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Summary

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The primary goal of our study was to produce greenhouse gas emission -estimates (GHGE-estimates) for average diets in Europe to be used in SUSDIET-project (Towards Sustainable Diets in Europe, the ERANET SUSFOOD Call 2014–2017). The SUSDIET-project aim was to optimize diets from environmental and nutritional point of view and to evaluate impacts of information policies of promoting sustainable diets.

We used a categorization of 151 food categories and gave GHGE-estimates for each food category. Altogether, we used 80 indicator products to represent the 151 food categories. GHGE-estimates of food product categories were based on statistics and existing literature (LCA-based studies) where we included agricultural production – and processing steps. We went through numerous studies (mostly scientific, peer reviewed articles) and chose literature-references with similar methodologies. We used literature- and expert evaluation -based GHGE-defaults for cooking, storing and packing, and left transportation and consumers' travels to grocery stores outside our system boundaries. Additionally, since the used dietary data was based on food consumed (daily food consumption data reported by participating consumers from UK, France, Italy, Finland and Sweden), we used conversion factors to convert the GHGE-estimates of produced food to match the weight of food consumed. As uncertainties of the GHGE-estimates are high, uncertainty ranges for the GHGE-estimates of the 151 food categories were also produced.

Keywords: climate impact, diet, harmonization, uncertainty

Content

1. Introduction, research objective

In this study we have produced greenhouse gas emission (GHGE) -estimates (i.e. climate impacts, carbon footprints) for food products consumed in Europe (Annex 1). These data are to be further used to compare foods in diets within countries and to find more climate friendly diet options in each country, and to aveluate environmental impacts of information policies aimed at promoting healthier diets. To allow comparisons and further use of the data, we aimed at harmonizing some of the key methodological issues of the GHGE-estimates. Additionally, we took uncertainties into account with, what we call, "*uncertainty ranges*" that indicate the typical range of the GHGE-estimates.

In previous studies, there has been effort to improve harmonization of methodologies used in diets' climate impact estimations. One study on harmonization of diets' climate impact evaluations, is the study by WWF (Live Well for life[1]), whilst, the authors also conclude that further development in the harmonization of climate impact evaluations of diets is still greatly needed. We reviewed the previous diet studies (e.g. Aston et al. 2012[2], Hoolohan et al. 2013[3], LiveWell for life 2013[1], Vieux et al. 2013[4]) to create a starting point for our study and to design the best available methodology for our study.

The GHGE-estimates produced in this study are formed for an average European diet to be able to compare countries in as fair manner as possible. Whilst some previous projects have established country specific GHGE-estimates (e.g. LiveWell for life 2013[1]), country specific estimates are very uncertain when different data sources are used. GHGE-estimates are based on Life Cycle Assessment (LCA) studies, and the challenge is that LCA, and in particular LCA used for estimating environmental impacts of food, is still a young research area, and it is a common practise to use different methodologies for different studies. Thus, across scientific studies there are generally no common methodologies on how to assess GHGE-emissions, which can create large differences in the results. In fact, it should be questioned whether country specific estimates can be used to compare countries when there are still major uncertainties in the GHGE-data. In some cases country specific estimates are more justified: e.g. when results are not used to compare countries or when the shares of beef from combined milk and beef production and suckler beef production vary between countries, but in most cases it is more difficult to justify whether the differences in GHGEs are real between countries or a cause of different methodologies. Hence, we propose that average estimates are used until there is further development in creating comparable country specific GHGE datasets.

The results of this study are dependent on the data sources used (especially GHGE-data and dietary data) and the generalizations and estimations that needed to be made. However, it should be noted that whilst we aimed at improving the existing methodologies to produce GHGE-estimates for food products, there will be uncertainties in the final results, no matter what methodology is used. To increase awareness of the uncertainties of the results of this study, we present the uncertainties in chapter 5 and uncertainty ranges of the final GHGE-estimates in Annex1. Additionally, we have created a user-guide for the GHGE-estimates (Annex 1) to avoid possible misuse of the GHGE-estimates.

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[1] Live Well for LIFE. (2012)A balance of healthy and sustainable food choices for France, Spain and Swedenhttp://livewellforlife.eu/wp-content/uploads/2013/02/A-balance-of-healthy-and-sustainable-food-choices.pdf

[2] Aston LM, Smith JN, Powles JW. (2012) Impact of a reduced red and processed meat dietary pattern on disease risks and greenhouse gas emissions in the UK: a modelling study. BMJ Open. 2012 Sep 10;2(5). pii: e001072. doi: 10.1136/bmjopen-2012-001072. Print 2012.

[3] Hoolohan C, Berners-Lee M, McKinstry-West J, Hewitt CN (2013) Mitigating the greenhouse gas emissions embodied in food through realistic consumer choices. Energ Policy 63: 1065-1074

[4] Vieux F, Darmon N, Touazi D, Soler LG (2012) Greenhouse gas emissions of self-selected individual diets in France: Changing the diet structure or consuming less? Ecol Econ 75: 91-101

2. Methodology

Our study is based on life cycle assessment (LCA) which is a widely used method to calculate GHGE's and other environmental impacts of products. We used the results of existing LCA studies on GHGEs of food products and made several adjustments to meet the requirements of the project.

2.1. Dietary data

Dietary data was received from the participating five countries: France, UK, Finland, Sweden and Italy. The dietary data was based on diet entries (food consumed), and there were over 2000 participants from each country. The data was further divided into 151 food categories. The most specific data was from France, and hence we have used French data to fine tune the GHGE-estimates for the 151 categories.

