



# Food patterns and dietary recommendations in Spain, France and Sweden

Healthy people, healthy planet.



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## Foreword

Food is at the heart of many key environmental issues. Growing, producing and importing food contributes substantially to climate change. It's a driving force behind habitat and biodiversity loss. And it's a huge drain on water resources. That's why helping to develop a sustainable food system for healthy people and a healthy planet is one of our priorities. By making small changes to your diet, you can help the environment – and eat healthily too!

The change in the Western diet – to one that's high in meat, dairy and processed food – is a recent phenomenon. It's occurred at the same time as a growth in issues such as obesity, type II diabetes and heart disease. This is not a localised problem: throughout Europe diets are changing, and they're impacting on people and the planet.

The food we eat affects some of the Earth's most important and sensitive ecosystems. Practices such as land clearance and land conversion for food and agricultural production endanger wildlife across the world – including orang-utans, armadillos, Iberian lynx and tigers.

Livestock production has the largest impact. Livestock farming leads in most cases to a range of direct and indirect environmental stresses such as habitat conversion, greenhouse gas emissions, eutrophication and soil erosion. Some 306 of the 825 WWF terrestrial eco-regions reported livestock as one of their current threats. With rapidly increasing global demand for food and other renewable resources this number is expected to rise significantly.

WWF's LiveWell UK project set out to make a first step towards defining a sustainable, healthy diet. We began by adapting the UK government's advice on eating – the Eatwell plate – so it also considered carbon. The result, based on the best available information in the public domain, was a definition of a low-carbon diet that's nutritionally viable: the LiveWell plate.

LiveWell shows that by reducing but not eliminating animal-based proteins from our diet we can meet recommendations for health and emissions reduction targets for 2020. LiveWell illustrates that our choices must be about balancing the proportions of different foodstuffs in our diet. This flexible approach allows different cultural, religious and individual dietary needs or preferences to be taken into account.

Working together with *Friends of Europe*, WWF is now applying a similar approach to diets across Europe, through our LiveWell for low impact food in Europe – or LiveWell for LIFE - project.

This report is our initial foray into developing a sustainable diet in Spain, France and Sweden. Business as usual is not an option and this is an excellent first step towards a outlining win-win for people and planet.

Duncan Williamson  
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## Summary

As part of the LiveWell for low impact food in Europe (LIFE) project, **Blonk Milieu Advies (Blonk Environmental Consultants) and Voedingscentrum (Dutch Nutrition Centre)** have compiled information on dietary patterns in Spain, France and Sweden. They've also looked at what these countries should be eating, according to their national dietary guidelines. This report details the results of their work.

**The next stage of the LiveWell for LIFE project will be to develop ideas for more healthy and sustainable diets for each country. This is urgently needed because current dietary habits contribute to climate change and environmental degradation and are having a negative impact on people's health, leading to irreversible environmental changes and several non-communicable diseases (NCDs). Both these issues have huge costs to society.**

Government food-based dietary guidelines (FBDGs) show people how they can eat a healthy, balanced diet that meets nutritional requirements. FBDGs are often shown in a graphic such as a diet pyramid, plate or wheel and vary between countries depending on their cultural heritage. Spain has the Mediterranean Diet Pyramid; France has a staircase with nine rules (9 repères); Sweden has the Food Circle (Matcirkeln) accompanied by an ideal diet for men and women. The Swedish guidelines also have more detailed advice on quantities people should eat, depending on gender and activity levels.

The next stage of LiveWell for LIFE, which will develop healthy and sustainable diets, requires more detailed information on nutrients. We collected food composition tables and national Recommended Daily Intakes (RDIs) for nutrients. Where national recommendations on key nutrients or energy were not available, those of the World Health Organisation (WHO) or European Food Safety Authority (EFSA) have been used.



Survey data from the pilot countries shows that dietary trends in all three are progressing towards an average Western diet, where people eat a lot of meat, calorie-dense foods and too little fruit, vegetables and legumes. The LiveWell UK Plate<sup>2</sup> diet shows what people should be eating to be healthier and more sustainable (more plants and certified sustainable foods; less meat and highly processed food). However, current dietary trends indicate that all three countries are far from eating like this. Meat consumption in Spain is the highest with Spanish adults eating on average 163g of meat per day. An optimized diet with respect to Carbon Footprint will contain more plant foods and restore the recommended nutrient content of the national diets.

Unhealthy dietary habits are a strong risk factor for NCDs such as obesity, cardiovascular diseases, type II diabetes and certain types of cancer. There are significant differences in the prevalence of NCDs between pilot countries. These differences may be related to variations in dietary habits. Some of the economic costs associated with NCDs are summarised in this report. For example, obesity is estimated to be responsible for 2-8%<sup>49</sup> of national healthcare budgets. If current dietary trends continue, these costs will increase even further.

Dietary habits in Spain, France and Sweden urgently need to change if we're to improve people's health and achieve a 25% reduction in greenhouse gas emissions by 2020. Already, some studies have shown that eating more healthily goes hand-in-hand with eating more sustainable food.



## 1. Introduction

Current dietary habits in Europe<sup>1</sup> contribute significantly to climate change. Changing these habits goes hand-in-hand with eating more healthily because sustainable diets contain more fruit, vegetables and other plant foods and rely less on foods with a high climate impact, such as beef and dairy<sup>2</sup>.

Through the LiveWell for LIFE project, WWF and *Friends of Europe* are working to introduce the concept of healthy and sustainable diets within the EU, starting with three pilot countries – Spain, France and Sweden.

Our pilot project builds on earlier work in the UK, where the Rowett Institute has already developed a LiveWell UK diet<sup>2</sup> based on the UK's government's food-based dietary guidelines (FBDGs). This seven-day diet meets nutritional requirements and achieves a significant reduction in greenhouse gas emissions along the food chain. It is also palatable and realistic.



Poor diets are contributing to people's ill-health. This makes another strong case for changing dietary trends. Unhealthy diets combined with sedentary lifestyles are causing high rates of NCDs<sup>8</sup> such as obesity, type II diabetes, cardiovascular disease and certain types of cancer. These illnesses impact on people's well-being and life expectancy – and on national health care budgets.

This report gives an overview of data collected on food consumption patterns, dietary recommendations and diet-related health problems in Spain, France and Sweden.

WWF chose the pilot countries because they represent a variety of diets in Europe and the different levels of 'policy readiness' for a change to more sustainable diets. We compare data about actual consumption in these countries with national and international nutritional recommendations (for example, from the Food and Agriculture Organisation and World Health Organisation (WHO) and the UK LiveWell Plate. We also summarise the implications for public health.

The European food chain, from farm to fork, is responsible for an estimated 30% of Europe's greenhouse gas emissions and 20% of its fossil fuel consumption<sup>1,4</sup>. The LiveWell for LIFE project has set a target of a 25% reduction in greenhouse gas emissions from the food chain by 2020, to help meet the European Community's overall target of a 20% reduction. Studies looking at the contribution of diets in Spain<sup>5</sup>, France<sup>6</sup> and Sweden<sup>7</sup> to climate change show that livestock products such as meat and dairy are responsible for a major part of the impact. Replacing these products in part with plant foods can decrease the overall climate impact and improve the nutritional value<sup>2</sup> of what people eat.

## 2. Food-based dietary guidelines in pilot countries

### 2.1 Spain

In 2001, Aranceta et al<sup>9</sup> published the first dietary guidelines for Spain, in the form of a food pyramid. These were based on the findings of a group of Spanish experts (Sociedad Española de Nutrición Comunitaria). The pyramid was updated in 2004. Based on this pyramid, the Fundación Dieta

Mediterránea developed the Mediterranean Diet Pyramid (MDP)<sup>10</sup>. The advice it contains is supported by the Spanish Ministry of Agriculture, Food and the Environment (Ministerio de Agricultura, Alimentación y Medio Ambiente). This report will focus on the MDP (see Figure 1).

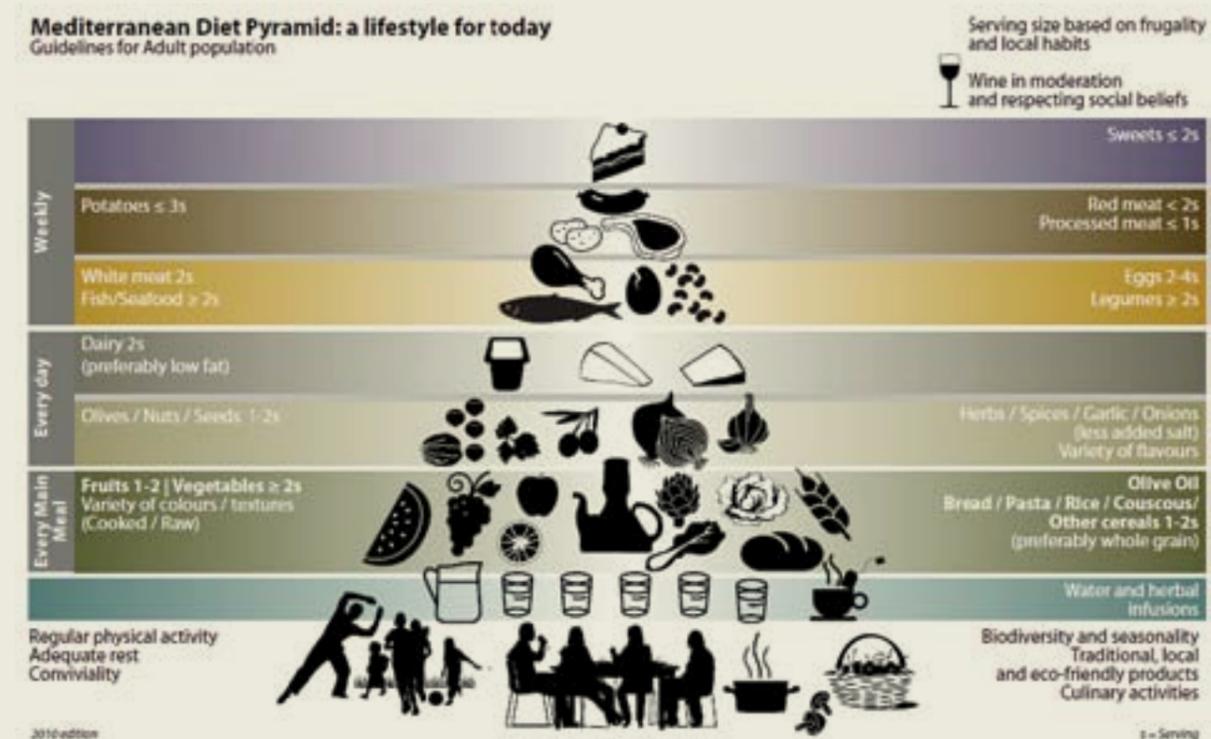


Figure 1: Mediterranean Diet Pyramid

As in other food pyramids, the vertical position informs on the relative importance of a food and the recommended frequency. The MDP distinguishes between consumption with every meal, daily and weekly consumption. It also includes the recommended amount of servings. The MDP draws attention to sustainability by promoting biodiversity, seasonality, local and eco-friendly products. The Fundación Dieta Mediterránea is currently developing guidelines for a sustainable diet.

The website ([www.fdmmed.org](http://www.fdmmed.org)) already offers consumers information on seasonal products.

The MDP highlights the social aspect of food by stressing the importance of conviviality. The MDP does not mention common serving sizes in Spain. These are required to develop a LiveWell plate for Spain, so we collected them from older recommendations<sup>9</sup> (see Table 1).

The MDP is general, and doesn't include any definition of an "ideal diet" for Spanish women or men. There are upper and/or lower limits for the number of servings of many food groups, but apart from wine, the MDP has no advice on portion sizes. The limit for wine, mentioned in the accompanying text, is two glasses a day for men and one for women. The large bandwidth in recommended amounts for the other food groups is challenging for the next phase of the project. The methods used to calculate the LiveWell plates for Spain, France and Sweden need definite boundaries<sup>2</sup>.

There are a large range of options in each of the MDP's food groups, and some options have more nutritional value than others. Although the MDP recommends wholegrain varieties of bread, pasta and rice, these are not very popular in Spain. Only 6% of all bread consumed is wholegrain, according to a recent survey<sup>12</sup>.

Another format for FBDGs still used in Spain is the New Wheel of Foods (Nueva Rueda de los Alimentos)<sup>13</sup>, published by the Spanish Society for Dietetics and Food Science (SEDCA). The wheel (see Figure 2) has six segments representing different food groups. The size of the segments represents the recommended quantity of each food group in a healthy diet, with less preferred foods placed towards the centre in a highlighted section. Physical activity and water are in the axis of the wheel, emphasising that they are basic requirements for a healthy lifestyle.



