fulfils an important function in the gel-forming ability, which makes food move more slowly through the intestinal tract, including the small intestine. This allows longer time for the intestine to absorb nutrients other than carbohydrates (Nordic Council of Ministers 2014).

An increased intake of dietary fibre could influence the lipid status in plasma by lowering of cholesterol levels. This is good from a health point of view since high cholesterol levels increase the risk of developing atherosclerosis and hypertension (Frayn 2010c). Dietary fibres affect the enzymes and viscosity in the ileum, and by affecting the bile salt reabsorption and allowing more to be excreted in the faeces, the total cholesterol level in the body decreases (Ellegård & Andersson 2007).

2.2.4. Recommended intake

To maintain a good state of health, there are recommendations regarding the intake of nutrients. Sufficient intake varies between individuals and depends on factors like age, weight, gender, genetics, and physical activity. Thus, there are some reference values to cover all people in these recommendations.

Average requirement, AR, is a recommended intake that is required to be sufficient for 50% of the population. This means that for half of the individuals in a group,

the recommendations will be below their needs, while the nutritional needs of the other half will be met. The variation is large because it is an average value, but for healthy people, AR is a good measure to determine the risk that the nutrient supply is insufficient (Dwyer 2003). AR is primarily used to assess the risk of insufficient intake in a group of individuals. The percentage that has an intake which does not meet the AR corresponds to those that risk insufficient intake (Nordic Council of Ministers 2014)

The recommended intake, RI, is the amount of a nutrient that covers the needs for 97 - 98% of the population to maintain a good nutritional status. RI is determined by adding two standard deviations to AR and is adapted for long-term consumption. RI is mainly used when planning a diet for a group of people with a certain age and gender (Nordic Council of Ministers 2014).

2.2.5. Imported food

Sweden imports much of the food we consume and is a net importer of food in general. In 2019, the import increased by 4% if fish is excluded from the calculations. The product groups that contributed the most to this increase were cereals, beverages, coffee, oils, fruit, vegetables and the category “various food”. If fish is included in the calculations, the increased import equals 5%. Fish constitutes the largest part of Swedish imports, constituting over 30% of all imported food. Norway is the country from which Sweden imports the most, although fish products is almost the only category that is imported. In addition to Norway, Denmark, the Netherlands and Germany are the countries from which Sweden import the most. Norway being excepted, Sweden has the largest trade deficit with the Netherlands, which can be explained by the fact that the Netherlands is an intermediary for goods from the rest of the world outside the EU (Strandberg & Lind 2020).

As previously mentioned, fish is the product that is imported to greatest extent but also the product that Sweden exports the most. Fish products are exported from Sweden in the form of processed fish products. This kind of exports make the export- and import statistics increase. The fact that imports of fish are often excluded from the calculations is due to the fact that the statistics are often unreliable. The official catch statistics are considered substandard and therefore, fish not been included in the statistics since the year 2000 (Jordbruksverket 2019a).

2.2.6. Direct and total consumption

Direct consumption includes food that is consumed in households and in producers' so-called home consumption. This includes semi-prepared and prepared products as well as fresh foods. Total consumption refers to the total consumption including the raw materials that is used in the food industry during the production and processing of food. For example, in case of meat consumption, direct consumption includes meat in the form in which we have access, i.e., as we buy it in the store. Total consumption also includes bones, skin and other things that are not edible. Since these values are presented in kilograms or litres, it is important to understand what is included in each category, as the values will differ significantly between direct and total consumption (Jordbruksverket 2019b). Both direct and total consumption values probably overestimate what is actually consumed, as household waste is not included (Jordbruksverket 2019b).

3. Methods

3.1. Study design

Based on the foods that Sweden imports to the greatest extent, three different scenarios have been created to describe how the supply of energy, dietary fibre and nutrients change in the event of a security policy crisis leading to disturbances in the food supply. The origin of energy and nutrition from each food category has been compiled in tables in Excel, to be reduced based on the supply change in each scenario. The results are presented in figures where the three scenarios are compared.

Scenarios

1. **100% intake reduction of *vegetables and fruits***
2. **50% intake reduction of *meat products*, *seafood* and *vegetables and fruits***
3. **30% intake reduction of all food categories.**

The information that forms the basis for this report has been taken from statistical databases where all data comes from 2019. Literature searches have been made in databases such as Primo, Google Scholar and Science Direct.

3.2. Sources of food statistics

The effects on energy and nutrient supplies of the different scenarios are estimated using statistics from the Central Bureau of Statistics, SCB. Statistics on Sweden's imports and net trade, i.e., the difference in how much is imported and exported of foods, is presented in figure 7. All used statistics are from 2019.