2.2. Functional unit

The functional unit (FU) of the study is kg CO_2-eq./kg food ready-to-eat, since the dietary data is expressed as "food consumed". Therefore, we also considered weight changes of cooking/preparing the food products (and the relative impact to the GHGE-estimates) due to water evaporation, water added and inedible parts removed (see 3.2).

2.3. Weight changes, food losses

Since the dietary data is expressed as food ready-to-eat, we used conversion factors to convert the GHGE-estimates' functional units to match the dietary data, e.g. GHGE-estimates are based on cooked food when the dietary data was cooked food etc. (Table 1). We used the publication of McCance and Widdowson (The Composition of Foods 7th Summary Edition, 2015) to calculate 1) edible proportions of foods, e.g. when removing peels from fruits and vegetables, and to calculate 2) weight changes when preparing and cooking different food products at home, e.g. the weight reduction when cooking different kinds of meats. In addition, we evaluated several sources for suitable conversion factors from live-weight to carcass weight and further to bone-free meat (Table 1).

Table 1. Conversion factors to convert the GHGE-estimates' functional units to match the dietary data (ready-to-eat food).

Food category	Conversion factor (GHGE-estimate is divided by the factor)
Fruit, peeling	0,66–0,76 [1]
Vegetables	
Peeling vegetables	0,74–1,00 [1]
Cooking vegetables	1,00
Rice, cooking	2,77 [1]
Dried legumes, cooking	2,00 [2]
Fish	
Live weight to fillet	*0,50–0,59* [2]
Cooked fillet	*0,90* [1]
Seafood, cooking	0,66–0,80 [1]
Beef	
Live weight to carcass	*0,52–0,57* [3]
Carcass to boneless meat	*0,70* [4]
Cooked meat	*0,72* [1]
Lamb	
Live weight to carcass	*0,50* [5]
Carcass to boneless meat	*0,65* [6]
Cooked meat	*0,70* [1]
Pork	
Live weight to carcass	*0,75* [7]
Carcass to boneless meat	*0,80* [8]
Cooked meat	*0,66* [1]
Poultry	
Live weight to carcass	*0,70* [9]
Carcass to boneless meat	*0,72* [10]
Cooked meat	*0,75* [1]

[1] McCance, Widdowson (2015) McCance and Widdowson's The Composition of Foods (7), 2015, 7, P001-P003, DOI:10.1039/9781849737562-FP001

[2] Expert evaluation

[3] Nguyen, T.L.T., J.E. Hermansen, L. Mogensen (2010) Environmental consequences of different beef production systems in the EU, J Clean Prod 18:756–766; Williams, A.G., E. Audsley, D.L. Sanders (2006) Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities, Main Report, Defra Research project IS0205, Bedford: Cranfield University and Defra; Pesonen&Nousiainen, Luke, personal communication (2016)

[4] Leip, A., Weiss, F., Wassenaar, T., Perez, I., Fellmann, T., Loudjani, P., Tubiello, F., Grandgirard, D., Monni, S., Biala, K. (2010) Evaluation of the livestock sector's contribution to the EU greenhouse gas emissions (GGELS) – final report. European Commission, Joint Research Centre. Available at: http://ec.europa.eu/agriculture/analysis/external/livestock-gas/full_text_en.pdf; Goodsell, M. & Stanton, T. (2011) A Resource Guide to: Direct Marketing Livestock and Poultry. January 2011. Available at: http://smallfarms.cornell.edu/resource-guide-to-direct-marketing-livestock-and-poultry/

[5] Leip, A., Weiss, F., Wassenaar, T., Perez, I., Fellmann, T., Loudjani, P., Tubiello, F., Grandgirard, D., Monni, S., Biala, K. (2010) Evaluation of the livestock sector's contribution to the EU greenhouse gas emissions (GGELS) – final report. European Commission, Joint Research Centre. Available at: http://ec.europa.eu/agriculture/analysis/external/livestock-gas/full_text_en.pdf; Ripoll-Bosch, R., I.J.M. de Boer, A. Bernués, T.V. Vellinga (2013) Accounting for multi-functionality of sheep farming in the carbon footprint of lamb: A comparison of three contrasting Mediterranean systems, Agric Syst 116:60–68; Williams, A.G., E. Audsley, D.L. Sanders (2006) Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities, Main Report, Defra Research project IS0205, Bedford: Cranfield University and Defra

[6] Raines, C. R. The butcher kept your meat? The Pennsylvania State University. Department of Dairy & Animal Science; Slaughter & Processing. Country home meat co. Edmond, Okla, U.S. http://www.countryhomemeats.com/slaughter_and_processing.htm;

[7] Leip, A., Weiss, F., Wassenaar, T., Perez, I., Fellmann, T., Loudjani, P., Tubiello, F.,Grandgirard, D., Monni, S., Biala, K. (2010) Evaluation of the livestock sector's contribution to the EU greenhouse gas emissions (GGELS) – final report. European Commission, Joint Research Centre. Available at: http://ec.europa.eu/agriculture/analysis/external/livestock-gas/full_text_en.pdf; Lesschen, J.P., M. van den Berg, H.J. Westhoek, H.J. Witzke, O. Oenema. Greenhouse gas emission profiles of European livestock sectors, Anim Feed Sci Tech 166–167:16–28, 2011; Nguyen, T. L. T., Hermanssen, J.E., Mogenssen, L. (2010) Fossil energy and GHG saving potentials of pig farming in the EU. Energy Policy 38:2561–2571; Williams, A.G., E. Audsley, D.L. Sanders (2006) Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities, Main Report, Defra Research project IS0205, Bedford: Cranfield University and Defra.