Figure 2 New Wheel of Foods (Source: SEDCA)

Table 1: Serving sizes and recommended consumption frequency for Spain, based on the Mediterranean Diet Pyramid and Aranceta et al<sup>9</sup> (n.d.= not defined)

Frequency	Product Group	Servings	Serving size
		s=serving	gram
Weekly	Sweets	≤2s	
Weekly	Processed meat	≤1s	25-30 g
Weekly	Red meat	≤2s	100-125g
Weekly	Potatoes	≤3s	150-200g
Weekly	Legumes	≥ 2s	60-80g
Weekly	Eggs	2-4s	1-2 x 50g
Weekly	Fish/seafood	≥ 2s	125-150g
Weekly	White meat	2s	100-125g
Every day	Dairy (prev. low fat)	2s	milk 200-250ml/cured cheese 40-60g/80-125 g fresh cheese/200-250 yoghurt
Every day	Herbs, spices, garlic, onions	n.d.	
Every day	Olives, nuts, seeds	1-2 s	20-30g
Every meal	Bread, pasta, rice,couscous, other cereals (prev. wholegrain)	1-2 s	bread 40-60g/pasta,rice 60-80g
Every meal	Olive oil	n.d.	10 ml (8.6g)
Every meal	Vegetables	≥ 2s	150-200g
Every meal	Fruits	1-2 s	120-200g
Every day	Water & herbal infusions	4-8 s	200 ml
Every day	Physical activity	n.d.	≥30 minutes
Optional daily	Wine	max. 1-2s	glass



### 2.3 Sweden

The Swedish FBDGs are represented by the Food Circle (Matcirkeln). The Swedish National Food Agency (Livsmedelsverket, www.slv.se) developed the Food Circle in 1992<sup>19</sup>. It has seven equal segments (see Figure 4). The graphic doesn't show quantities people should eat. General advice is to eat at least one portion from each group every day, but it is not necessary to eat equal amounts from each group. Effectively, this means the Food Circle recommends at least three portions of fruit and vegetables, one portion of meat or fish and one portion of dairy per day. People should eat some of the foods in the circle, like butter and cheese, in moderation.



Figure 4: Swedish Food Circle (Matcirkeln), published by Livsmedelsverket

The Food Circle does not include water or wine like the Mediterranean Diet Pyramid or the French Stairs, but the Livsmedelsverket's website gives additional advice on water and other drinks. Within the Food Circle a strong emphasis is given to fruit and vegetables. Interestingly, potatoes and root vegetables are together in one group, in contrast to most other countries where root vegetables are part of the vegetable group. In contrast to the Eatwell Plate<sup>20</sup> and the French Stairs it only shows foods that are suitable for daily consumption, a separate segment for those foods high in sugar and/or fat is missing.

### The Food Circle has the following groups. Additional advice from the accompanying leaflet is in brackets:

- Fruit and berries (juice may be an alternative)
- Vegetables, including pulses (choose coarser varieties, vary according to season. Pulses can sometimes replace meat and fish)
- Potatoes and root vegetables (most people should eat more of these)
- Bread, cereals, pasta, rice (preferably choose wholegrain alternatives)
- Fats (Spread a thin layer on bread and preferably choose low-fat margarine. When cooking, use soft or liquid cooking fat with a good fatty acid composition)
- Milk and cheese (use low-fat cheese and milk products)
- Meat, fish and eggs (try to choose lean alternatives. Eat more fish, including the more fatty species)

In addition to the Food Circle the Livsmedelsverket published advice on actual quantities of food people should eat, known as the Swedish Nutrition recommendations Objectified (SNO). A scientific justification for these recommendations is publicly available<sup>21</sup>. SNO applies to healthy adults of working age who do little or moderate physical activity. Therefore the recommended energy intake is 9.1MJ for women and 10.5MJ for men. Table 2 below summarises SNO's recommendations (for more details, see Annex I).

SNO verified if the nutritional advice given so far to the general public was adequate. Swedish people used to be advised to eat 500g a day of fruit and vegetables, but they found that for men it should be closer to 700g. Another finding was that low-fat margarine and liquid margarine are necessary to offset saturated fats from meat, cheese and dairy. The limit of 5g of salt a day was impossible to meet, due to high salt levels in bread, cured meat and cheese.

The numbering (FC Nr.) corresponds to the segments of the Food Circle. In the table, the groups do not completely correspond with the Food Circle segments – vegetables are divided into two groups depending on their dietary fibre content, for example. The foods mentioned in this list do not meet the Swedish National Recommendations (SNR) on all nutrients, as iron and protein slightly exceed the SNR. This was to make sure women of childbearing age got enough iron. Some foods have the Keyhole symbol (see Figure 5), which means they are healthier options within a food group, for example in the case of bread, meat and dairy. Meat products with the Keyhole label have a maximum of 15% fat.

Table 2: Recommended amounts of foods from SNO (2005)

FC Nr.	Group	Recommendation (SNO)
1	Fruits	appr. 250-350 g/d, max. 100 ml fruit juice
2&3	Vegetables: >2g fibre	125-175g (e.g. broccoli, white cabbage, beans, peas, spinach, carrots, other root vegetables)
2&3	Vegetables: <2g fibre	125-175g (e.g. lettuce, tomatoes (incl. crushed), cucumber, pepper, onion and mushrooms)
5	Fats	Low-fat margarine, oil, liquid margarine, 5g per slice of bread
4	Bread	150-200g; 6-8 slices, half should be wholemeal (keyhole), 1 slice with meat-based spread (e.g. liver paté), 1 slice with food, 4-6 with margarine)
7	Meat	1 portion/day, sausage 1 portion/week, 6-7 portions a week including sandwich meat, lean alternatives
7	Eggs	2-3 portions/week
7	Blackpudding	women: 1 portion/month
7	Liver paté	women: 1 portion/day
7	Reindeer/game	women: 1 portion/month
7	Fish	2-3 portions/week: 50% oily, 50% lean
3	Potatoes	1 portion/day
4	Rice/pasta	4 p/week
6	Dairy	300-400 ml/day, low-fat milk & yoghurt, milk in coffee and tea included
6	Cheese	max. 20 g/day low-fat
8	Leeway	13-14 en%, 1.2-1.6 MJ (~300-400 kcal): savoury snacks, pastries, cakes, ice cream, jam, fizzy drinks, sweets, alcoholic drinks. Sweet foods better than fatty foods

Similar to the Dutch recommendations<sup>22</sup> a leeway of 1.2-1.6MJ is reserved for foods that primarily provide energy, the so-called energy dense foods. People can choose any combination of foods within this group to fill up this leeway as long as they meet all other recommendations. In general, Swedish people eat too many foods from this category. The LiveWell Plate for the UK also contains 22.3% foods high in fat and/or sugar<sup>2</sup>, such as chips, buns and carbonated soft drinks.



Figure 5: Swedish Keyhole symbol for healthier options

### 3. Guidelines and consumption trends

#### 3.1 Consumed quantities in dietary surveys

##### 3.1.1 Spain

Spanish people have several meals each day. In the morning, people usually start with a light breakfast (el desayuno) typically with coffee, sweet rolls, toasts or biscuits. Lunch (la comida) is the main hot meal of the day. Between lunch and the evening meal (la cena) people often have a snack late in the afternoon, for example a sandwich<sup>23</sup>. The traditional Spanish diet can be characterized as a typical Mediterranean diet<sup>24</sup> – although there is no clear definition of what this means. The term comes from the 1960s, when several studies

by Ancel Keys suggested that Mediterranean countries had lower incidence of coronary heart disease<sup>25</sup>. The Mediterranean diet is characterised by a high intake of vegetables, pulses, fruits and cereals (in the past largely unrefined); a moderate to high intake of fish; a low intake of saturated fats but high intake of unsaturated fats, particularly olive oil; a low to moderate intake of dairy products, mostly cheese and yogurt; a low intake of meat; and a modest intake of ethanol, mostly as wine<sup>26</sup>.

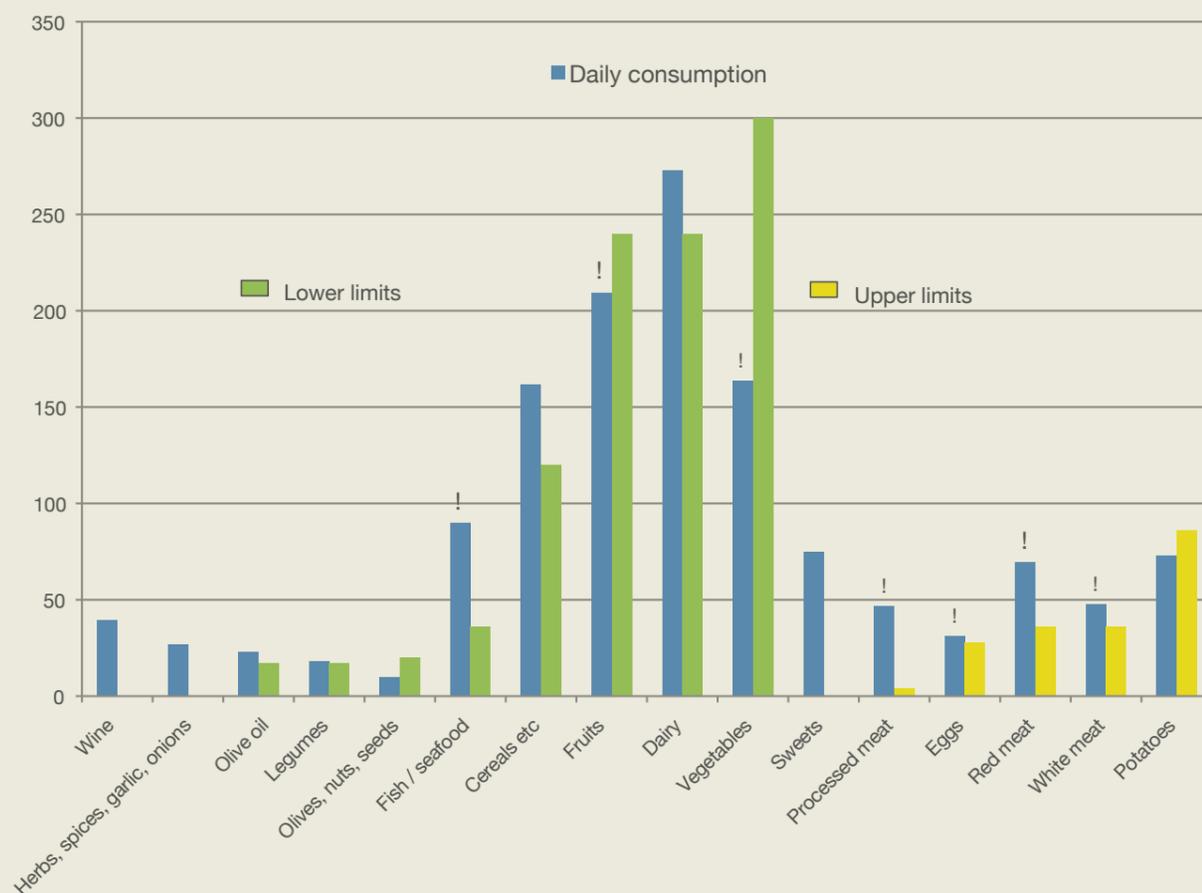


Figure 6: Amounts of foods consumed per day, as shown in the ENIDE survey, versus the recommendations of the Mediterranean Diet Pyramid. The recommendations marked in green are lower limits, the upper limits in yellow. An exclamation mark highlights food groups of particular interest that are mentioned in the text.



As a result of an application by Spain, Greece, Italy and Morocco, the Mediterranean diet is on UNESCO's List of Intangible Heritage. This means the governments in these countries are obliged to protect this cultural heritage, but current consumption trends are endangering the Mediterranean diet<sup>27,24</sup>. Research shows a downward trend in adherence to the Mediterranean Diet over the last decades<sup>24</sup>. Earlier studies found that the Spanish diet was shifting towards more fat and dairy<sup>28</sup>, but that fruit consumption was still the highest in Europe. Figure 6 shows how much people actually eat of different food groups compared with the recommendations. Lower limits are highlighted in green, upper limits in yellow. Due to the large bandwidth in the recommendations (see Table 1) we do not show both limits. In several cases the upper limit would lead to unrealistic daily rations. For fish there is no upper limit.

According to this comparison, the intake of all types of meat (red meat, white meat, processed meat) and eggs are above the maximum allowance. The average Spanish adult eats 163g of meat and meat products a day. The high intake of red meat (69g a day) is especially worrying, because it has a high climate impact<sup>29</sup>. Consumption of fish is also high, well above the adequate intake of two servings a week, but due to the lack of an upper limit not too high. Because many fish stocks are unsustainable, an upper level would be appropriate. Intake of dairy seems within the range of what is adequate, but due to variations in serving sizes, this comparison is not very accurate. We used the weight of a minimum serving of milk or yoghurt (200g) and one serving of cheese (40g) as the reference. However, median daily intake is 273g of milk and yoghurt and 25g of cheese.

Intake of fruit and vegetables is too low, illustrating that dietary habits in Spain are moving towards an average Western diet. Intake of cereal products (bread, pasta, rice, etc.) is within the recommendations, but the lower limit for this product group is actually very low.

In conclusion, the current Spanish diet is quite far from the recommendations of the MDP. This is worrying due to the health implications this might have. High intake of meat and fish will also lead to an increased carbon footprint for Spanish diets and detrimental impacts on global ecosystems.

### 3.1 Consumed quantities in dietary surveys ( continued )

#### 3.1.2 France

Food culture is particularly important in France. In 2010, UNESCO put the traditional gastronomic meal on its Intangible Heritage List<sup>30</sup>. A traditional gastronomic meal in France is characterized by a fixed structure, starting with an apéritif (drink before the meal) and ending with liqueurs, with at least four courses.