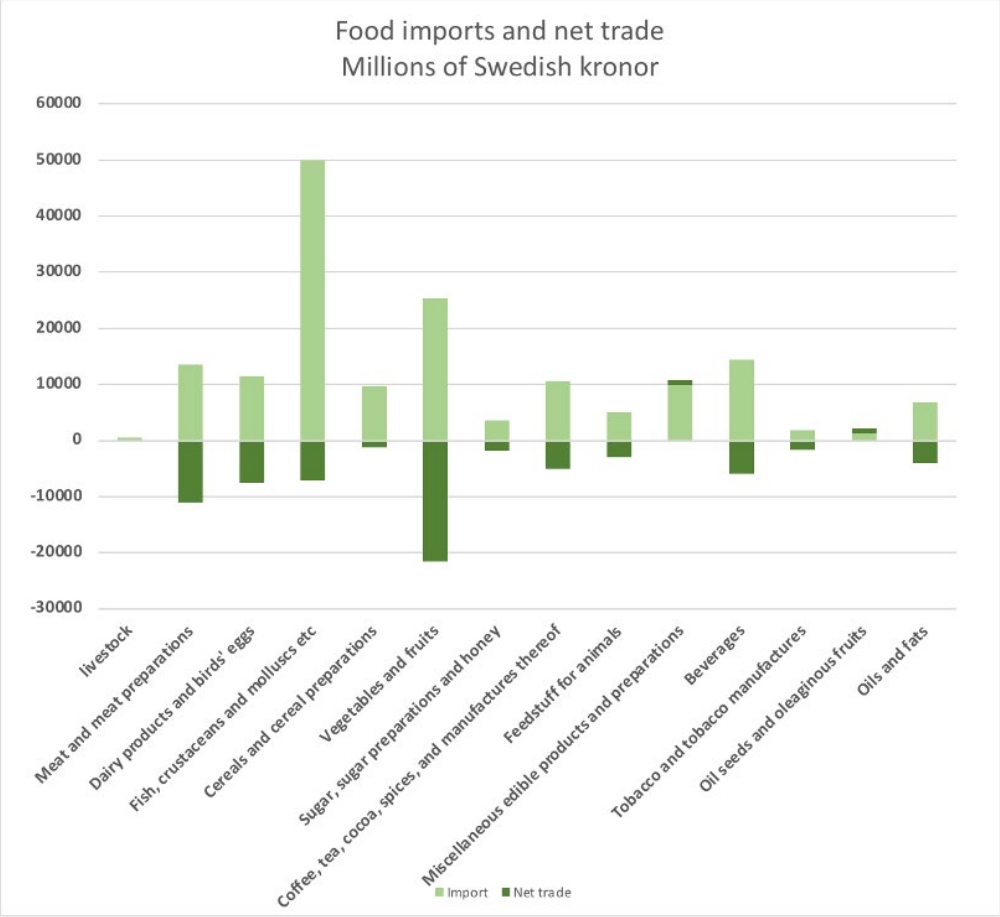

Figure 7. Swedish import and net-trade expressed in millions of Swedish kronor. The net trade balance is measured as the total value of exported food minus the total value of imported food. The values for imports are based on statistics from the Central Bureau of Statistics, SCB on imports in 2019. https://www.scb.se/hitta-statistik/.

Sea food is the most imported food group and is therefore one of the chosen categories in two of three scenarios. In all scenarios, the category *vegetables and fruits* is taken into account since it has the largest net trade. *Meat products* is the third most imported food category without taking beverages into account. Beverages are imported to a larger value than meat products, but is not included in any of the scenarios because it is not considered to be of greater importance from a nutritional perspective. Meat products also have a greater net trade than beverages and therefore the conclusion to exclude beverages. Thus, the categories meat products, sea food, vegetables and fruit constitute the product groups that make up the studied scenarios.

Energy and nutrients

Statistics on energy and nutrient supply sorted by product and food consumption in Sweden were accessed through the open statistics database, published reports, and

compilations by Swedish Board of Agriculture (Jordbruksverket 2021)In addition to the Swedish Board of Agriculture's own surveys and registers, their statistics include data from Central Bureau of Statistics, SCB, the Swedish Public Health Agency, the National Food Administration, the Swedish Hunters' Association and the Sami Parliament. The Swedish Board of Agriculture's reported results are thus combinations of all data (Jordbruksverket 2019b).

Consumption, energy and nutrient intake.