[8] How much meat? Oklahoma Department of Agriculture, Food & Forestry, Meat Inspection Services, Food Safety Division. http://www.oda.state.ok.us/food/fs-hogweight.pdf; Slaughter & Processing. Country home meat co. Edmond, Okla, U.S. http://www.countryhomemeats.com/slaughter_and_processing.htm; Nousiainen, Luke, personal communication 2016

[9] Lesschen, J.P., M. van den Berg, H.J. Westhoek, H.J. Witzke, O. Oenema. Greenhouse gas emission profiles of European livestock sectors, Anim Feed Sci Tech 166–167:16–28, 2011; Williams, A.G., E. Audsley, D.L. Sanders (2006) Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities, Main Report, Defra Research project IS0205, Bedford: Cranfield University and Defra.

[10] Expert evaluation

2.4. System boundaries

Our system boundaries included the food chain from primary production to consumption (Figure 1). In more detail we included primary production, processing, packaging (including recycling of packaging material), storing and cooking at home to our system boundaries. Transports, consumer travels, food waste, land use changes and changes in carbon stocks were excluded.

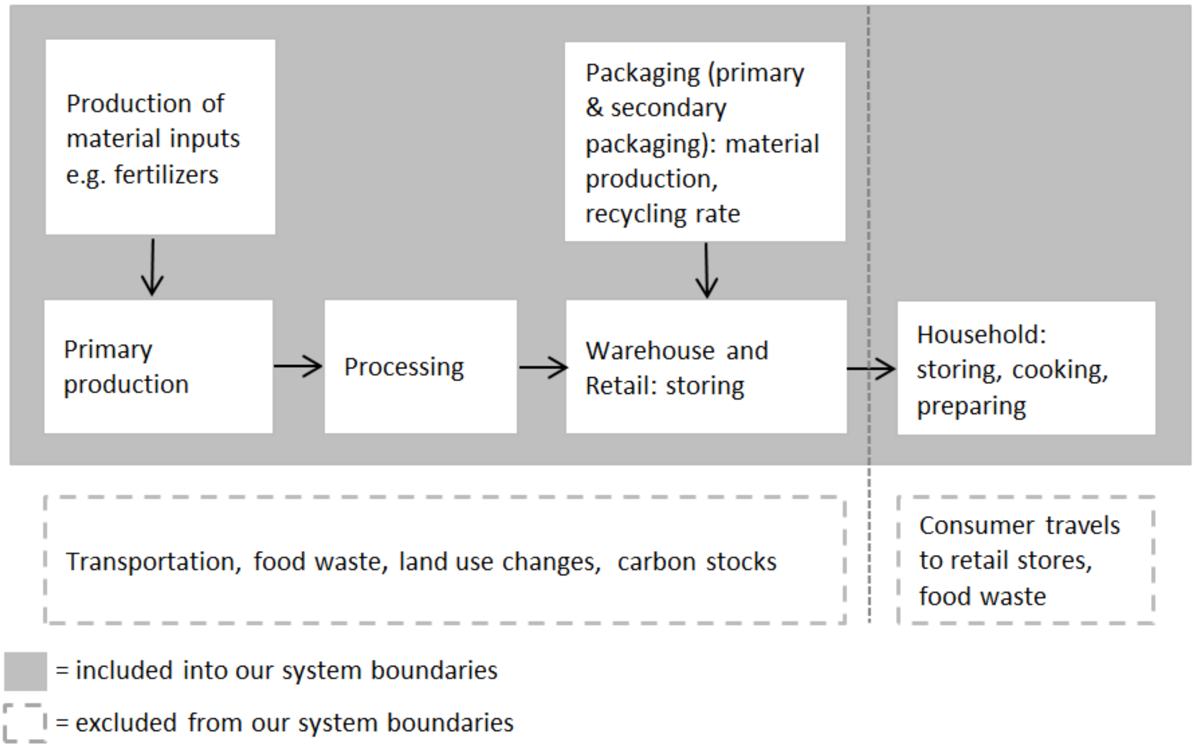

Figure 1. System boundaries.

Transportation and consumers' travels to grocery stores were excluded from the study because there is lack of data to specify the exact transportation vehicles and transportation routes for different food products, and we estimated that due to these uncertainties it is not possible to differentiate the transportation between different food categories. Additionally, GHGEs of transportation, in general, have relatively small contribution to total GHGEs of diets. Furthermore, since the main goal of the project was to compare foods in diets, and not to calculate the absolute GHGEs, we did not consider it necessary to include transportation and travels to grocery stores to the final GHGE-estimates.

Air-freight can have substantial impact to GHGEs of products, but we did not include it to our study, because no detailed data is available regarding what products are air-freighted. It was also assumed that it would not make a great difference between product categories. While it is acknowledged that air freight is a common practice for certain fresh vegetables and fruits (according to Marriot 2005[5] for example fresh peas and beans, grapes and asparagus originating from Sub-Saharan Africa), the level of consumption of these fruits and vegetables is significantly lower in comparison to the most consumed fresh vegetables and fruits (tomatoes, oranges, apples etc). For example, in UK

[5] Marriott, Clive (2005).From Plough to Plate by Plane: An investigation into trends and drivers in the airfreight importation of fresh fruit and vegetables into the United Kingdom from 1996 to2004. MSc Dissertation, University of Surrey, Surrey.