It is prepared for special family occasions, such as weddings and anniversaries. Although tradition is still very important, French dietary habits are moving towards an average European diet<sup>31</sup>, especially among young people. Young people eat more pizza and sandwiches than older people, for example.



Figure 7: Mean intake of foods (INCA2) compared with PNNS guidelines. The graph shows the amount of servings a day or per week (fish). The portion size of starchy foods is uncertain, therefore this comparison (\*) is not accurate. All foods are placed in one food group except for fish, which is mentioned separately.

Two national dietary surveys (INCA1 and INCA2), held eight years apart (1997-98 and 2006-07), show people's consumption of dairy, meat, bread and potatoes is decreasing. In some cases, like dairy, there was a significant difference between men and women. Encouraging trends include decreased consumption of pastries, croissant-like pastries, cakes, biscuits, sugar and confectionery, and increases in fruit and vegetable intake. A less healthy trend was increased consumption of ice cream and chocolate. Fish consumption remained stable on a sufficient level. However, intake of meat decreased, particularly for women. This might mean women aren't getting enough iron, but it lowers the climate impact.



The traditional French daily routine is characterised by three main meals plus an afternoon snack, particularly for children. The INCA2 study showed this routine has stayed in place mainly for the youngest and oldest participants<sup>31</sup>. However, it is increasingly breaking down among 15- to 35-year-olds.

In France, meals are a time for the family to get together. This social element to meal times is very apparent in both the INCA1 and INCA2 studies. If their family is not present, people tend to share meals with friends or colleagues.

Due to uncertainty about portion sizes and the general nature of the recommendations in the PNNS, a comparison with the actual intake has limitations. The PNNS guidelines do not distinguish between age, gender or energy requirement<sup>32</sup>. Some directions about the interpretation of the PNNS guidelines are given in studies using a PNNS Guideline Score<sup>32</sup> (PNNS-GS). These epidemiological studies assess the relationship between adherence to the PNNS guidelines and health outcomes. To assess adherence, they defined clear categories for the amount of portions in each food group. For instance, the PNNS recommendation on alcohol consumption is a maximum of two glasses a day for women. This can be specified further, because abstainers and subjects consuming less than one glass a week receive the highest PNNS-GS.

Consumption of meat, eggs and fish in France is right in between the upper and the lower limits of the PNNS guidelines, so more than adequate (see Figure 7). Dairy intake should increase fractionally. Fruit and vegetable intake is too low. People eat fruit and vegetables in almost equal amounts, with men eating a bit more fruit and women more vegetables. On average, intake of alcohol is more than one glass a week, but still below the limit of two to three glasses a day. Men are closer to the limit than women. According to INCA2, people drink less water than recommended, but coffee and tea are not counted as water.

The recommendations on starchy foods are not very specific on amounts. They say people should eat at least one portion during each meal, according to appetite. A daily intake between three and six servings receives the highest PNNS-GS score<sup>33</sup>, implying that this is the average requirement necessary to provide enough energy and nutrients. Due to this large bandwidth in portion sizes, it is difficult to estimate the amount of daily servings, therefore the comparison in Figure 7 is not very accurate with respect to starchy foods.

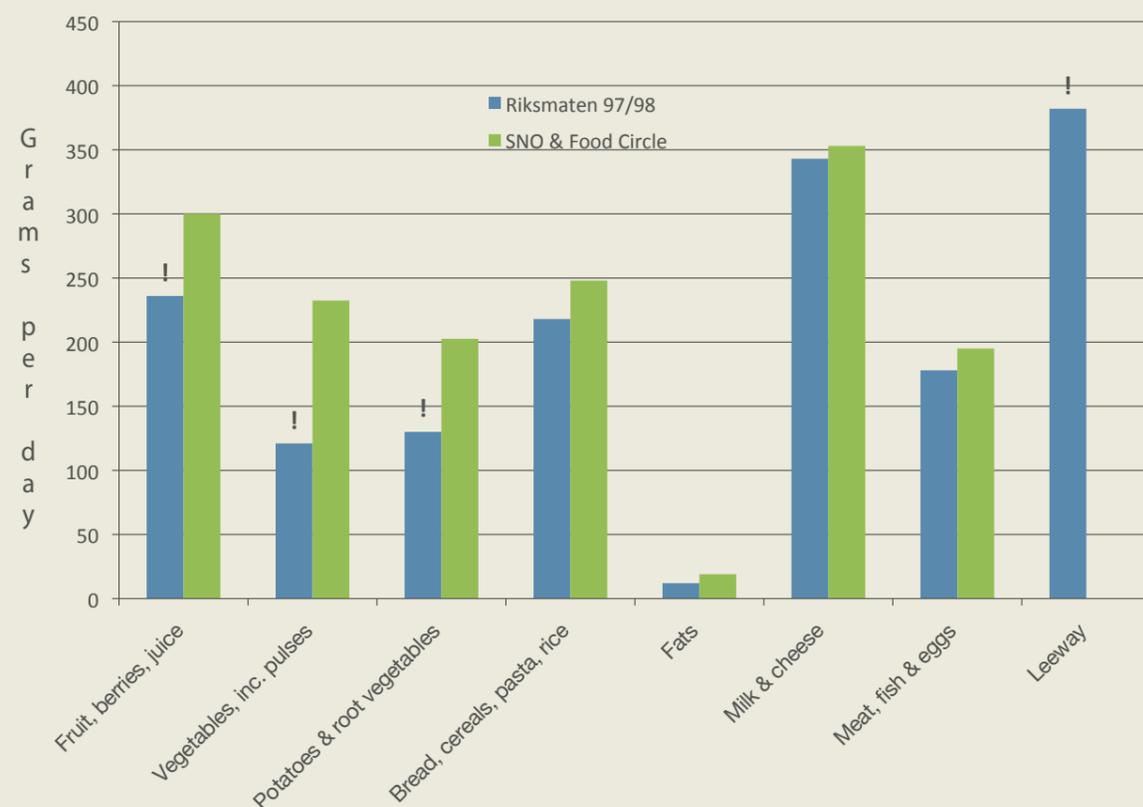


### 3.1 Consumed quantities in dietary surveys ( continued )

#### 3.1.3 Sweden

In traditional Swedish cuisine, local produce like dairy products, cereals, cabbage, root vegetables, pork meat, potatoes and a large variety are important. Many dishes are served with lingonberry jam. This type of cuisine is known as Husmanskost (“house owners food”)<sup>34</sup>.

Figure 8: Intake of foods by adult Swedish women according to Riksmaten 1997-98 compared with SNO recommendations. The food groups correspond to the Food Circle and SNO. Exclamation marks highlight food groups of particular interest.



Part of tradition is preserved in the Swedish dietary recommendations, with the specific mention of berries and a separate segment for root vegetables. According to a recent scientific study on diets and cardiovascular disease in Sweden<sup>35</sup>, a traditional diet contains more medium-fat milk, offal, boiled coffee, and potatoes and lower amounts of low-fat products and alcoholic drinks. A diet in line with the recommendations contains more high-fibre cereals, low-fat milk products, fruit, vegetables, tea, and fish and less frequent consumption of coffee and products rich in fat and sugar. This illustrates that a traditional diet is not by definition a healthy diet, as it contains a high amount of saturated fat and traditionally boiled coffee, which is known to elevate cholesterol levels because it contains cafestol.

Another example of a healthy alternative to the traditional Nordic diet is the New Nordic Diet (NND), developed by researchers from Denmark<sup>36</sup>. It is tailored to regional conditions, environmentally friendly and based on foods originating from the Nordic region. The NND guidelines suggest eating more calories from plant foods and fewer from meat; more foods from the sea and lakes; and more foods from the wild countryside.

Food group	Women			Men		
	Riksmaten 97/98	Hulk 89	SNO	Riksmaten 97/98	Hulk 89	SNO
Margarine spread	12	15	19	23	29	25
Cheese	28	38	20	31	43	22
Milk, yoghurt	311	335	320	376	449	375
Bread	85	82	165	116	116	205
Potatoes	116	110	175	168	181	210
Roots	14	10	28	12	8	39
Vegetables	113	84	222	84	73	270
Fruit and berries	148	130	214	104	106	250
Juice	88	65	86	87	54	114
Porridge, gruel	37	43	25	38	50	36
Breakfast cereals, muesli	6	4	4	8	6	7
Pancakes etc.	12	12	0	14	17	0
Pizza, pie, pirog	20	12	0	27	16	0
Rice, dishes	24	16	18	31	21	25
Pasta	34	14	36	47	16	43
Legumes	8	5	10	11	15	13
Meat, poultry and dishes	97	72	95	129	99	120
Eggs	15	16	21	15	19	26
Fish, seafood	35	30	45	34	34	64
Blood products	2	2	5	2	2	8
Offal	4	6	15	5	7	15
Sausages and dishes	25	19	14	36	29	18
Nuts, snacks	6	2	0	8	3	0
Sweet bakery products	42	46	0	44	43	0
Ice cream, parfait	12	15	0	14	13	0
Cream	4	4	13	2	3	17
Sweet soups, desserts	14	26	0	16	25	0
Marmalade, jam	10	10	0	10	13	0
Soft-drinks, fruit syrups	138	101	0	206	127	0
Chocolate and candy	13	8	0	13	7	0
Sugar, syrup, honey	3	4	0	6	7	0
Alcoholic beverages	129	89	0	254	227	0
Coffee, tea, water	1230	882	0	980	771	0
Spices, salt, vinegar	3	0	0	3	0	0
Sauces	12	0	0	13	0	0

Table 3: Intake of foods according to dietary surveys in Sweden compared with SNO recommendations. Colours highlight trends: orange (too high), yellow (too low) and positive (green). The SNO combines both roots and vegetables and porridge, gruel, breakfast cereals and muesli. These are allocated proportionally to the intake.

The last dietary survey of adults in Sweden was in 1997-98 (Riksmaten 1997-98). A new study began in 2010, but the results have not been published yet, so we have to rely on the old study, although it is outdated. Analysis and discussion of the relevance of the 2010 data to this project may take place after the data is released.

In Figure 8 we compare the results of the 1997-98 survey with the recommended diet according to SNO<sup>21</sup> and the Food Circle. Based on the survey, the Swedish National Food Administration (Livsmedelsverket) concluded that the Swedish population should eat more bread, fruit and vegetables, and less of the foods in the so-called leeway<sup>37</sup>. They also concluded that people should eat better quality fats, which is just as important as reducing total fat intake.

Table 3 shows the differences between the recommendations and the survey in detail and highlights positive and negative trends. Some trends not mentioned above are: intake of margarine spread was lower than in the SNO. Cheese consumption is too high, but seems

to have dropped since an earlier survey (Hulk 1989). Because cheese is high in saturated fat, further decrease would be positive, although it is a good source of calcium. Consumption of other dairy products is close to the recommendations, with men consuming a fraction more cheese than the guidelines.

Interestingly, the SNO includes liver pate (offal) and blood products – black pudding, for example. The rationale behind this is that these products are high in iron. Without them it would be difficult for women of childbearing age to meet the recommendations.

Another positive trend was that the consumption of cream was below the amount in the SNO reference diet. Because of the high fat content of cream, this was also judged as a positive outcome.

Men and women eat slightly more meat than is recommended. However, fish intake is well below the quantities recommended in SNO, especially for men.



### 3.1 Consumed quantities in dietary surveys ( continued )

#### 3.1.4 Comparisons between countries and the LiveWell UK plate

Food patterns vary significantly between countries. To make a detailed comparison, we first re-classified all available survey data into a uniform format. We used the classification of food groups used in EPIC-Soft<sup>38</sup>, a computer program used for 24-hours dietary recalls in the European EPIC cohort study. Figure 9 shows each country's intake of different foods compared with the average of all four countries; Spain, France and Sweden and the UK<sup>39</sup>.