The Swedish population's direct consumption of food groups per year is presented in total amounts and per capita. The consumption and the supply of energy, macronutrients, dietary fibre and vitamin A, vitamin C, iron, calcium and thiamine presented in this report are taken from the Swedish Board of Agriculture's statistics database. This data is based on calculations performed by the National Food Administration. Vitamin supplements are not included in the calculations (Jordbruksverket 2019b). The five micronutrients vitamin A, vitamin C, thiamine, iron, calcium are the micronutrients that are presented in Swedish Board of Agriculture's statistics database, and this is also the reason for choosing them for this study. The recommended and average daily intake for energy, dietary fibre and selected nutrients are based on the latest Nordic Nutrition Recommendations, NNR, 2012.

3.3. Import and export statistics

SCB statistics for imported and exported foods are used as a basis for making the scenarios. SCB uses a type of division of foods into categories for import and export which are based on the international Standard International Trade Classification, SITC. Each product group has a given code. In this essay, the codes are not mentioned, only the names of the product groups.

The Swedish Board of Agriculture lists the categories "fruit and berries" and "vegetables" separated while The Central Bureau of Statistics, SCB, combines the two categories into "Vegetables and fruits". Since the chosen scenarios include fruits, berries and kitchen plants all together, those categories are combined in all calculations. In this report they are named *Fruits and vegetables.* The category *fish, crustaceans and molluscs,* is abbreviated as *sea food* and *meat and meat preparations* is named *meat products (table 1)*.

Table 1. Abbreviations used in the text. Standard International Trade Classification, CITC, is used internationally as a way of classifying goods, initiated by the United Nations.

Swedish SITC	English SITC	Used abbreviation
Kött och köttvaror	Meat and meat preparations	Meat products
Fisk, kräft- o.blötdjur m.m	Fish, crustaceans and molluscs etc	Sea food

It should be noted that the Swedish Board of Agriculture's compilation of imported foods is reported by "country of dispatch" and not "country of origin", thus the perception of imports may be somewhat misleading and give a skewed picture of the importance of different countries (Strandberg & Lind 2020). This applies especially to fruit and vegetables that comes from countries outside Europe. These products come to an intermediary country in Europe before being imported to Sweden.

Most of the fish that Sweden imports comes from Norway, which is not a member of the EU. Norway constitutes the largest source of imported fish to Sweden and is therefore a very important trading partner. Fish is the food category that Sweden exports the most. This means that Sweden acts as an intermediary for Norwegian fish to be transferred to the EU-28

3.4. Management of calculations

To analyse the possible nutritional consequences of the reduced availability of food, the population has been divided according to gender into age categories. Likewise, men and women have been divided into two physical activity levels, PAL 1.4 and PAL 1.8. The values for total energy requirements for each PAL category are recalculated by using the basic metabolic rate and reference weight for each age and gender category. This data, as well as recommended intake, RI, and average requirement, AR, come from NNR. The availability of micronutrients is examined with respect to these recommendations.

By investigating the consequences for population groups with different energy needs, categories that may risk insufficient intake can be identified. In the case of a serious crises, society has to continue to function. Some central groups in society may have higher energy needs, for example fire men, soldiers and hospital staff. These are examples of those who can have a PAL value of 1.8. However, most people will be able to lower their activity level in a crisis. The average value of

PAL is 1.6, and to show how much energy that is needed for individuals with very low activity, the lowest PAL in this study has been set at 1.4.

Men and women have been divided and examined separately. The chosen age range is based upon, and has been adapted to the division that NNR used in their recommendations. The age range is 18 to 74+, where specific values exist for individuals between 18 and 74. Individuals over 74 years are included in the calculations because their nutritional needs are considered to be equivalent to those in the age category 61 to 74 years. Children under the age of 18 are not included in the calculations because the nutritional needs differ widely in the ages up to 18 years.

The different percentages that are deducted in the scenarios reflect how direct consumption would affect the nutritional supply in total, i.e., if the consumption of both imported and domestically produced food decreases by the respective percentage. The limited supply presented in the scenarios is based on the import statistics where the most imported product groups are the basis for the assumptions.

By a known basic nutrient supply to start with, the three scenarios were made by subtracting values for the scenario-specific product groups. This made it possible to investigate the changes for energy, dietary fibre and nutrients. To present this data in a clear way, figures are used where the differences between the scenarios can be seen in the same figure together with the baseline supply as a reference.

Since the need for energy and dietary fibre varies depending on age and activity level, variation in needs is presented in a figure with a range for women and men for the two selected activity levels PAL 1.4 and Pal 1.8. Dietary fibre is presented in the same way as energy, as values are energy adjusted. The micronutrients are presented in separate tables since they are expressed in different units.