AEA Technology evaluated that only around 11% of greenhouse gas emissions of food transports is caused by air freight (Defra 2005[6]).

Food waste (food is wasted e.g. due to some inefficiencies, accidents etc.) was not included to the GHGE-estimates due to lack of food category specific food waste data.

Direct land use changes are also not included to the GHGE-estimates due to lack of specific enough dietary data. The dietary data did not allow us to allocate specific raw material, e.g. palm oil, to different food products, and therefore, it was not possible to include land use changes to GHGE-estimates without creating additional high uncertainties.

2.5. Choosing indicator products

In this project we used categorization where there are 151 food categories. However, each food category does not represent only one food item. In most of the cases each food category contains different food items, for instance, fruiting vegetables category includes tomatoes and other fruiting vegetables, such as, peppers and cucumbers.

Since there are no available GHGE-estimates (see more chapter 4.) for the 151 food categories, we chose certain indicator products to represent the 151 food categories. Based on the available GHGE studies, we used altogether 80 indicator products to represent the 151 food categories (See Annex 1). For example, there are several beef studies and therefore, the indicator product of the beef category is beef. Meanwhile, many categories are less clear and there we used different approaches to choose the suitable indicator product based on 1) the most common product/products in the category and 2) available GHGE-data. For instance, pome fruits category contains different pome fruits, but since the category contains mainly apple, we use apple as the indicator product for the entire category. Moreover, e.g. stone fruits category contains nectarines, peaches, apricots and other stone fruits, but since the best reference studies are from peaches, we chose peach as the indicator product for the stone fruits category. Additionally, in several cases it was considered as sufficient that one indicator product represents several food categories, for instance, orange juice represents all eight fruit juice categories (Annex 1: A.12.00–05, 07–08).

Moreover, it should be noted that since the GHGE-estimates produced in this study are formed for an average European diet the GHGEs are not country specific emission estimates. This is because of lack of specific data that might justify the use of different GHGE-estimates for different countries. Surely, in some cases country specific estimates are more justified: e.g. when results are not used to compare countries or when the shares of beef from combined milk and beef production and suckler beef production vary between countries, but in most cases it is more difficult to justify whether the differences are real between countries or a cause of different methodologies. Hence, we propose that the average estimates are used until further development in creating comparable country specific GHGE datasets.

[6] DEFRA (2005) The Validity of Food Miles as an Indicator of Sustainable Development. Report produced for DEFRA by AEA Technology. Department for Environment, Food and Rural Affairs, London.

3. Development of GHGE-estimates for food categories

To evaluate the climate impacts of European diets, we collected LCA studies where GHGEs of food products where estimated. From the existing literature we included emissions from primary production – and processing steps and excluded all other steps (Annex 1). This was done because we wanted to harmonize the emissions from all the remaining steps of the food chain by adding harmonized GHGE-estimate-defaults for cooking at home, storing and packaging into the final GHGE-estimates.

3.1. GHGE-estimates for food categories: primary production and processing stages

We used the existing literature to produce the GHGE-estimates of primary production and processing of the 80 indicator products (see subchapter 3.4). Thus, we removed from the GHGE-estimates of other (possible) life cycle stages, such as, cooking at home, packaging and storage.

As a principal we chose literature-references that used methodologies suitable to this study, for instance, similar system boundaries and allocation rules, and representative production systems: preferably the study sample needed to be big and representative enough, the study needed to be from Europe or a country that imports the product to Europe and the production method needed to be commonly used (conventional production, not organic etc.). Additionally, we chose the references for the GHGE-estimates based on the quality of the study, thus, we preferred scientific, peer-reviewed articles. A large amount of scientific literature on climate impacts of food products is available and we went through numerous scientific studies. However, there are not enough scientific studies to calculate GHGEs of a diet, and therefore we also went through other studies, such as, conference papers, project reports and EPD's. The final GHGE-estimates (Annex 1) are mainly based on the medians of the GHGE-estimates of the accepted literature references (References), with a few exceptions explained below in this chapter (more specific approaches for the chosen categories).

To start our literature search we prioritized the most important food categories and did a more profound literature search among those categories. For the prioritizing we used rough GHGE-estimates for the 151 food categories based on our previous studies, expert evaluations and Barilla's Double Pyramid Database[7]. We used the French dietary data to rate the 151 food categories according to their contribution to the final GHGEs of average French diet (we weighted the initial GHGE-estimates with the amounts consumed). By using the ratings we focused on the top-30 indicator products that contribute the most to the climate impact of French diet (including e.g. beef, cheese, coffee, wine, pork, chicken etc.), and put more effort to the literature review on those indicator products.

Secondly, we used Luke's own datasets, Google scholar -search and the Barilla's Double Pyramid-database to find GHGE-estimate references for the rest of the indicator products. Similarly to the top-30 indicator products, we used the medians of the GHGE-estimates of the accepted data sources with a few exceptions explained below (more specific approaches for the chosen categories).

Thirdly, we chose different and slightly more specific approaches for the following categories: 1) all composite dishes (A.19), 2) beef (A.06A.01), 3) meat categories: A.06A.04, A.06A.05, A.06E.00, A.06E.03 and A.06E.06, 4) all fish/seafood -categories (A.07), 5) cheese (A.08B), 6) fruiting vegetables (A.02.03) and leaf vegetables (A.02.05), and 7) berries and small fruits (A.05.04).