Figure 9: Intake of EPIC-Soft food groups in pilot countries and the UK (average is 100%)

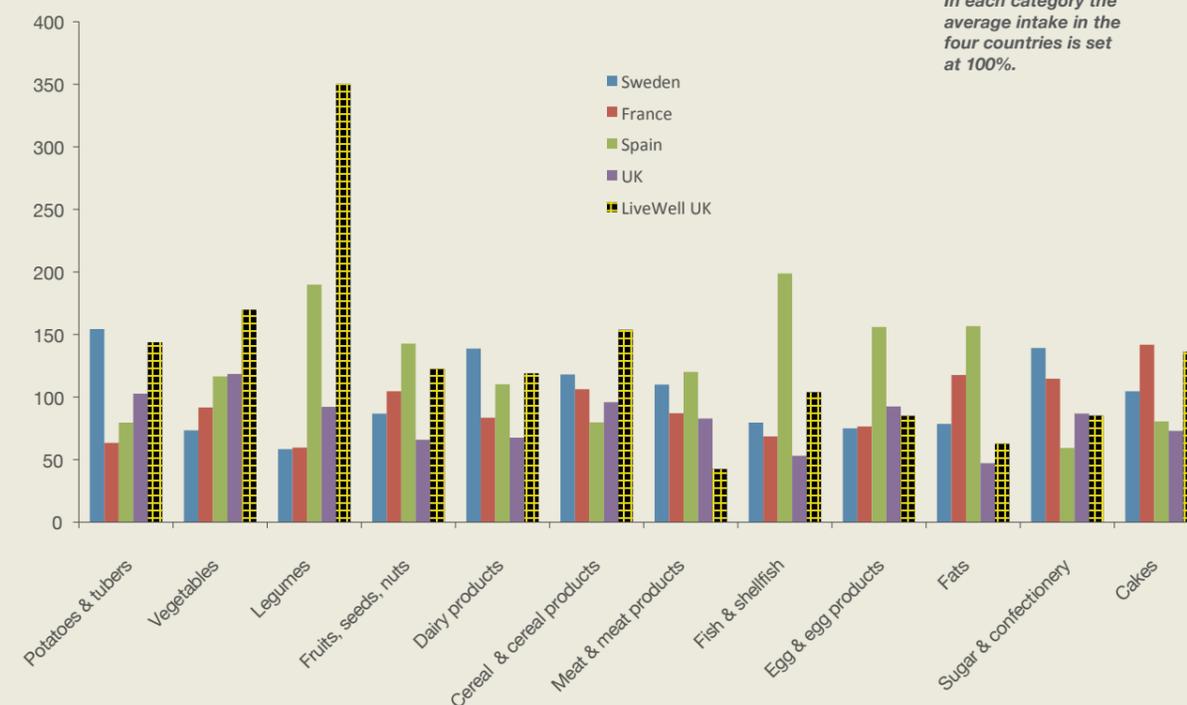
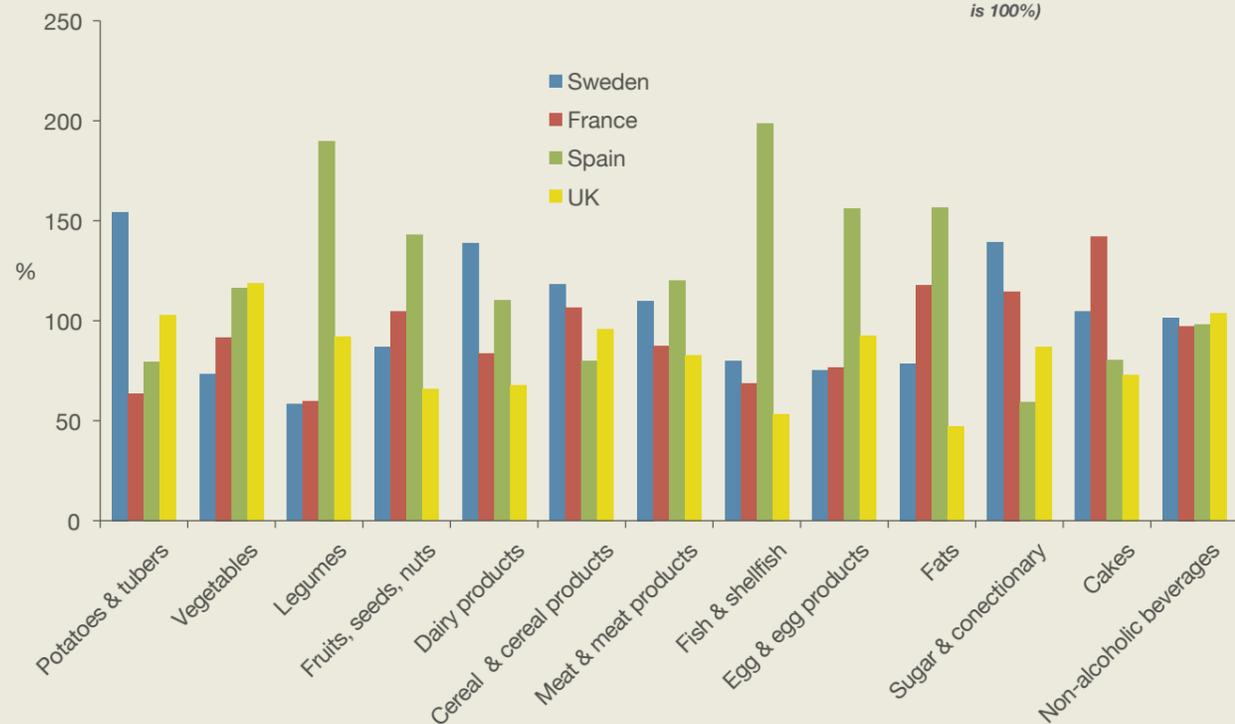


Figure 10: Intake of foods in the four countries compared with the LiveWell UK Plate (EPIC-Soft classification). In each category the average intake in the four countries is set at 100%.

The four countries drink around the same amount of non-alcoholic beverages, as all people have similar requirements for liquids. However, the number of calories coming from this category can vary hugely, depending on what type of drinks people consume.

Spanish people eat the most legumes, fruits, fish, meat, fats and eggs. Their relatively high intake of legumes and fruit is positive and reflects Mediterranean dietary heritage, although it is still below the recommendations. High intake of fats, eggs and meat is responsible for the fact that the contribution of protein and fat to the overall calorie-intake in Spain<sup>40</sup> exceeds the recommendations. From a nutritional perspective, high consumption of fish and seafood is a positive aspect of the Spanish diet, but it raises questions about sustainability because of depleting fish stocks.

Compared with the other countries, Sweden consumes a lot of dairy, cereal products, sugar/confectionary and potatoes. Surprisingly, intake of vegetables in the UK – as recorded during the National Diet and Nutrition Survey 2008-09<sup>39</sup> – is higher than in the three pilot countries, although the difference with Spain is small.

Figure 10 compares the intake of foods in pilot countries and the LiveWell UK Plate. Non-alcoholic and alcoholic beverages are not included because they are not part of the LiveWell UK Plate.

The LiveWell UK Plate has more plant foods like potatoes, vegetables, cereal products and especially legumes (pulses) than the other three countries. There are large amounts of legumes in the LiveWell UK Plate to provide an alternative source of protein, with lower climate impact, than meat. The amount of meat in the LiveWell UK Plate is much lower than the current intake in all four countries because of its high climate impact.

Also, the amount of fish in the LiveWell UK Plate is limited compared with current intake in Spain, but above other countries' current intake. The Plate has enough oily fish and healthy fish fatty acids (EPA and DHA), so it could be argued that Spain's consumption is too high. As mentioned above, it is certainly well above the minimum allowance. Dairy in the LiveWell UK Plate is relatively high – only Sweden's intake exceeds it. This is to provide the required amount of calcium in people's diets.



### 3.2 Nutrients

#### 3.2.1 Spain

Analysis of the ENIDE study is still ongoing. Mean intake of foods for the whole population, men and women combined<sup>12</sup>, and some general conclusions<sup>41</sup> have already been published. Table 4 summarises the information available on Spanish people's intake of energy and macronutrients, comparing it with the RDIs. We found no Spanish recommendations for energy intake. However, intake in Spain seems high when we consider that the average recommendation for men and women combined in the other two pilot countries varies from 2300 to 2450kcal. The proportion of protein and fat in the Spanish diet is higher than recommended, probably due to relatively high amounts of meat and fish. Consequently the intake of carbohydrates is too low.

The fatty acid composition of the average Spanish diet is rather good, except for the amount of saturated fat. High intake of meat and meat products most likely causes this. Spanish recommendations for saturated fat are rather strict compared to Sweden and the Netherlands, where 10% of total energy is the maximum allowance.



	Unit	RDI		ENIDE
		Men	Women	All
Energy	kcal			2482
Protein	en%	10-12	10-12	16
Fat	en%	<35	<35	40.2
saturated	en%	<7	<7	12.1
monounsaturated	en%	13-18	13-18	17.8
polyunsaturated	en%	<10	<10	6.7
n-3 fatty acids	-	0.2-2 g/d	0.2-2 g/d	
Carbohydrates	en%	50-60	50-60	41.2
Alcohol	en%	<10	<10	2.4
Alcohol	g			8.5

Table 4: Intake of energy and nutrients compared with the recommendations. Colours highlight trends: negative (orange) and positive (green).

Spanish people's high intake of mono-unsaturated fatty acids comes from eating relatively large quantities of olive oil.

If Spanish people ate according to the dietary guidelines, it would certainly have a positive effect on their intake of nutrients and the quality of fat they consume.



### 3.2 Nutrients ( continued )

#### 3.2.2 France

The report accompanying the INCA2 study<sup>42</sup> has lots of detail on French people's intake of nutrients and energy. We compared the results with the RDIs (see Table 5). Energy intake in France is lower than in Spain. French women eat slightly below the recommendation, but this might be a result of under-reporting, which is always a problem in dietary surveys. As in Spain, French people eat more protein, fat and carbohydrates than the recommendations. High protein intake is related to consumption of meat and fish.

French intake of B vitamins seems adequate, except for folate. This is not particularly worrying, especially because RDIs in other countries are below the actual intake in France. The same is true for vitamin C and vitamin E. French people could increase their intake of vitamin C and folate by eating more citrus fruits.

Intake of vitamin D from food is less than recommended, like in many other countries. In most cases, exposure to sunlight compensates for this. In some countries, like Sweden and the Netherlands, a supplement is recommended for certain groups. It's also recommended that certain foods are enriched with vitamin D. Oily fish and liver products are natural sources of vitamin D.

Because consumption of dairy is below the recommended amount, French women's calcium intake is slightly below recommendations. Their intake of iron is also less than recommended, although this does not necessarily lead to deficiencies in a significant part of the female population. That depends of the bioavailability of iron in the diet. In this case the French RDI is in line with recommendations elsewhere. Red meat is a good source of bioavailable iron, as it contains heme iron, which is more easily absorbed than iron from plant sources. Both French men and women consume less copper, iodine and magnesium than recommended, but intake would be adequate when compared with other guidelines (See Annex II).

In general, intake of nutrients, apart from sodium, would improve if French people followed the PNNS guidelines.

**Table 5: Intake of energy and nutrients compared with the recommendations. Colours highlight trends: negative (orange) and positive (green).**



Nutrient	Unit	RD		INCA2	
		Men	Women	Men	Women
Energy	kcal	2500-2700	2000-2200	2500	1855
Protein	en%	11-15	11-15	17.2	16.7
Fat	en%	30-35	30-35	38.5	39.6
Carbohydrates	en%	50-55	50-55	41.9	42.9
Dietary fibre	g			19.2	16
Alcohol	en%			5.9	2.1
Alcohol	g			21	5.7
vitamin A	(µg RE)	800	600	783.2	628.2
B1 thiamin	mg	1.3	1.1	1.3	1.1
B2 riboflavin	mg	1.6	1.5	2	1.7
B3 niacin	mg	14	11	21.3	16.4
B5 Pantothenic acid	mg	5	5	6.3	5.1
B6	mg	1.8	1.5	1.9	1.6
B7 Biotin	(µg)	50	50		
folate	(µg)	330	300	306.9	268.1
B12	(µg)	2.4	2.4	6.5	5.1
vitamin C	mg	110	110	91.3	94.3
vitamin D	(µg)	5	5	2.7	2.4
vitamin E	mg	12	12	11.9	11.1
vitamin K	(µg)	45	45		
calcium	(mg)	900	900	984.2	850.4
phosphorus	(mg)	750	750	1435.7	1114.3
potassium	(mg)			3286.9	2681.1
sodium	(mg)	3200	3200	3446.6	2533.4
iron	(mg)	9	16	14.9	11.5
zinc	(mg)	12	10	12.4	9.1
copper	(mg)	2	1.5	1.6	1.3
iodine	(µg)	150	150	135.8	116.7
selenium	(µg)	60	50		
magnesium	(mg)	420	360	324.7	261.5
Manganese	(mg)	2.0-5.0	2.0-5.0	3.1	2.7
Chromium	(µg)	30-100	30-100		
Molybdene	(mg)	50-100	50-100		
Fluoride	(mg)	2.5	2		

#### 3.2.3 Sweden

We compared intake of nutrients as determined in the 1997-98 survey (Riksmaten) with the Swedish Nutrition Recommendations (Table 6). Intake of energy was lower than expected, but this may be due to under-reporting.

Compared with the recommendations, Swedish women ate slightly too much protein. Men and women's intake of fat and saturated fat was too high and intake of dietary fibre and carbohydrates too low. Intake of vitamin D through food is adequate for men and close to the recommendations for women. This is due to enrichment of dairy with vitamin D. As Sweden is a northern country, people are not exposed to enough sunlight for the body to synthesise adequate amounts of vitamin D. This vitamin is necessary to ensure good bone health, which is an EFSA approved claim.

Women and men's intake of vitamin E and folate is below the recommendations. Low intake of folate might be a problem for women who want to get pregnant, as this vitamin prevents the development of neural tube defects<sup>43</sup>. In some countries, foods are enriched with folate to prevent deficiencies. In others, it's recommended that women who want to get pregnant or all women of childbearing age take a 400mg supplement<sup>44</sup>. The Swedish authorities decided against mandatory folate fortification of food because of possible adverse health effects. Eating according to SNO would mean women get more folate<sup>43</sup>.

Intake of sodium is too high at an average of 7.1g of salt for women and 8.9g for men. High salt intake increases the risk of stroke<sup>45</sup>. Potassium, on the other hand, protects against stroke<sup>46</sup>. Swedish men and women eat close to the recommendations for potassium. They could increase their intake by eating more fruit and vegetables.

Dietary nitrate can lower blood pressure<sup>47</sup>. Limited amounts of sunshine in northern countries may cause elevated levels of nitrate in leafy and root vegetables, offering this protection. On the other hand, high nitrate levels can lead to the formation of carcinogenic nitrosamines if eaten in combination with certain types of fish<sup>48</sup>.