4. Results

4.1. Energy

Depending on scenario, i.e. which of the imported food groups that decreased, the outcome differed. In scenario 1, the availability of *vegetable and fruits* decreased, leading to a 10% reduction in the availability of energy compared to the base scenario. The effect on the supply of energy was, however, limited (Figure 8). Only men with a high level of activity, PAL 1.8, were affected, since their energy need was higher than the average energy supply. The same applied to scenario 2 where 50 % of *vegetables and fruits, meat products* and *sea food* was reduced. For most of the population, the available energy in scenarios 1 and 2 was sufficient. This included men with lower activity levels and women with both high and low activity levels. In the event of scenario 3 with a 30% reduction in energy supply of all food categories due to reduced imports, the impact on energy supply was noticeable for the majority of the population. For men with activity level 1.4 aged 18-60 years, the available energy in scenario 3 is insufficient. Those whose needs are met in this scenario are all women with PAL 1.4 and men with PAL 1.4 that are over 60 years of age (data not shown).

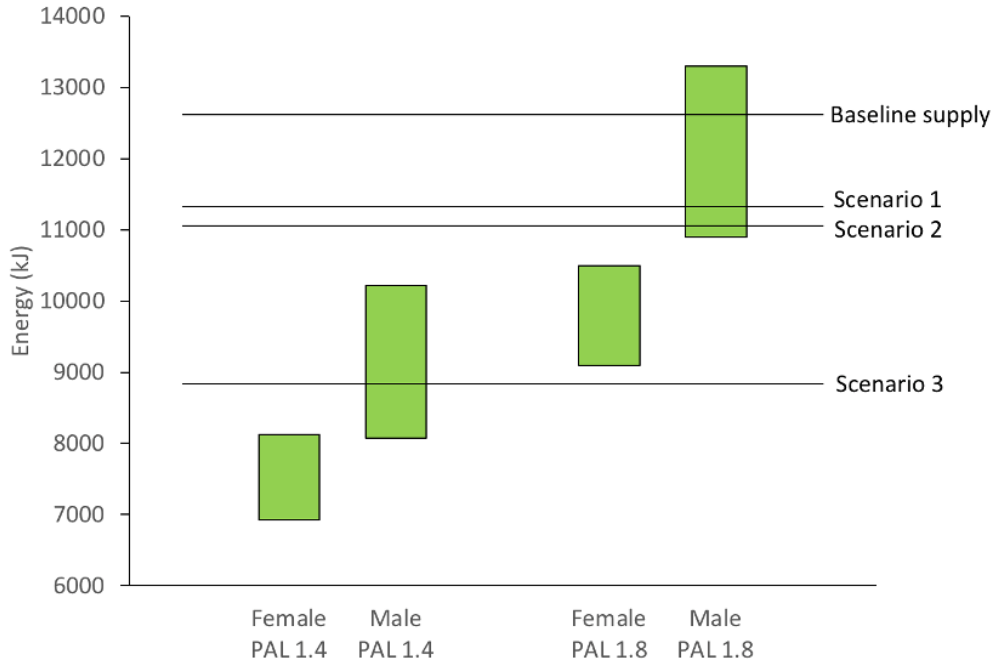

Figure 8. Energy supply in the different scenarios and in relation to energy needs, according to physical activity and gender. Presented with three scenarios in combination with baseline supply. The bars correspond to the range of energy needs that each group has with an age range of 18-74 years in each group. Baseline supply corresponds to the available amount of energy without any of the scenarios being applied. The scenarios show what energy level would be available based on the different conditions. The scenarios refer to, 1: 100% intake reduction of vegetables and fruits. 2: 50% intake reduction of Meat products, Seafood and vegetables and fruits. 3: 30% intake reduction of all food categories.

4.2. Dietary fibre

The need for dietary fibre is based on the energy requirement, where 3 g/MJ is recommended. It can be seen in figure 9 that the majority of the population does not get enough dietary fibre, not even in normal cases. This is an already known fact and higher intake of fibre rich foods is stressed in the Swedish dietary advice (Livsmedelsverket 2020).

The lack of dietary fibre becomes apparent in scenario 1, as *vegetables and fruits* next to potatoes are the largest source of dietary fibre (figure 6). In the event of scenario 1, the risk of insufficient intake of fibre is obvious for both men or women. The same applies in scenario 3 where the availability of dietary fibre ends up at a substandard level since the availability of all product groups decreases by 30%. It is 67% lower in comparison with “normal intake”. This is because the product group “grain products and bread” is included (and reduced), which is the largest source of dietary fibre.

The result in scenario 2 also shows lower levels than in baseline supply. Only some women with PAL 1.4 get enough dietary fibre (data not shown), for the remaining groups and gender the intake is insufficient even in this case.