[7] Barilla Center for Food & Nutrition. Double Pyramid: Healthy Food for People, Sustainable Food for the Planet. Milan: Barilla Center for Food & Nutrition; (2010).

1. To estimate GHGEs for composite dishes category, the French “Composite dishes” -data (A.19) was further broken down into specific food ingredients and each ingredient was given a GHGE-estimate of the most suitable indicator product. Thus, we were able to calculate GHGEs for each composite dish using the GHGE-estimates of indicator products of the other food categories (literature data) and weight them according to the relative shares of food ingredients in the French composite dishes. The breaking down of composite dishes into food ingredients was done based on French data due to lack of data of food ingredients in composite dishes in other countries. Thus, this adds up to the uncertainties of the study as French composite dishes are likely not fully representative of average European composite dishes.

2. The beef (A.06A.01) was calculated by weighting GHGE-estimates (medians of chosen GHGE-studies) of combined milk and beef production and suckler beef production based on how much of beef in Europe is from combined and from suckler beef production systems. The weighting was based on Eurostat-statistics on number of dairy and non-dairy cows in EU-15 in 2014 and included several expert assumptions on the carcass weights and slaughter ages of cows, heifers and bulls, and replacement rates. As a result, we estimated that in Europe on average 62% of beef originates from combined production and 38% from suckler beef production.

3. GHGE-estimates of the mixed beef, pork and poultry meat categories: A.06A.04, A.06A.05, A.06E.00, A.06E.03 and A.06E.06, were based on a weighted average GHGE-estimate of the categories: beef (A.06A.01), pork (A.06A.02) and poultry (A.06B.00). The GHGEs of those categories were weighted based on the relative amounts of beef, pork and poultry consumed in France.

4. The fish and seafood categories (A.07) were calculated differently because the GHGEs of cultivated and wild fish/seafood are significantly different, but the dietary data do not separate them. We used the EU Market Observatory for Fisheries and Aquaculture products[8] data on amounts of fish/seafood consumed in EU. It was further divided into cultivated and wild fish/seafood. For the GHGE-estimates of wild fish/seafood, we used literature estimates of fuel consumption of fishing boats[9]. For the GHGE-estimates of cultivated fish/seafood, we used literature data and expert evaluations. The final GHGE-estimates for fish and seafood categories were formed by weighting the GHGEs of cultivated and wild fish/seafood. Categories’ A.07.00, A.07.02, A.07.06, A.07.03 and A.11A.02 GHGE-estimates were based on a GHGE-estimate average of the other fish and seafood categories in France.

5. Cheese category (A.08B) was further broken down into soft, semi-hard and hard cheeses since the GHGEs of cheeses are dependent on the amount of milk used to produce the cheese, and the harder the cheese is, the more milk is used on average. Thus, the GHGE-estimate for hard cheeses is higher than for soft cheeses. We used literature references to calculate GHGE-estimates for soft, semi-hard and hard cheeses. The final GHGE-estimate for the cheese category was formed by weighting the GHGEs of the three cheese categories based on the consumed amounts. We calculated the cheese GHGE-estimate for France and UK (by breaking both dietary datasets into soft, semi-hard and hard cheeses) and used the average of the two countries.

6. Especially tomato, cucumber and lettuce (categories A.02.03 and A.02.05) are produced differently in colder climate, since in colder climate (e.g. northern Europe) the production takes place

[8] Eumofa (2011) The EU Fishmarket, Available at: http://www.eumofa.eu/documents/10157/bf18cf2c-1b33-440d-8870-e05b2644b58b

[9] Schau, E.M., Ellingsen, H., Endal, A., Aanondsen, S.A. (2009) Energy consumption in Norwegian fisheries. Journal of Cleaner Production 17(3):325-334.

in heated greenhouses for most of the year, whereas, in warmer climate the production does not require additional heating. Therefore, we estimated the shares of production that require heating. This estimate was based on rough calculation on tomato exporters that import to Europe, including European countries, and their relative export shares, where roughly one third of the exporters were considered as countries that require heating in their production[10] (data on export shares by exporting countries was from FAOSTAT[11]). The GHGE-estimates for heated and non-heated production of tomato, cucumber and lettuce were produced using literature data. Since tomato and cucumber belong to the same product category, the final GHGE-estimate of the category was weighted based on the amounts of tomato and cucumber consumed in France.

7. In the French dietary data, berries and small fruits category contained significant amounts of grapes as well as berries of which strawberry was chosen as the representative berry. Both, grape and strawberry GHGE-estimates were based on literature references. We calculated GHGE-estimate of the category based on the relative amounts of grapes and berries consumed in France.

3.2. GHGE-estimates for food categories: cooking at home, storing and packaging stages

To harmonize system boundaries of GHGE-estimates of indicator products, we calculated the GHGE-estimates of cooking at home, storing and packing of food products for each food category separately from GHGE-estimates of production and processing. However, there were several exceptions where 1) the product was not expected to be cooked, and a few exceptions, where 2) the product was not packed e.g. 'tap water'. All in all, we calculated the GHGE-estimates of storing for all of the product categories (excluding e.g. "tap water"), packing for 98% of consumed food and drinks (excluding e.g. "tap water") and cooking for around 35% of consumed food and drinks.

On average, the climate impact of cooking, storig and packing is low in caprison to climate impact of production and processing of food. Thus, the methodologies used for GHGE-estimates of cooking, storing and packing are simplified methodologies in comparison to the methodology to form GHGE-estimates for production and processing of food.