Some Swedish women may suffer from iron deficiency, as their mean intake is below the Swedish recommendations. Whether this is actually the case depends on the bioavailability of iron in diets. When the diet contains red meat, the bioavailability is high.

The quality of nutrients and fat in the Swedish diet would certainly improve if people followed the national dietary guidelines<sup>43</sup>.

		SNR		Riksmaten	
		Women	Men	Women	Men
Energy	MJ (kcal)	9.1 (2177)	11.5 (2751)	1867	2365
Protein	en%	10-15 e	10-15 e	16%	15%
Fat	en%	<30	<30	35%	35%
saturated	en%	<10	<10	14%	15%
monounsaturated	en%	10-15 e	10-15 e	13%	13%
polyunsaturated	en%	5-10 e	5-10 e	5%	5%
n-3 fatty acids	en%	1	1	-	-
Carbohydrates	en%	55-60 e	55-65 e	43%	43%
saccharose	en%	<10	<10	5%	6%
Dietary fibre	g	25-35	25-35	16.4	18.1
Alcohol	en%	<5	<5	3%	4%
Vitamin A	RE	800	900	1110	1310
Vitamin D	ug	5	5	4.9	6.2
Vitamin E	mg	8	10	6.8	7.8
Vitamin C	mg	60	60	93	80
Thiamin	mg	1.1	1.4	1.3	1.6
Riboflavin	mg	1.3	1.6	1.6	1.89
Niacin	NE	15	19	31	39
Vitamin B6	mg	1.2	1.5	1.87	2.24
Vitamin B12	ug	2.0	2.0	6	6.9
Folate	ug	300	300	217	232
Calcium	mg	800	800	925	1070
Phosphorus	mg	600	600	1290	1570
Sodium	mg	2000	2000	2850	3580
Potassium	mg	3100	3500	3060	3540
Magnesium	mg	280	350	295	345
Iron	mg	15 (12-18)	10	10.4	12.3
Zinc	mg	7	9	9.9	12.6
Selenium	ug	40	50	32	36

**Table 6: Intake of energy and nutrients compared with the recommendations. Colours highlight trends: negative (orange) and positive (green).**



## 4. Diet-related health issues in pilot countries

### 4.1 Obesity

Over the last decades obesity (BMI>30) and overweight (25<BMI<30) have become major health threats in European countries. Three times as many people are obese or overweight now compared with the 1980s, according to WHO. Changes in lifestyle, increased availability of calorie-dense foods and social determinants<sup>49</sup> are factors contributing to the imbalance between energy intake and energy consumption. Direct health implications are impaired physical ability and psychological problems<sup>50</sup>. Obesity is also an important risk factor for cardiovascular disease, type II diabetes and certain types of cancer<sup>51</sup>. WHO estimates that the obesity pandemic in Europe takes up 2% to 8% of national health care budgets and causes 10% to 13% of all deaths.

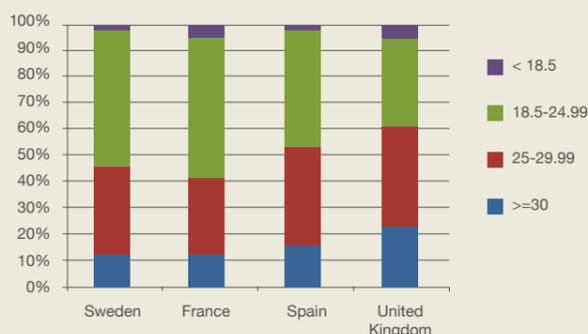


Figure 11: BMI distribution among adults in the UK and pilot countries (Source: Eurostat, 2012)

The prevalence of obesity and overweight varies strongly between and within countries across Europe. Sweden and France have relatively low rates compared to other Western countries (see Figure 11), 12% and 12.4% respectively. However, more than 40% of France and Sweden's population have an unhealthy high bodyweight. In Spain, 15.6% of adults are obese and 53.3% are overweight. This is similar to other Mediterranean countries like Portugal and Greece, but higher than France and Italy (see Figure 12).

Across Europe, countries struggle to define policies to counter the pandemic. So far, approaches targeted at individuals have had a low success rate in restoring the energy balance. Many scientific studies have proven that energy-restricted diets may be successful in the short term, but offer no permanent solution for most people<sup>52</sup>. Community-based efforts with health education in schools and promotion of physical activity have proven to be much more successful. This approach is also more effective in reaching all socio-economic groups<sup>53</sup>. An example is the EPODE project that started off in France.



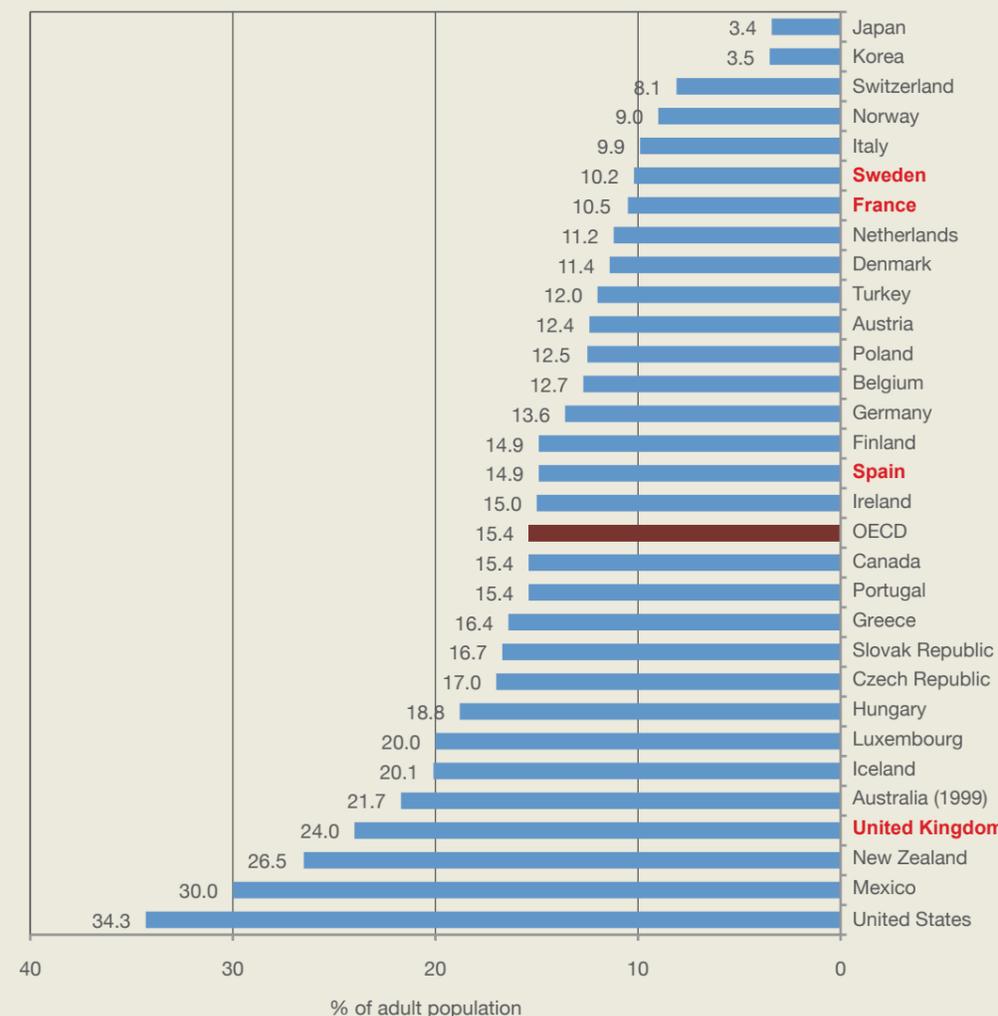
Studies in Spain show that a traditional Mediterranean diet may reduce the incidence of obesity<sup>54</sup>. A French study also found that people with a lifestyle close to the PNNS had a lower obesity risk during a 6 year follow-up period<sup>33</sup>.

The prevalence of overweight people in France<sup>42</sup> (obesity excluded) is higher in men: 38.9% of men are overweight, compared with 24.2% of women. The prevalence of obesity does not differ according to gender and affects 11.6% of adults. Overweight and obesity rates increase with age in men and women alike. Moreover, the prevalence of obesity in adults is inversely associated with the level of education. Lastly, there is a significant obesity gradient between the North and South, with a higher prevalence in the North.



In Sweden, numbers of obese and overweight people have risen since the 1980s, but figures now seem to have plateaued<sup>55</sup>. Community-based efforts in Sweden to decrease prevalence show hopeful results<sup>56</sup>.

Figure 12: Obesity (BMI>30) in Organisation for Economic Co-operation and Development (OECD) countries, total population (Source: OECD, 2012)





## 4.2 Cardiovascular diseases

Diet is closely linked to cardiovascular diseases (CVD). Several nutritional factors are directly linked to CVD – and in most cases the scientific evidence is convincing.

Apart from direct links, there is also severe co-morbidity caused by obesity. Dietary factors directly influencing CVD are:

- **Saturated fatty acids:** increased risk of Ischemic Heart Disease when replacing poly-unsaturated fatty acids (PUFA), increased LDL-cholesterol<sup>57</sup> when replacing PUFA.
- **Trans fatty acids:** increased risk of Ischemic Heart Disease, increase LDL-cholesterol and lower HDL-cholesterol<sup>58</sup>.
- **Sodium (salt):** increased risk of stroke and Ischemic Heart Disease, increased blood pressure.
- **Red meat:** increased risk of CVD-mortality<sup>59</sup>, replacement with fish, nuts, legumes and whole grains decreases the risk.
- **Fruit and vegetables:** weak or non-significant cardio-protective effect<sup>60</sup>. Lowers blood pressure in interventions trials.
- **Dietary fibre:** decreased risk of CVD<sup>61</sup>.
- **Fish and fish fatty acids<sup>62</sup>:** decreased risk of sudden cardiac death.

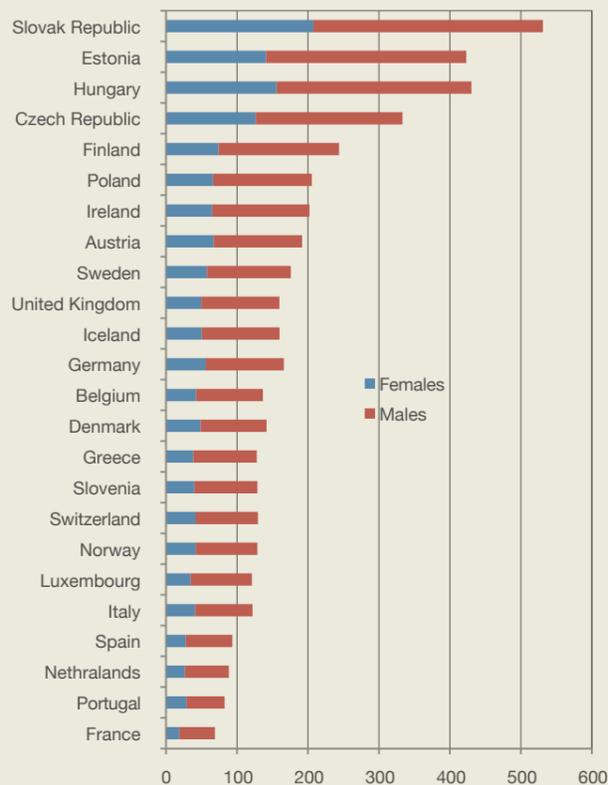


Figure 13 Ischemic Heart Disease mortality rate (2008 or nearest) (Source: OECD, 2012)

The mortality rate due to CVD depends on many factors, such as dietary factors, lifestyle factors, population and health care. Preventive treatment with medicines and advances in cardiovascular surgery have contributed substantially to lowering the CVD death rate. For instance in the Netherlands, CVD is no longer the main cause of death in men. On one hand, we must be careful when comparing CVD death rates between countries. However, we can safely assume that health care in each of the three pilot countries is well organised.

Figure 13 shows that Sweden has the highest Ischemic Heart Disease mortality rate (heart attacks) of the three pilot countries. Part of the reason for this may be diet, but it is difficult to determine the main causes. Science has not found a clear reason for this trend. Experts have speculated that dietary fats and red wine consumption play a role<sup>63</sup>. A recent Swedish study shows that a Mediterranean type diet decreased overall mortality and CVD mortality among middle-aged men<sup>64</sup>, whereas a carbohydrate-restricted diet increased risk. The rate of Ischemic Heart Disease in France is the lowest in Europe, despite their relatively high intake of saturated fat. This phenomenon is called the French Paradox<sup>63</sup>, and is often attributed to a moderate consumption of red wine. But after many years of research, scientists still have not found a definitive explanation.

An unhealthy diet and obesity are risk factors for high blood pressure, which increases the rate of strokes. Dietary factors increasing the risk are a high intake of sodium and a low intake of potassium and fish oil. Also related, but to a lesser extent, are low magnesium and calcium intake and excessive coffee and alcohol consumption<sup>65</sup>. Fruit and vegetables are important sources of potassium. Increasing the intake of this mineral in Western countries to 4.7g/day might decrease the stroke rate by 8% to 15%<sup>66</sup>.