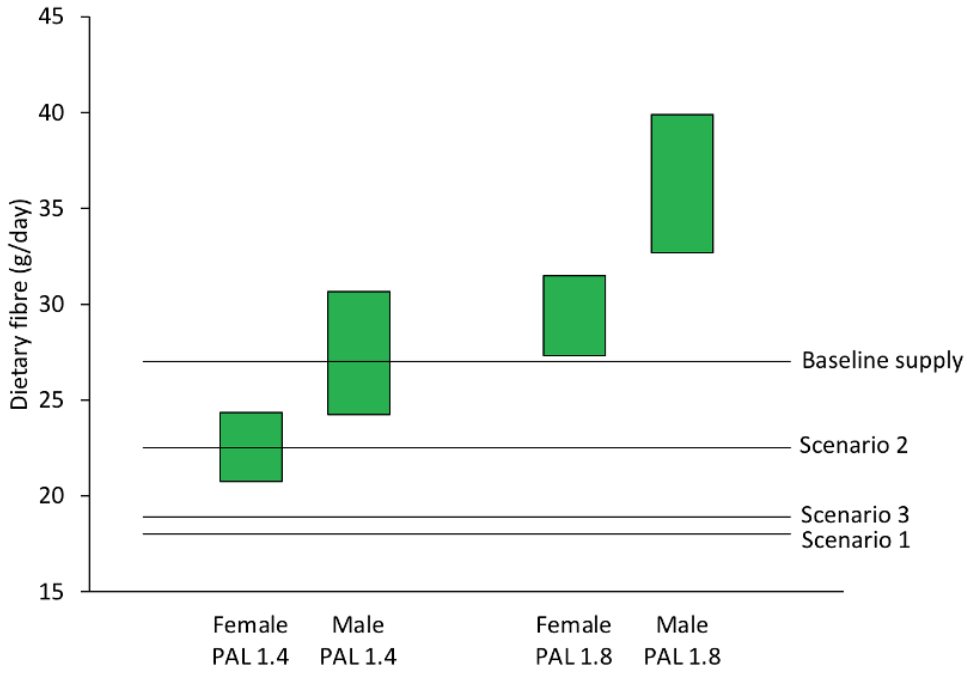

Figure 9. The supply and demand of dietary fibre based on physical activity level and gender. The bars correspond to the need for dietary fibre *that each group has. Age ranges are 18-74 years in each group. The baseline supply corresponds to the available amount of dietary* fibre *without any of the scenarios being applied. The scenarios show the amount of dietary* fibre *that would be available based on the different conditions. The scenarios refer to, 1: 100% intake reduction of vegetables and fruits. 2: 50% intake reduction of Meat products, Seafood and vegetables and fruits. 3: 30% intake reduction of all food categories.*

4.3. Micronutrients

Vitamin C

The recommended intake is the same for men and women but the average requirement, AR, differs slightly. In scenario 1, where the supply of *vegetables and fruits* is reduced by 100%, the results indicate that vitamin C will not be available in sufficient quantities to meet the average needs of the population (Figure 10). In scenario 2, AR is met for both men and women, but the supply is not high enough to meet the recommended intake, RI. The same applies to scenario 3, i.e. AR is met for both men and women, but not the recommended intake, RI .

Vitamin A

In all scenarios, both AR and RI are fulfilled regarding the intake of vitamin A. In scenario 3 the RI level is barley reached, due to that intake of all food categories is declining, and since vitamin A is found in the majority of product groups. Vitamin A deficiency? is rarely a problem in a varied diet.