3.2.1. Cooking at home

Most of the food consumed in Europe is cooked at home. Part of the food consumed is not home-cooked, but we did not have the data on the shares of home-cooked food, and hence, to simplify the GHGE-estimates of cooking of food, we have assumed that all food is cooked at home.

For calculating the GHGEs of cooking at home we used several studies and Luke's databases to estimate the average energy use (kWh) of cooking different food products. We converted the kWhs into GHGEs using the GHGE-estimate of the European average electricity grid (ecoInvent[12]). Since we did not have data on average cooking methods of the food categories, we used a very simplified methodology, where we only used two defaults for energy use (Work Efficiency Institute 1992[13]). The lower default (0.12 kg GHGE) was used when the food product needed only heating up: coffee, tea or soup, and the higher default (0.24 kg GHGE) was used in all of the other cases, e.g. when cooking meat, pasta, vegetables and porridge.

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[10] Note: this assessment method does not take into account producers who produce only for domestic use.

[11] FAOSTAT 2016 Production http://faostat3.fao.org/download/Q/*/E

[12] ecoInvent: *www.ecoinvent.org*

[13] Work Efficiency Institute (Työtehoseura) 1992. Liedellä vai mikroaaltouunissa? Työtehoseura r.y., kotitalousosasto, Star offset Oy 1992

Food items and drinks that we assumed not to be cooked at home were: cold drinks (e.g. water, wine, and juices), fruit and fruit products, snacks, and desserts. Based on the detailed French data, we made a rough estimate on how much of each category is eaten raw or cooked, we calculated that roughly around 35% of vegetables and vegetable products, 30% of grain products, 100% of root vegetables, 100% of legumes, 77% of meat and meat products, 100% of fish and fish products, 13% of dairy products, 25% of sugar and confectionaries, 42% of fats, 100% of coffee and tea, 99% of composite food, and 30% of herbs, spices and condiments are cooked.

3.2.2. Storing

We used several GHGE-studies and Luke's databases to estimate the GHGEs of storing food at the grocery store/whole sale and at home. GHGE-estimates were calculated as three defaults for three storing options: dry 0.06 kgCO_2-eq./kg ready-to-eat food, cold 0.30 kgCO_2-eq./kg and freeze 1.06 kgCO_2-eq./kg (ecoInvent[11], Personal communication 2015[14], Viinisalo ym. 2008[15]).

We made several assumptions how different product categories are stored on average. Dry products such as coffee, sugar, rice and pasta were expected to be stored in dry, whereas, vegetables, fruits and milk were expected to be stored both dry and cold. Also, among drinks fruit and vegetable juices, soft drinks, alcoholic beverages, and bottled water, were expected to be stored mostly in dry but also in cold (80% dry and 20% cold). Aggregated food categories meat and meat products and fish and other seafood and food categories cream, yoghurt, cheese, eggs, butter, and margarine, were expected to be stored in cold. Food categories ices and desserts (mainly ice cream), water ice were expected to be stored in freezer; 20% of bread, fine bakery wares, and categories: vegetables and vegetable products, potatoes and potatoes products, legumes, beans, berries and small fruits and meat and meat products were expected to be stored in freezer; and 30% of fish and other seafood -category were expected to be stored in freezer.

3.2.3. Packaging

For calculating the GHGEs of packaging we used several GHGE-studies of different packing materials. We also took into account the European average recycling rates for the materials (Eurostat 2016[16]). We used Luke's database, Finnish Packaging Recycling RINKI -data[17] and expert evaluation on the packaging sizes of different indicator products (to estimate the amount of packing material used per one kilo of food product) and the average materials of primary and secondary packing of the indicator products.

A simplified classification of resulting specific GHGE-estimates from packaging of different indicator products are presented in Table 2**Error! Reference source not found.**.

[14] Personal communication 2015 Eeva Perälä Inex partners, Oy, Personal comment 13.10.2015

[15] Viinisalo M, Nikkilä M, Varjonen J (2008) Elintarvikkeiden kulutusmuutokset kotitalouksissa vuosina 1966–2006, Kuluttajatutkimuskeskus

[16] Eurostat 2016 http://ec.europa.eu/eurostat/statistics-explained/index.php/Packaging_waste_statistics

[17] RINKI http://rinkiin.fi/for-households/recycling-packaging-in-finland/

Table 2. GHGE's of packaging of different indicator products.

Packaging, kg GHGE / kg indicator product	Indicator product
>0.40	Products canned/in glass jar, Liquids in glass bottle: spirits, whiskey, wine, vinegar, and olive oil
>0.20–<0.40	Other liquids in glass bottle
>0.10–<0.20	Liquids in plastic bottle, Chocolate, Dried fruits and nuts, Fish and seafood, Honey, Ice cream, All meat products, All dairy products
<0.10	All cereals, Berries, fruits and vegetables, Butter and margarine, Coffee and tea, Condiments, Egg, Sugar

3.2.4. Cooking at home, storing and packaging of composite dishes

Similarly to GHGE-estimates of production and processing of composite dishes (4.1.), the GHGE-estimates of cooking at home, storing and packing of 'composite food' categories were based on cooking, storing and packing of indicator products, where each ingredient was given a GHGE-estimates of cooking, storing and packing of the most suitable indicator products.