Figure 14 Stroke mortality rate in Europe (per 100,000) (Source: OECD 2012)

France has the lowest stroke mortality rate (Figure 14) of the three pilot countries; 26 deaths per 100,000 inhabitants for men and women combined. In Spain it is 36 deaths per 100,000 and in Sweden 40 deaths per 100,000. The difference between France and Spain may be related to the higher prevalence of obesity in Spain; obesity is a major risk factor for high blood pressure<sup>65</sup>. Dietary factors like fish consumption may explain the difference between France and Sweden, as the prevalence of obesity in both countries is similar. A Mediterranean-style diet could help prevent age-related changes in blood pressure<sup>67</sup>.

## 4.3 Diabetes (type II)

Type II diabetes is caused by being obese and overweight. It is characterised by a decreased sensitivity to insulin, which inhibits muscles' uptake of glucose. Elevated levels of glucose in the blood are toxic for the body, increasing the risk of stroke, renal failure, limb amputation, impaired eyesight and blindness.

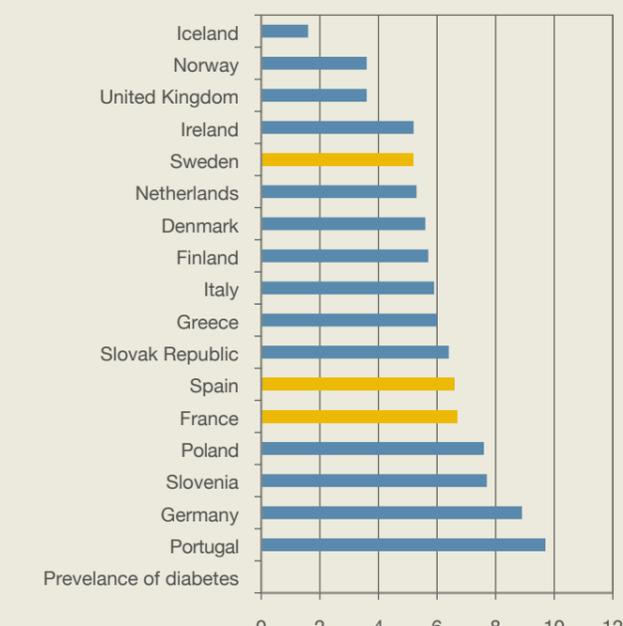


Figure 15: Prevalence (%) of diabetes in European populations (Source: OECD)

A poor diet is related to the development of type II diabetes due to the link with obesity. Physical exercise and changing diet can reverse insulin resistance<sup>68</sup>.

A Mediterranean-style diet seems to help protect against type II diabetes, as shown in an intervention trial<sup>69</sup> and a prospective cohort study<sup>70</sup> in Spain. Interestingly, the prevalence of diabetes in France and Spain is higher than in Sweden (see Figure 15). Based on the prevalence of obesity and overweight in these countries we would expect France to be closer to Sweden. We have not found an explanation for this observation.



### 4.4 Cancers

According to WHO, about 30% of cancer deaths are due to the five leading behavioural and dietary risks: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use and alcohol use. The World Cancer Research Fund (WCRF)<sup>28</sup> comprehensively reviewed the relationship between diet and cancer risk. Table 7 summarises the main findings:

Foods	Type	Association	Evidence
Red meat and processed meat	colorectal cancers	↑	Convincing
Alcoholic drinks	breast, colorectal (men), mouth and upper dietary tract	↑	Convincing
Diets high in calcium	prostate	↑	Probable
Salt and salty foods	stomach	↑	Probable
Alcoholic drinks	liver, colorectal (women)	↑	Probable
Foods rich in dietary fibre	colorectal	↓	Probable
Fruit, vegetables, legumes (pulses), nuts and seeds	dietary tract and prostate	↓	Probable
Milk and dairy	colorectal	↓	Probable

Table 7: Associations between dietary factors and cancer (Source: WCRF)

One of the most convincing associations between diet and cancer is a high intake of red meat (beef, pork and lamb, for example). A recent study found that substituting one portion a day of other foods with red meat increased cancer mortality risk by 16% (Hazard Ratio)<sup>59</sup>. The WCRF recommends people who eat red meat limit their consumption to 500g a week, and sets a public health goal of 300g for a population average. We have not done detailed analysis of red meat consumption in the three pilot countries, but certainly in Spain intake of red meat is above the 500g limit.

The relationship between alcohol intake and cancer is also convincing. People are advised to limit themselves to two drinks a day.

Plant foods in general have a protective effect against cancer, which could indicate that the low consumption of fruit and vegetables in all pilot countries is a concern. Often components like antioxidants are said to be responsible for this, but so far evidence is inconclusive. Some studies have shown antioxidant supplements actually increase cancer risk<sup>28</sup>.

### 4.5 Costs of diet-related health issues

A healthy lifestyle increases life expectancy and the number of years spent in good health<sup>71</sup>. From an economic perspective this saves money on national health care budgets. For example, in the UK, the National Health Service spends an estimated £5.8bn a year in direct costs related to poor diets. On the other hand, in some cases healthy food may cost more, forcing people with a tight budget to choose unhealthier foods, as studies from France<sup>72</sup>, Sweden<sup>73</sup> and Spain<sup>74</sup> have shown. Stimulating consumption of healthy foods may require financial investment by governments – reduced tax on healthy foods, for example. This will prevent higher health care costs later on. The LiveWell for LIFE project should investigate into the costs of changing to a more sustainable diet.

The costs associated with obesity have been studied extensively. Around Europe, estimates of the total costs associated with overweight and obesity varying from 0.09% to 0.61% of each country's gross domestic product<sup>75</sup> and from 1% to 5% of national health care budgets<sup>76</sup>.

Obesity in Spain is estimated to be responsible for 7% of the country's total health costs<sup>77</sup> - €2.5bn annually. Odegaard et al<sup>78</sup> estimated the total cost of obesity in Sweden at €390m annually, 1.9% of Sweden's health care budget, which seems low in comparison with other countries. Hospital care alone was estimated to account for €190m. In an earlier study from the same researchers, indirect costs associated with early death due to obesity were estimated at €309m<sup>79</sup>. In France the annual total cost of obesity was estimated to be €2.1 to €6.2bn in 2002, which was 1.5% to 4.6% of total health expenditure<sup>80</sup>.

Indirect costs associated with obesity include productivity loss caused by absenteeism, disability pensions and premature death. Studies from Sweden, Finland and the Netherlands found a link between obesity and the amount of sick leave and disability pensions<sup>76</sup>.

An older French study<sup>81</sup> estimated direct and indirect costs of obesity at 2% and 0.10% of the national health care budget. However, the authors stated that they were unable to estimate all costs due to missing information. Recent estimates (Table 8) from the UK show that indirect costs associated with overweight and obesity may be up to seven times higher than direct costs<sup>82</sup>.

Estimated future costs of elevated BMI (£ billion/year)	2007	2015
Total NHS costs of diabetes	2	2.2
Total NHS costs of coronary heart disease	3	4.7
Total NHS costs of stroke	4.7	5.2
Total NHS costs of other related diseases	6.8	7.4
Total costs (all related diseases)	17.4	19.5
NHS cost increase above current, due to elevated BMI (overweight and obesity)	-	2.1
NHS costs attributable to elevated BMI (overweight and obesity)	4.2	6.3
NHS costs attributable to obesity alone	2.3	3.9
Wider total costs of overweight and obesity, taken at 7x direct costs (figures include rounding effects)	15.8	27
Projected percentage of NHS cost @ £70 billion	6.00%	9.10%

Table 8: Predictions for direct and indirect costs associated with overweight and obesity in the UK<sup>82</sup>

Obese people are at high risk of developing type II diabetes, some at a very young age. People with diabetes need lifelong medical care, approximately two to three times more than other people. According to WHO, diabetes care may take up 15% of national health care budgets<sup>83</sup>. The International Diabetes Federation estimates that health care costs related to type II diabetes account for 11.6% of the world's total health care expenditure. The average annual cost of caring for a diabetes patient in Europe was estimated at €2,800<sup>84</sup> – and €5,400 in France<sup>85</sup>. Total costs of diabetes in Sweden are estimated at €920m<sup>86</sup> annually.

The link between unhealthy diets and certain types of cancer is indirect, making it difficult to estimate the associated additional health costs.

The high costs for health care and society mentioned above show the need to develop community-based preventive measures to promote healthy diets and an active lifestyle. An additional benefit is that these diets tend to be more sustainable<sup>4,3</sup>. If current dietary trends don't change, health costs will increase dramatically<sup>82</sup> – and the impact on the world environment will be irreversible.



## Conclusion

**Current dietary habits in Spain, France and Sweden have progressed from traditional food patterns towards more average Western diets, with too little wholegrain cereals, legumes, fruit and vegetables. Intake of red meat and high-calorie processed foods has increased. These trends have negative consequences for public health and the climate impact of national diets.**

Direct costs to treat the diseases caused by poor diets put a huge strain on national health care budgets. Indirect costs to society – for example, due to increased absence from work, or disability – are estimated to be even higher.

As part of government campaigns to promote healthier diets in Spain, France and Sweden there are food-based dietary guidelines (FBDGs) aimed at the general public. They consist of a basic set of rules, often accompanied by a graphic representation of a healthy diet – for example, in the form of a food diet pyramid, plate or wheel. The Spanish pyramid is the only set of FBDGs that draws attention to sustainability, but it doesn't mention how people can eat more sustainably. Specific recommendations for eating sustainably are under development.

The aim of LiveWell for low impact food in Europe (LIFE) is to modify national FBDGs in Spain, France and Sweden so they have a lower climate impact, similar to WWF's LiveWell Plate for the UK. As the guidelines in Spain and France are very general and don't specify recommended quantities, they do not offer a clear starting point. Diets with a very high or very low climate impact are still possible within the scope of the recommendations. Therefore LiveWell Plates for Spain and France could consist of a basic set of rules for less climate-intensive options within the boundaries of the current guidelines. The guidelines for Sweden, represented as a Food Circle (Matcirkeln), are accompanied by a reference diet for men and women, which is very specific on quantities of foods. Together, these offer a good starting point for the development of a less climate-intensive LiveWell Plate for Sweden.

The next stage of the LiveWell for LIFE project will use the findings from this piece of work as a foundation to build specific LiveWell diets in Spain, France and Sweden, which we aim to publish in autumn 2012.

## References

1. Tukker, A et al. 2006. *Environmental Impact of Products (EIPRO)*. EC Joint Research Centre.
2. Macdiarmid, J, Kyle, J, Horgan, G et al. 2011. Livewell: a balance of healthy and sustainable food choices.
3. Marinussen, M, Blonk, H and C van Dooren. 2011. *Naar een gezond en duurzaam voedselpatroon een verkenning naar potenties en dilemma's*. Blonk Milieu Advies, Gouda/Voedingscentrum, Den Haag.
4. Audsley, E, Brander, M et al. 2010. *How low can we go? An assessment of greenhouse gas emissions from the UK food system and the scope reduction by 2050* [online]. WWF. Available at: <https://dspace.lib.cranfield.ac.uk/handle/1826/6503> [Accessed 14 May 2012].
5. Muñoz, I, Milà i Canals, L and AR Fernández-Alba. 2010. Life cycle assessment of the average Spanish diet including human excretion. *The International Journal of Life Cycle Assessment* [online]. 15(8): 794-805. Available at: [www.springerlink.com/index/10.1007/s11367-010-0188-z](http://www.springerlink.com/index/10.1007/s11367-010-0188-z) [Accessed 14 May 2012].
6. Vieux, F, Darmon, N, Touazi, D and LG Soler. 2012. Greenhouse gas emissions of self-selected individual diets in France: Changing the diet structure or consuming less? *Ecological Economics* [online]. 75: 91-101. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0921800912000043> [Accessed 14 May 2012].
7. Wallén, A and Nils Brandt, RW. 2004. Does the Swedish consumer's choice of food influence greenhouse gas emissions? *Environmental Science & Policy*. Volume 7 (issue 6): 525-535.
8. World Health Organisation. Brochure on non-communicable diseases [online]. Available at: [www.euro.who.int/\\_\\_data/assets/pdf\\_file/0020/140672/CorpBrochure\\_noncommunicable\\_diseases.pdf](http://www.euro.who.int/__data/assets/pdf_file/0020/140672/CorpBrochure_noncommunicable_diseases.pdf) [Accessed 14 May 2012].
9. Aranceta, J and Serra-Majem, L. 2001. Dietary guidelines for the Spanish population. *Public Health Nutrition* [online]. 4(6a). Available at: [www.journals.cambridge.org/abstract\\_S1368980001000441](http://www.journals.cambridge.org/abstract_S1368980001000441) [Accessed 14 May 2012].
10. Anon. Mediterranean Diet Pyramid: a lifestyle for today [online]. Available at: [http://fdmed.org/dietamed/piramide\\_INGLES.pdf](http://fdmed.org/dietamed/piramide_INGLES.pdf) [Accessed 14 May 2012].
11. Dapcich, V. 2004. *Guía de la alimentación saludable*. SENC.
12. AESAN. 2011. ENIDE 2011 [online]. Available at: [www.aesan.msc.es/en/AESAN/web/evaluacion\\_riesgos/subseccion/enide.shtml](http://www.aesan.msc.es/en/AESAN/web/evaluacion_riesgos/subseccion/enide.shtml) [Accessed 14 May 2012].
13. Anon. *La nueva rueda de los alimentos* [online]. Available at: [www.nutricion.org/recursos\\_y\\_utilidades/rueda\\_alimentos.htm](http://www.nutricion.org/recursos_y_utilidades/rueda_alimentos.htm) [Accessed 14 May 2012].
14. Anon. *Les 9 repères* [online]. Available at: [www.mangerbouger.fr/bien-manger/que-veut-dire-bien-manger-127/les-9-reperes](http://www.mangerbouger.fr/bien-manger/que-veut-dire-bien-manger-127/les-9-reperes) [Accessed 14 May 2012].
15. Anon. *Bien Manger Bouger* [online]. Available at: [www.mangerbouger.fr](http://www.mangerbouger.fr) [Accessed 14 May 2012].
16. NPPS. 2002. *La santé vient en mangeant*.
17. Hercberg, S and Chat-Yung, S CM. 2008. The French National Nutrition and Health Program: 2001-2006-2010. *International Journal of Public Health*. 53(2): 68-77.
18. Nishida, C, Uauy, R, Kumanyika, S and P Shetty. 2007. The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases: process, product and policy implications. *Public Health Nutrition* [online]. 7(1a): 245-250. Available at: [www.journals.cambridge.org/abstract\\_S1368980004000230](http://www.journals.cambridge.org/abstract_S1368980004000230) [Accessed 14 May 2012].
19. Livsmedelsverket. 2010. *The Food Circle*.
20. Food Standards Agency. *The eatwell plate* [online]. Available at: [www.nhs.uk/Livewell/Goodfood/Documents/Eatwellplate.pdf](http://www.nhs.uk/Livewell/Goodfood/Documents/Eatwellplate.pdf) [Accessed 14 May 2012].
21. Enghardt Barbieri, H and Lindvall, C. 2005. Swedish Nutrition Recommendations Objectified (SNO). *Levsmedelsverket* [online]. 2005; (1). Available at: [www.slv.se/upload/dokument/rapporter/mat\\_naring/Report\\_20\\_2005\\_SNO\\_eng.pdf](http://www.slv.se/upload/dokument/rapporter/mat_naring/Report_20_2005_SNO_eng.pdf) [Accessed 14 May 2012].
22. Voedingscentrum. 2011. *Richtlijnen voedselkeuze 2011*.
23. About.com. *Spanish meals*. Available at: [http://spanishfood.about.com/od/discoverspanishfood/a/spain\\_meals.htm](http://spanishfood.about.com/od/discoverspanishfood/a/spain_meals.htm) [Accessed 14 May 2012].