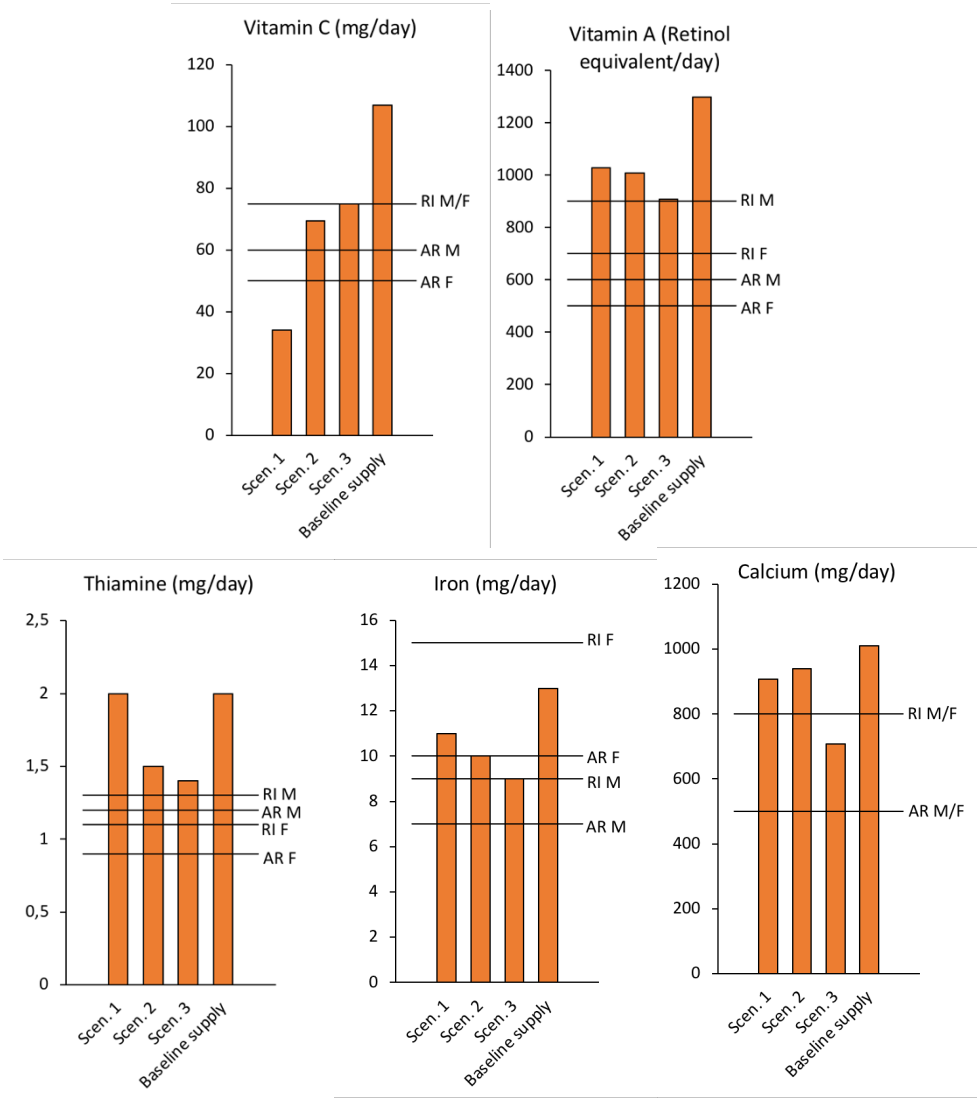

Figure 10. The results of each nutrient presented separately. Each diagram indicates the supply of the nutrient by scenario 1, 2, 3 and the baseline supply. Recommended intake, RI, and average intake, AR are marked for women, F and men, M. The RI value is the same for men and women for vitamin C. For calcium, both RI and AR are the same for men and women. The scenarios refer to, 1: 100% intake reduction of vegetables and fruits. 2: 50% intake reduction of Meat products, Seafood and vegetables and fruits. 3: 30% intake reduction of all food categories.

Thiamine

In all scenarios, the thiamine levels are sufficient. The supply in *Scenario 1* is unchanged compared to baseline supply, since sources of thiamine are not limited.

Scenario 2 and *3*, generate significantly lower levels of thiamine. However, none of the scenarios result in levels below either RI or AR (figure 10).

Iron

For iron, the need differs a lot between women and men, where women have significantly greater needs, which is clearly seen in figure 10. None of the scenarios, including the baseline supply are sufficient to reach the very high recommended intake recommended for women. The result for *scenario 1* shows that the iron intake is fully sufficient with respect to AR for both women and men, as well as RI for men. This also applies to the baseline scenario. In *scenario 2*, the needs are covered for all needs for men, but the supply is just enough to reach the AR for woman. In *scenario 3,* the level of iron only covers the needs of men.

Calcium.

The values for both RI and AR are the same for both men and women with respect to calcium. Only for *scenario 3,* it turns out that the supply is too low with respect to RI, while AR is covered. *Scenario 1* and *2* show relatively equal levels, just below baseline supply.

5. Discussion

5.1. Time perspective

The time of year when these scenarios take place has not been taken into account in the study. For some of the food categories it plays a major role during which time of the year a possible crisis would arise. The National Food Agency assignment from the government to investigate the food supply in the event of a crisis extends over a period of three months. During that period vitamin C, dietary fibre and iron are the micronutrients that risk being ingested in insufficient amounts. However, deficiencies of these nutrients will occur after a period longer than 3 months. A too low energy intake, on the other hand, will affect the population more directly and is therefore the most important aspect to take into account in a short crisis. *Scenario 3*, where the intake of all food categories decreases by 30%, shows the greatest consequence in the short term.