4. Assessing uncertainties

There are various reasons that bring uncertainty to the final GHGE-estimates of this report. These uncertainties can be divided into 1) uncertainties in the dietary data, 2) uncertainties in the GHGE-estimates, 3) uncertainties in the methodology of converting the GHGE-estimates into same functional units as the dietary data, and 4) uncertainties in the assessment methodology of GHGE-estimates.

The GHGE-estimates are based on several GHGE-values from literature, and therefore, the choice of literature references was very crucial step of this study. We produced uncertainty ranges for the GHGE-estimates to address the uncertainties related to assessment of GHGEs of indicator products (see below) (uncertainty 2). These ranges are intended to communicate about the uncertainties of the GHGE-estimates, and suggest that one should be cautious when making any assumptions based on the GHGE-estimates. However, there are still several issues that make these uncertainty ranges rather weak and one should not take these ranges as something scientific. For instance, since we use indicator products the uncertainty ranges of GHGE-estimations are highly dependent on the chosen indicator products.

Since the focus of this study was to develop GHGE-estimates for foods ready-to-eat, we did not consider the uncertainties in the dietary data itself (how it has been compiled and how well it represents average national diet) (uncertainty 1). Moreover, since the GHGE-estimates need to match the dietary data we made assumptions regarding the dietary data: estimates of weight changes (uncertainty 3) and estimates regarding cooking at home, storing and packing (uncertainty 4). Especially, the uncertainties regarding cooking at home and storing are uncertain since the estimates are largely based on our own assumptions. However, on average cooking and storing have significantly smaller impact to the final GHGE-estimates in comparison to production and processing.

Due to high uncertainties in the final GHGE-estimates, we strongly advice that the given uncertainty ranges are taken into account when using the GHGE-estimates and drawing conclusions from them.

For the uncertainty ranges of packing, storing and cooking at home, we used a range from -25% to +25%. To create uncertainty ranges for the GHGE-estimates of production and processing, we used a few simple principles:

1) Quartiles: if there were four or more data sources from literature, we used the boundary value of lower quartile as the minimum value of uncertainty range and the boundary value of upper quartile as the maximum value;
2) Minimum-maximum: if there were only 2–3 data sources we used minimum and maximum values;
3) 50–50: if there was only one GHGE-estimate we used -50%–+50% uncertainty range, unless:
4) 25–25: if there was only one GHGE-estimate but it was considered as a reasonably reliable estimate and by comparing the estimate to similar products it was still considered as a reasonable estimate;
5) Average of other categories: in cases where the GHGE-estimate was based on an average of other product categories (some meats and all 'Composite dishes') we used the uncertainty ranges of the other product categories and calculated an average uncertainty range by weighting the other product categories' uncertainty ranges according to the amounts consumed of each product category.

5. Other environmental impacts

Due to limited resources and availability of data, only greenhouse gas emissions (i.e. GHGEs = carbon footprint = climate impact = global warming potential) were considered in our study. Even though climate impact cannot depict all environmental impacts such as biodiversity, it is still comprehended that it gives a fairly good indication how we should change our dietary patterns since in many cases high climate impacts also indicate high eutrophication and acidification impacts. Naturally exceptions exist such as eutrophication of cultivated fish in vulnerable areas such as Baltic Sea, or organic/extensive meat production systems which might have low impact on the biodiversity but much higher climate impact. However, in this project we concentrated on the average European production, and how to generally decrease the climate impacts of diets. Therefore, if one wants to make more environmentally sound food choices, the results of this project can be followed in general, but to make sure that the expected benefits of diet changes are always environmentally sound, one should take into account also other environmental impacts besides climate impact. There is still need for further research to be able to include other environmental impacts into assessment and to compare different environmental impacts on a dietary level. In the first place, there is a lack of product level information on different environmental impacts.

6. Annex 1. GHGE-estimates of food categories

READ THIS FIRST: User guide for the GHGE-estimates

When using the GHGE-estimates one should notice the following requirements:

1) **Functional unit: One should use the same functional unit as we have used when using these GHGE-estimates.** Our functional unit is kg CO_2-equivalents (i.e. GHGE) per kg ready-to-eat food. The GHGE-estimates are calculated for ready-to-eat food items, thus, the items are considered prepared (i.e. inedible parts (peels, bones etc.) removed), and (possibly) cooked (e.g. water added to dry items, such as, rice, dried legumes).

2) **Additional GHGE-estimates: In case additional GHGE-estimates are used along with the estimates provided here, one should adjust the additional GHGE-estimates, so that they have same functional units and system boundaries, and use similar methodology to ours.** Since this is highly demanding task, which requires deep understanding of LCA and our methodology, one needs to be cautious when using additional GHGE-estimates.

3) **Categorization and indicator products: One should consider the categorization and indicator products we have used and match one's own food dataset accordingly.** When the used indicator product does not seem suitable for one's own food dataset, one should look for alternative indicator products.
    - For instance, our indicator product for 'vegetable products' is 'tomato, canned'. In case one's own food category 'vegetable products' (or similar category) does not include canned vegetables, but fresh vegetables, one should decide whether to use alternative indicator product, for instance, 'tomato'.

4) **Uncertainty range: One should verify results with the lower and upper boundaries as a sensitivity analysis, especially when the data is used for decision making.** The average European GHGE-estimates and uncertainty ranges (lower and upper boundaries) are only rough estimates. There are several uncertainties and restrictions, which should be taken into account when drawing conclusions.

5) **Transparency: One should always clearly present the methodology used, clarify uncertainties and limitations, and possible additional adjustments made**.