## References ( continued )

24. Varela-Moreiras, G, Avila, JM, Cuadrado, C et al. 2010. Evaluation of food consumption and dietary patterns in Spain by the Food Consumption Survey: updated information. *European Journal of Clinical Nutrition* [online]. 64 Suppl 3: S37-43. Available at: [www.ncbi.nlm.nih.gov/pubmed/21045847](http://www.ncbi.nlm.nih.gov/pubmed/21045847) [Accessed 14 May 2012].
25. Willett, W. 2006. The Mediterranean diet: science and practice. *Public Health Nutrition*. Feb; 9(1A): 105-10.
26. Willett, W, Sacks, F, Trichopoulou, A, Drescher, G, Ferro-Luzzi, A and E TD Helsing. 1995. Mediterranean diet pyramid: a cultural model for healthy eating. *American Journal of Clinical Nutrition*. Jun; 61(6 S: 1402S-1406S).
27. Bach-Faig, A, Fuentes-Bol, C, Ramos, D, Carrasco, JL, Roman, B, Bertomeu, IF, Cristià, E and D Geleva. 2011. The Mediterranean diet in Spain: adherence trends during the past two decades using the Mediterranean Adequacy Index. *Public Health Nutrition*. Apr; 14(4) (Epub 2010 Oct 29.): 622-8.
28. WCRF/AICR. 2007. *Food, Nutrition, Physical Activity, and the prevention of cancer: a global perspective*.
29. Anon. *Agri-Footprint*. Available at: <https://www.agri-footprint.com/indicators/gge/pages/default.aspx> [Accessed 14 May 2012].
30. UNESCO. *Gastronomic meal of the French*. Available at: [www.unesco.org/culture/ich/index.php?lg=en&pg=00011&RL=00437](http://www.unesco.org/culture/ich/index.php?lg=en&pg=00011&RL=00437) [Accessed 14 May 2012].
31. Dubuisson, C, Lioret, S, Touvier, M et al. 2010. Trends in food and nutritional intakes of French adults from 1999 to 2007: results from the INCA surveys. *The British Journal of Nutrition* [online]. 103(7): 1035-48. Available at: [www.ncbi.nlm.nih.gov/pubmed/20028601](http://www.ncbi.nlm.nih.gov/pubmed/20028601) [Accessed 14 May 2012].
32. Estaquio, C, Castetbon, K, Kesse-Guyot, E et al. 2008. The French National Nutrition and Health Program score is associated with nutritional status and risk of major chronic diseases. *The Journal of Nutrition* [online]. 138(5): 946-53. Available at: [www.ncbi.nlm.nih.gov/pubmed/18424606](http://www.ncbi.nlm.nih.gov/pubmed/18424606) [Accessed 14 May 2012].
33. Kesse-Guyot, E, Castetbon, K, Estaquio, C et al. 2009. Association between the French nutritional guideline-based score and 6-year anthropometric changes in a French middle-aged adult cohort. *American Journal of Epidemiology* [online]. 170(6): 757-65. Available at: [www.ncbi.nlm.nih.gov/pubmed/19656810](http://www.ncbi.nlm.nih.gov/pubmed/19656810) [Accessed 14 May 2012].
34. Wikipedia. *Swedish cuisine*. Available at: [http://en.wikipedia.org/wiki/Swedish\\_cuisine](http://en.wikipedia.org/wiki/Swedish_cuisine) [Accessed 14 May 2012].
35. Berg, CM, Lappas, G, Strandhagen, E et al. 2008. Food patterns and cardiovascular disease risk factors: the Swedish INTERGENE research program. *The American Journal of Clinical Nutrition* [online]. 88(2): 289-97. Available at: [www.ncbi.nlm.nih.gov/pubmed/18689363](http://www.ncbi.nlm.nih.gov/pubmed/18689363) [Accessed 14 May 2012].
36. Mithril, C, Dragsted, LO, Meyer, C, Blauert, E and MK Holt. 2012. Guidelines for the New Nordic Diet. *Public Health Nutrition*. Jan 17: 1-7.
37. Enghardt Barbieri, H and Lindvall, C. 2005. Swedish Nutrition Recommendations Objectified (SNO). *Levsmedelsverket*. 2005;(1).
38. Voss, S, Charrondiere, UR, Slimani, N, Kroke, A, Riboli, E and J Wahrendorf. 1998. EPIC-SOFT: a European computer program for 24-hour dietary protocols. *Z Ernahrungswiss*. 37(3)(Sep): 227-33.
39. Food Standards Agency. *Food Standards Agency NDNS Chapter 2 List of tables* [online]. Available at: [www.food.gov.uk/multimedia/pdfs/publication/ndnstables0809.pdf](http://www.food.gov.uk/multimedia/pdfs/publication/ndnstables0809.pdf) [Accessed 14 May 2012].
40. AESAN. 2011. *Presentación de ENIDE 2011*. Available at: [www.aesan.msc.es/AESAN/docs/docs/notas\\_prensa/Presentacion\\_ENIDE.pdf](http://www.aesan.msc.es/AESAN/docs/docs/notas_prensa/Presentacion_ENIDE.pdf) [Accessed 14 May 2012].
41. Ibid.
42. Lafay, L. 2007. *Étude Individuelle Nationale des Consommations Alimentaire 2 (INCA2) (2006-2007) Rapport*.
43. Olsson, JC, Sundberg, BE and CM Wittho. 2009. Effect of 2 pieces of nutritional advice on folate status in Swedish women: a randomized controlled trial 1-3. *American Journal of Clinical Nutrition*. 2009;(2).
44. McNulty, H, Cuskelly, GJ and M Ward. 2000. Response of red blood cell folate to intervention: implications for folate recommendations for the prevention of neural tube defects. *The American Journal of Clinical Nutrition* [online]. 71(5 Suppl): 1308S-11S. Available at: [www.ncbi.nlm.nih.gov/pubmed/10799407](http://www.ncbi.nlm.nih.gov/pubmed/10799407) [Accessed 14 May 2012].
45. He, FJ MG. 2009. A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. *The Journal of Human Hypertension*. Jun; 23(6).
46. van Mierlo, L, Greyling, A, Zock, PL, Kok, FJ and JM Geleijnse. 2010. Suboptimal potassium intake and potential impact on population blood pressure. *Archives of Internal Medicine*. 170(16): 1501-2. Available at: [www.ncbi.nlm.nih.gov/pubmed/20837839](http://www.ncbi.nlm.nih.gov/pubmed/20837839) [Accessed 14 May 2012].
47. Larsen, FJ, Ekblom, B, Sahlin, K and JO Lundberg. 2006. Effects of Dietary Nitrate on Blood Pressure in Healthy Volunteers. *New England Journal of Medicine*. 2792-2793.
48. Zeilmaker, MJ, Bakker, MI, Schothorst, R and W Slob. 2010. Risk assessment of N-nitrosodimethylamine formed endogenously after fish-with-vegetable meals. *Toxicological Sciences: an Official Journal of the Society of Toxicology*. 116(1): 323-35. Available at: [www.ncbi.nlm.nih.gov/pubmed/20351056](http://www.ncbi.nlm.nih.gov/pubmed/20351056) [Accessed 14 May 2012].
49. Marmot, M. 2010. *Interim first report on social determinants of health and the health divide in the WHO European Region Interim first report on social determinants of health and the health divide in the WHO European Region*. WHO.
50. European Commission. 2007. *White Paper on a Strategy for Europe on Nutrition, Overweight and Obesity related health issues*. European Commission, Brussels, Belgium.
51. WCRF/AICR. 2007. *Food, Nutrition, Physical Activity, and the prevention of cancer: a global perspective*.
52. Katan, MB. 2009. Weight-loss diets for the prevention and treatment of obesity. *The New England Journal of Medicine*. 360(9): 923-5. Available at: [www.ncbi.nlm.nih.gov/pubmed/19246365](http://www.ncbi.nlm.nih.gov/pubmed/19246365) [Accessed 14 May 2012].
53. Borys, JM, Le Bodo, Y, Jebb, S et al. 2012. EPODE approach for childhood obesity prevention: methods, progress and international development. *Obesity reviews: an official journal of the International Association for the Study of Obesity* [online]. 13(4): 299-315. Available at: [www.ncbi.nlm.nih.gov/pubmed/22106871](http://www.ncbi.nlm.nih.gov/pubmed/22106871) [Accessed 14 May 2012].
54. Beunza, JJ, Toledo, E, Hu, FB, Bes-rastrollo, M and M Serrano-marti. 2010. Adherence to the Mediterranean diet, long-term weight change, and incident overweight or obesity: the Seguimiento Universidad de Navarra. *American Journal of Clinical Nutrition* [online]. 2010;(3). Available at: [www.ajcn.org/content/early/2010/10/20/ajcn.2010.29764](http://www.ajcn.org/content/early/2010/10/20/ajcn.2010.29764) [Accessed 14 May 2012].
55. Johansson, G. 2010. Overweight and obesity in Sweden. A five year follow-up, 2004-2008. *Scandinavian Journal of Public Health* [online]. 38(8): 803-9. Available at: [www.ncbi.nlm.nih.gov/pubmed/20823045](http://www.ncbi.nlm.nih.gov/pubmed/20823045) [Accessed 14 May 2012].
56. Magnusson, MB, Sjöberg, A and KI Kjellgren. 2011. Childhood obesity and prevention in different socio-economic contexts. *Preventative Medicine*. Dec 1(53(6): 402-7.
57. Astrup, A, Dyerberg, J, Elwood, P et al. 2011. The role of reducing intakes of saturated fat in the prevention of cardiovascular disease: where does the evidence stand in 2010? *PLoS Medicine*. May 2010: 684-688.
58. Brouwer, I, Wanders, AJ and MB Katan. 2010. Effect of animal and industrial trans fatty acids on HDL and LDL cholesterol levels in humans - a quantitative review. *PLoS one* [online]. 5(3): e9434. Available at: [www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2830458&tool=pmcentrez&rendertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2830458&tool=pmcentrez&rendertype=abstract) [Accessed 14 May 2012].
59. Pan, A, Sun, Q, Bernstein, AM, Schulze, MB, Manson, JE, Stampfer, MJ and WC Willett. 2012. Red Meat Consumption and Mortality: Results From 2 Prospective Cohort Studies. *Archives of Internal Medicine*. March 12.
60. Dauchet, L and Amouyel, P. 2009. Fruits, vegetables and coronary heart disease. *National Review of Cardiology*. Sep;6(9): 599-608.
61. Lattimer, JM and Haub, MD. 2010. Effects of dietary fiber and its components on metabolic health. *Nutrients* [online]. 2(12): 1266-89. Available at: [www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3257631&tool=pmcentrez&rendertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3257631&tool=pmcentrez&rendertype=abstract) [Accessed 14 May 2012].