In the event of a long-term crisis, it is reasonable that agriculture and Sweden's food production will change and adapt to the new conditions, while in a crisis of only three months it is not possible for agriculture to switch. In agriculture, cultivation is usually planned well in advance and the time perspective of three months is too short a time to adjust the production. A planning cycle in agriculture extends over at least one year (LRF 2019). In the event of a long-term crisis, there is an opportunity for agriculture to change crop rotation or change cultivation to other varieties.

The time of year in which a possible crisis occurs is of the utmost importance, as Sweden is depending on import of fruit and vegetables during most of the year. For dietary fibre and vitamin C, the need is greatest. In principle, the only source of vitamin C that we ourselves can grow to a large extent is potatoes. If a crisis arises during the winter, potatoes would therefore be an important source of vitamin C for Sweden's population. It is therefore important that potatoes are grown and stored if needed.

5.2. Nutritional consequences

5.2.1. Energy and dietary fibre

The possible outcome of an insufficient amount of food rich in energy is greatest in *scenario 3*, where 30% of the intake decreases. In such an event, it is possible that the food needs to be rationed and restrictions on physical activity may become reality. PAL 1.4 means a very sedentary lifestyle and according to the calculations, it is this activity level that is most appropriate in an event of such low access to energy as in *scenario 3*. In *scenario 1* and *2*, the reduction in energy supply does not appear to have the same consequences for the population.

Unlike the baseline supply of energy, allowing energy to be consumed in abundance, this is not the case with dietary fibre. Even in normal cases, the available amount of dietary fibre is not sufficient for the Swedish population to the extent it is recommended. The need is much greater than what people consume and in the event of *scenario 1*, where the supply of *vegetables and fruit* decreases, the supply becomes substandard and neither men nor women, regardless of PAL, can consume sufficient quantities. A lack of dietary fibre would probably not give any direct deficiency symptoms. Dietary fibre has a proven beneficial role in metabolism and health, and it would be a mistake not to take fibre into account as an important food component in case of a crisis.

5.2.2. Micronutrients

The baseline scenario indicates that the supply of the majority of the nutrients will suffice and meet the population's need by a good margin. By eating a varied diet, based on these calculations, there is no clear reason why general supplementation would be necessary. Iron is the only nutrient where not even baseline supply meets the recommended intake for women. The presumed explanation for this is that women of childbearing age have a higher need due to menstruation and the event of pregnancy. Supplements in these cases can thus be a good idea.

Elimination of *vegetables and fruit* intake, results in very low intakes of vitamin C, insufficient for both women and men's recommended intake and average needs, especially in *scenario 1*. For vitamin A and thiamine the needs are met in all scenarios. RI of calcium is not met for either men or women in scenario 1. Despite a reduction in iron supply compared to baseline, the supply in scenario 1 will meet the requirements except for the recommended intake by women, which is significantly higher than iron needs for the other population groups.

In the case of a long-term condition of *scenario 1*, there is a risk that the population will develop deficiency symptoms, e.g. scurvy. Vitamin C has a low ability to be stored in the body and the main food sources for vitamin C, except for potatoes, are de facto imported to a very high extent. These facts in combination make the supply of vitamin C very vulnerable. Sweden is dependent on a functioning food import of vegetables and fruits to ensure the needs of the population. Alternatively, we can look back at how it was done historically when fruit and berries were used to preserve and save for the rest of the year. Currants, for example, are very rich in vitamin C and can be grown in most parts of Sweden. It should be possible to adapt the production in many ways.

In *scenario 2* where the intake of fish, meat and vegetables is reduced by 50%, the recommended intake of vitamin C is not met, which is a clear result of the reduction of *vegetables and fruit*. However, the supply will be sufficient to meet the needs of Vitamin A, thiamine and calcium. The iron supply in *scenario 2* decreases by 23% compared to baseline supply, which is probably linked to the reduction in the supply of meat, which is an important source of iron.

As the total intake of micronutrients decreases by 30% in *scenario 3*, In this scenario, the limited supply will cause the largest shortcomings when compared to needs for the different nutrients. The recommended levels of vitamin C, vitamin A and thiamine are met by small margins, while the supply of calcium and iron does not reach all recommended levels. For iron, the supply covers recommended and average intake for men but is insufficient for women. *Scenario 3* is the only scenario where calcium needs are not fully met by the supply. AR for women and men is covered but the recommended calcium intake is not, for either sex, where the RI is the same for women and men.

5.3. The import

This report is based on statistics from 2019, but it is worth mentioning that imports decreased in 2020 due to the corona pandemic and this constitutes a clear trend break (Jordbruksverket 2021). This fact reinforces the significance and relevance of this study since it shows that a crisis will affect the possibility of import. The imports of food and agricultural products decreased in 2020 by 1%, if fish is excluded. The product groups that decreased the most were meat, and cereals, milk and sugar. If, on the other hand, fish is included, the reduction of imports was almost 3%. Large parts of the food that is imported will also be processed and later constitute exports, i.e. the food is further exported. Here, too, fish has a special position because it is the product group that to a large extent is re-exported.

The corona pandemic affected the whole world in terms of health, but also trade which became very unpredictable. Sweden's exports of goods declined especially at the beginning of 2020, but recovered surprisingly quickly in the second half of the year (Kommerskollegiums 2021). The scenarios in this essay are based on the possibility that similar crises could occur. In a situation of drought or crop failure in- or outside Europe, it is imaginable that the possibility of import will decrease as each country will first ensure that the food is sufficient for its own population. For this reason, it is important to recognise the weaknesses in domestic supply in advance.

6. Conclusion

The fact that Sweden in recent years has decided to invest increasing resources in defence clearly indicates the importance of strengthening the country's self-sufficiency. It is not only the budget for armed forces that is increasing, it is also the budget for civil defence. Likewise, interest among people is increasing and the general orientation in society towards a more self-sufficient direction. An increasing number of people care about locally produced food and a new green wave movement seems to be around the corner. People want to secure their ability to cope if the crisis comes. It is possible that the brochure “Om krisen eller kriget kommer”, earlier distributed by the Swedish Civil Contingencies Agency, MSB, had some impact. The brochure was sent out by post to the entire population in 2018, with recommendations what to do if there is a crisis or a war.

Examining which diet that will satisfy the nutritional requirements in the event of a crisis, is to a very high degree a relevant topic within the area of food preparedness. It is of great importance to first of all know our limitations, with regard to nutrition. Then measures that are deemed necessary to secure the supply can be done. It has been decided that Sweden should be able to maintain the supply of food for three months. To be this resilient all year round, there is a great need for a food storage, especially during the time of the year when it is impossible to grow food in Sweden.

The assignment given to the National Food Administration is part of a larger context in which the whole society must change in order to create resilience against possible crises. This essay is a small part of the puzzle that Sweden now is putting together.

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Appendix 1

Popular Scientific Summary

The development of security policy in the world has changed in recent years, which has led Sweden to strengthen the civil defence. Already in 2015 it was decided to begin with the reconstruction of both armed forces and civil defence. This was presented in the *defence bill* that applied for 2016-2020. In the latest version, which covers the years 2021-2125, even greater emphasis is placed on these issues and the relevant authorities have received large budget additions.

An important aspect of the mission to strengthen Swedish food production is to investigate our resilience. As part of this, the National Food Agency, the National Veterinary Institute and the Swedish Board of Agriculture have been given the common assignment to investigate how Sweden can secure its access to food and drinking water during a crisis. The National Food Administration is given a special task to investigate which foods must be available in various crisis situations to cover the population's needs for energy and nutrition. The named authorities will now investigate these issues from a time perspective of three months. This essay examines nutrients in the population in crisis situations, as a small part of this major issue.

Historically, Sweden's imports have increased year after year, but in 2020 there was a trend brake. This can of course be connected to the Corona pandemic. Imports then decreased for the first time in a very long time, indicating that a crisis situation will change the conditions for imports. This motivates and shows the relevance of this kind of investigations. At present, Sweden imports a lot of food, especially fish, meat, fruit and vegetables. Based on these food categories, three scenarios have been formed to show three examples of what could happen if imports decrease. The purpose is to see how the population's access to nutrients changes if certain foods are not available as usual.

The selected scenarios are:
1. 100% intake reduction of vegetables and fruits
2. 50% intake reduction of meat products, seafood and vegetables and fruits
3. 30% intake reduction of all food categories.

If scenario 1 arises at a time when fruit and vegetables cannot be produced in Sweden, i.e., during the winter, these foods will be a major shortage. Insufficient intake of fruits and vegetables leads foremost to low levels of vitamin C, but also dietary fibre. In scenario 2, the three most imported product groups decrease by 50% but still this scenario results in the least dramatic consequences. The supply of energy decreases by 30%, but it is still enough for most people. Scenario 3, when all categories decrease by 30%, also generates low levels of dietary fibre. The most crucial consequence in scenario 3 is that the population will not get sufficient energy, as in kcal. This is the most severe and most acute problem that will appear first, since it is energy that makes the body able to cope with daily life. Deficiency symptoms caused by insufficient intake of vitamins and minerals only appear after several months, or even years.

This essay shows not only the deficiencies can occur in different scenarios, but also that the population normally gets too little dietary fibre, and that women generally do not achieve sufficiently high levels of iron in their diet. As a general concluding recommendation: Eat your greens and choose whole grain!