## References ( continued )

62. Mozaffarian, D WJ. 2011. Omega-3 fatty acids and cardiovascular disease: effects on risk factors, molecular pathways, and clinical events. *Journal of the American College of Cardiology*. Nov 8; 58(2):2047-67).
63. Richard, JL. 1987. Coronary risk factors. The French paradox. *Arch Mal Coeur Vaiss*. 80 Spe(Apr): 17-21.
64. Sjögren, P, Becker, W, Warensjo, E et al. 2010. Mediterranean and carbohydrate-restricted diets and mortality among elderly men: a cohort study in Sweden 1-3. *American Journal of Clinical Nutrition*.
65. Geleijnse, JM and Grobbee, DE KF. 2005. Impact of dietary and lifestyle factors on the prevalence of hypertension in Western populations. *Journal of Human Hypertension* [online]. 19 Suppl 3: S1-4. Available at: [www.ncbi.nlm.nih.gov/pubmed/16302004](http://www.ncbi.nlm.nih.gov/pubmed/16302004) [Accessed 14 May 2012].
66. Van Mierlo, L, Greyling, A, Zock, PL, Kok, FJ and JM Geleijnse. 2010. Suboptimal potassium intake and potential impact on population blood pressure. *Archives of Internal Medicine* [online]. 170(16): 1501-2. Available at: [www.ncbi.nlm.nih.gov/pubmed/20837839](http://www.ncbi.nlm.nih.gov/pubmed/20837839) [Accessed 14 May 2012].
67. Núñez-Córdoba, JM, Valencia-Serrano, F, Toledo, E, Alonso, A and M Martínez-González. 2009. The Mediterranean diet and incidence of hypertension: the Seguimiento Universidad de Navarra. *American Journal of Epidemiology*. 169(3): 339-46. Available at: [www.ncbi.nlm.nih.gov/pubmed/19037007](http://www.ncbi.nlm.nih.gov/pubmed/19037007) [Accessed 14 May 2012].
68. O'Gorman, DJ. 2008. Exercise and the treatment of diabetes and obesity. *Endocrinology Metabolism Clinics of North America*. Dec; 37(4).
69. Salas-Salvadó, J. 2011. Reduction in the Incidence of Type 2 Diabetes With the Mediterranean Diet Results of the PREDIMED-Reus nutrition intervention randomized trial. *Diabetes Care*. 34(1).
70. Martínez-González, M, de la Fuente-Arrillaga, C, Nunez-Cordoba, JM et al. 2008. Adherence to Mediterranean diet and risk of developing diabetes: prospective cohort study. *British Medical Journal (Clinical research ed.)* [online]. 336(7657): 1348-51. Available at: [www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2427084&tool=pmcentrez&ndertype=abstract](http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2427084&tool=pmcentrez&ndertype=abstract) [Accessed 14 May 2012].
71. Kreijl, CF van, Knaap, AGAC and JMA van Raaij. 2006. *Our food , our health: Healthy diet and safe food in the Netherlands*.
72. Darmon, N, Ferguson, EL. 2002. Nutritional Models A Cost Constraint Alone Has Adverse Effects on Food Selection and Nutrient Density: An Analysis of Human Diets by Linear Programming. *Journal of Nutrition*. August: 3764-3771.
73. Rydén, PJ HL. 2011. Diet cost, diet quality and socio-economic position: how are they related and what contributes to differences in diet costs? *Public Health Nutrition*. Sep; 14(9): 1680-92. Epub 2011 Jan 24.
74. Schröder, H and Marrugat, J CM. 2006. High monetary costs of dietary patterns associated with lower body mass index: a population-based study. *International Journal of Obesity*. Oct; 30(10): 1574-9. Epub 2006 Mar 21.
75. Müller-Riemenschneider, F, Reinhold, T, and A Berghöfer. 2008. Health-economic burden of obesity in Europe. *European Journal of Epidemiology*. 23(8): 499-509.
76. Seidell, J. 1998. Societal and personal costs of obesity. *Experimental and Clinical Endocrinology and Diabetes*. 1998; 106 Suppl.
77. Sánchez, RV and José, LA. 2002. Los costes de la obesidad alcanzan el 7% del gasto sanitario. *Rev Esp Econ Salud*. 1:40e2.
78. Odegaard, K, Borg, S and U Persson. 2008. The Swedish cost burden of overweight and obesity - evaluated with the PAR approach and a statistical modelling approach. *International Journal of Pediatric Obesity*. Suppl 1: 51-7.
79. Borg, S, Persson, U, Odegaard, K, Berglund, G and JA Nilsson. 2005. Obesity, survival, and hospital costs – findings from a screening project in Sweden. *Value Health*. Sep-Oct; 8: 562-71.
80. Emery, C, Dinet, J, Lafuma, A, Sermet, C and B Khoshnood. 2007. Cost of obesity in France. *Presse Med*. Jun; 36: 832-40.
81. Lévy, E, Lévy, P and C Le Pen. 1995. The economic cost of obesity: the French situation. *International Journal of Obesity Related Metabolic Disorders*. Nov; 19(11).
82. Anon. *Foresight Tackling Obesities: Future Choices – Project report*.
83. WHO. 2011. *Global status report on noncommunicable diseases 2010*.
84. Jönsson, B. 2002. Revealing the cost of Type II diabetes in Europe. *Diabetologia*. Jul; 45(7): 5-12.
85. Jaffiol, C. 2009. Current management of type 2 diabetes in France. *Bull Acad Natl Med*. Oct; 193(7): 1645-61.
86. Bolin, K, Gip, C and AC Mörk. 2009. The cost and loss of productivity in Sweden 1987 and 2005 - a register-based approach. *Diabetic Medicine*. Sep; 26(9): 928-34.
87. Anon. *Necesidades de nutrientes Ingesta Recomendada de Nutrientes (I.R.) ó R.D.A. Recomendaciones de ingesta de nutrientes para la población española* [online]. Available at: [www.nutricion.org/recursos\\_y\\_utilidades/necesid\\_nutrientes.htm](http://www.nutricion.org/recursos_y_utilidades/necesid_nutrientes.htm) [Accessed 14 May 2012].
88. Quesada RMOFPJLBSEM. *PREJUICIOS Y VERDADES SOBRE LAS GRASAS Y OTROS ALIMENTOS*.
89. WHO. *Dietary recommendations/Nutritional requirements list of publications* [online]. Available at: [www.who.int/nutrition/publications/nutrientrequirements/en/index.html](http://www.who.int/nutrition/publications/nutrientrequirements/en/index.html) [Accessed 14 May 2012].
90. SCF. 1992. *Nutrient and energy intakes for the European Community* [online]. Available at: <http://ec.europa.eu/food/fs/sc/scf/out89.pdf> [Accessed 14 May 2012].
91. ANSES. *Apports nutritionnels conseillés: Tables récapitulatives* [online]. Available at: [www.anses.fr/index.htm](http://www.anses.fr/index.htm) [Accessed 14 May 2012].
92. Nordic Council of Ministers, Copenhagen. 2004. *Nordic Nutrition Recommendations 2004, 4th Edition*.



## Annex I

Food groups, subgroups	Gretel, 9.1 MJ		Hansel, 11.5 MJ	
	g/day	g/week	g/day	g/week
Fruit and vegetables, total	550	3850	673	4711
Vegetables	250	1750	309	2163
Lettuce, tomato, pepper, onion etc.	125	875	180	1260
Carrot, broccoli, white cabbage etc.	125	875	130	910
Fruits and berries	214	1498	250	1750
Fruit juice	86	602	114	798
Pulses, dried	10	70	13	91
Bread, total	165	1155	205	1435
White bread, refined rye	90	630	109	763
Wholemeal bread, crispbread	75	525	96	672
Breakfast cereals, porridge	29	203	43	301
Flour	7	49	9	63
Potatoes	175	1225	210	1470
Rice, couscous	18	126	25	175
Pasta	36	252	43	301
Meat and poultry	95	665	120	840
Lean types	41	287	51	357
Fatty types	54	378	69	483
Sausage	14	98	18	126
Liver pate	15	105	15	105
Blood-based foods	5	35	8	56
Fish and seafood	45	315	64	448
Eggs	21	147	26	182
Milk and yoghurt	320	2240	375	2625
Fat 0,5%	190	1330	210	1470
Fat 1,5%	118	826	148	1036
Fat 3%	13	91	17	119
Cheese	20	140	22	154
Fat ≤ 17%	14	98	15	105
Cottage cheese, whey cheese	5	35	5	35
Cream	13	91	17	119
Total fat (margarine, oil)	38	266	47	329
Margarine spread on bread	19	133	25	175

Swedish food list. Amounts of foods (raw) for women (Gretel) and men (Hans) with low physical activity<sup>37</sup>

## Annex II Nutrient recommendations

### Spain

The Spanish Society for Dietetics and Food Science (SEDCA) publishes recommended nutrient intakes for Spain<sup>87</sup>. Those for fat and fatty acids are summarised elsewhere<sup>88</sup>, see Annex II for a comprehensive overview. No Spanish recommendations were found on energy requirements, dietary fibre and certain common vitamins and minerals. Where restrictions are desired during the modelling of diets other recommendations, like those of WHO, can be used. Both WHO<sup>89</sup> and the Scientific Committee on Food<sup>90</sup> have published guidelines for energy requirements.

### France

An overview of the most current RDIs for nutrients in France is published on the website<sup>91</sup> of the French Agency for Food, Environment and Occupational Health Safety (ANSES) – see Annex II for an overview. We found no French recommendations on the different groups of fatty acids, alcohol and dietary fibre. If restrictions on these nutrients are required during the linear programming, the WHO recommendations could be applied. For alcohol, the amount of alcohol in two or three glasses can be used.

### Sweden

The Swedish Nutrition Recommendations are based on the Nordic Nutrition Recommendations<sup>92</sup>. The recommendations for fat, carbohydrates, protein, vitamins and minerals are identical (See Annex II). The SNR also includes recommendations on a balanced diet and eating pattern. Recommendations for certain vitamins and minerals are not included. If required, the WHO recommendations can be used as restrictions.

## Annex II Nutrient recommendations ( continued )

Nutrient	Unit	France		Spain		Sweden		WHO		EU	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Energy	kcal	2500-2700	2000-2200			2700	2200				
Protein	en%	11-15	11-15	10-12	10-12	10-15 e	10-15 e				
Fat	en%	30-35	30-35	<35	<35	<30	<30	20-35	20-35		
<i>saturated</i>	en%			<7	<7	<10	<10	<10	<10		
<i>monounsaturated</i>	en%			13-18	13-18	10-15e	10-15 e	15-20	15-20		
<i>polyunsaturated</i>	en%			<10	<10	5-10 e	5-10 e	6-11	6-11		
<i>n-3 fatty acids</i>	-			0.2-2 g/d	0.2-2 g/d	1 en%	1 en%	0.5-2 en%	0.5-2 en%		
<i>trans fatty acids</i>								<1	<1		
Carbohydrates	en%	50-55	50-55	50-60	50-60	55-65 e	55-60 e	>55	>55		
<i>saccharose</i>	en%					<10	<10				
Dietary fiber	g					25-35	25-35				
Alcohol	en%			<10	<10	<5	<5				
Alcohol	g			<30	<30	<20	<10				
vitamin A	µg RE	800	600	750	750	900	800	600	500	700	600
B1 thiamin	mg	1.3	1.1	1.2	0.9	1.4	1.1	1.2	1.1	1.1	0.9
B2 riboflavin	mg	1.6	1.5	1.8	1.4	1.6	1.3	1.3	1.1	1.6	1.3
B3 niacin	mg NE	14	11	20	15	19	15	16	14	18	14
B5 Pantothenic acid	mg	5	5					5	5	3-12	3-12
B6	mg	1.8	1.5	1.8	1.6	1.5	1.2	1.3	1.3	1.5	1.1
B7 Biotin	µg	50	50					30	30	15-100	15-100
folate	µg	330	300	200	200	300	300	400	400	200	200
B12	µg	2.4	2.4	2	2	2	2	2.4	2.4	1.4	1.4
vitamin C	mg	110	110	60	60	60	60	45	45	45	45
vitamin D	µg	5	5	2.5	2.5	5	5	5	5	0-10	0-10
vitamin E	mg	12	12	12	12	10	8	10	7.5	0.4*	>4->3
vitamin K	µg	45	45					65	55		
calcium	mg	900	900	600-850	600-850	800	800	1000	1000	700	700
phosphorus	mg	750	750			600	600			550	550
potassium	mg					3500	3100			3100	3100
sodium	mg	3200	3200			2000	2000	2000	2000	575- 3500	575- 3500
iron	mg	9	16	10-15	18	10	15 (12-18)	9	20	9	20
zinc	mg	12	10	15	15	9	7	7	4.9	9.5	7
copper	mg	2	1.5							1.1	1.1
iodine	µg	150	150	140-145	110-115			130	110	130	130
selenium	µg	60	50			50	40	34-26	34-26	55	55
magnesium	mg	420	360	350-400	330	350	280	260	220	150-500	150-500
Manganese	mg	2.0-5.0	2.0-5.0							1-10	1-10
Chromium	µg	30-100	30-100								
Molybdene	mg	50-100	50-100								
Fluoride	mg	2.5	2								

Sources: WHO/FAO, SCF 2004, AESAN, SENC, SEDCA, ANSES, Nordic Nutrition Recommendations 2004



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