6) In case there are any concerns regarding the use of the data or a wish to have the table in excel-form, we advise the user to contact us: Hanna Hartikainen and Hannele Pulkkinen (firstname.lastname@luke.fi)

Table 3. Food product categories, used indicator products, GHGE-estimates and related uncertainty ranges. See chapter 5 for more information on type of uncertainty ranges. N/A -marking in 'Number of sources' -column signifies that the value is not the median from data sources, but we have used a different approach (these calculations are specified in subchapter 4.1).

FDXL2	FoodExL2, Food category	Used indicator product	GHGE, $kgCO_2$-eq./ kg food	GHGE, lower boundary	GHGE, upper boundary	Type of uncertainty range	Number of used sources
A.01.00	Grains and grain-based products (unspecified)	Bread (flour)	0,8	0,6	0,9	quartiles	6
A.01.01	Grains as crops	Bread (flour)	0,8	0,6	0,9	quartiles	6
A.01.02	Grains for human consumption	Rice	1,3	0,9	1,5	quartiles	5
A.01.03	Grain milling products	Pasta	1,0	0,9	1,2	quartiles	6
A.01.04	Bread and rolls	Bread	1,0	0,8	1,1	quartiles	6
A.01.05	Pasta (Raw)	Pasta	1,0	0,9	1,2	quartiles	6
A.01.06	Breakfast cereals	Breakfast cereals	1,1	0,6	1,7	50–50	1
A.01.07	Fine bakery wares	Cakes, pastries	2,1	1,6	2,6	quartiles	27
A.02.00	Vegetables and vegetable products (unspecified)	Tomato	0,8	0,5	1,1	50–50	N/A
A.02.01	Root vegetables	Carrot	0,7	0,5	0,8	min–max	2
A.02.02	Bulb vegetables	Onion	0,7	0,5	0,8	quartiles	4
A.02.03	Fruiting vegetables	Fruiting vegetables	1,4	1,0	1,7	25–25	N/A
A.02.04	Brassica vegetables	Broccoli, cauliflower	1,0	0,8	1,1	min–max	3
A.02.05	Leaf vegetables	Lettuce	0,9	0,7	1,1	25–25	N/A
A.02.06	Legume vegetables	Green bean	1,7	1,2	2,2	min–max	2
A.02.07	Stem vegetables (Fresh)	Asparagus	1,6	1,0	2,2	min–max	2
A.02.08	Sugar plants	Sugar	0,5	0,4	0,8	min–max	3
A.02.09	Sea weeds	Lettuce	0,8	0,4	1,1	50–50	N/A
A.02.10	Tea and herbs for infusions (Solid)	Tea	0,3	0,2	0,3	quartiles	4
A.02.11	Cocoa beans and cocoa products	10% of milk chocolate	0,4	0,2	0,5	50–50	1
A.02.12	Coffee beans and coffee products (Solid)	Coffee	0,6	0,5	0,8	min–max	3
A.02.13	Coffee imitates (Solid)	Coffee	0,6	0,5	0,8	min–max	3
A.02.14	Vegetable products	Tomato, canned	1,1	0,7	1,4	50–50	N/A
A.02.15	Fungi, cultivated	Mushroom, canned	4,0	2,5	5,6	min–max	3
A.02.16	Fungi, wild, edible	Blueberry, wild	1,2	0,7	1,7	50–50	1

FDXL2	FoodExL2, Food category	Used indicator product	GHGE, $kgCO_2$-eq./ kg food	GHGE, lower boundary	GHGE, upper boundary	Type of uncertainty range	Number of used sources
A.03.01	Potatoes and potatoes products	Potato	0,8	0,6	1,0	quartiles	5
A.03.02	Other starchy roots and tubers	Potato	0,8	0,6	1,0	quartiles	5
A.04.00	Legumes, nuts and oilseeds (unspecified)	Walnut, hazelnut	1,7	0,6	2,0	min–max	3
A.04.01	Legumes, beans, green, without pods	Green bean	1,7	1,2	2,2	min–max	2
A.04.02	Legumes, beans, dried	Legumes	0,5	0,4	0,7	50–50	1
A.04.03	Tree nuts	Walnut, hazelnut	1,7	0,6	2,0	min–max	3
A.04.04	Oilseeds	Walnut, hazelnut	1,7	0,6	2,0	min–max	3
A.04.05	Other seeds	Walnut, hazelnut	1,7	0,6	2,0	min–max	3
A.05.00	Fruit and fruit products (unspecified)	Jam	1,2	0,9	1,5	25–25	1
A.05.01	Citrus fruits	Orange	0,6	0,5	0,7	quartiles	4
A.05.02	Pome fruits	Apple	0,5	0,3	0,6	quartiles	6
A.05.03	Stone fruits	Peach	0,8	0,5	1,0	min–max	2
A.05.04	Berries and small fruits	Grape, strawberry	0,8	0,7	1,3	quartiles	7
A.05.05	Oil fruits	Apple	0,5	0,3	0,6	quartiles	6
A.05.06	Miscellaneous fruits	Banana	0,7	0,6	1,4	min–max	3
A.05.07	Dried fruits	Grapes*4	2,7	1,9	3,4	min–max	2
A.05.08	Jam, marmalade and other fruit spreads	Jam, glass jar	1,5	1,1	1,9	25–25	1
A.05.09	Other fruit products (excluding beverages)	Jam, glass jar	1,5	1,1	1,9	25–25	1
A.06A.01	Beef	Beef	42,5	36,1	52,9	quartiles	16
A.06A.02	Pork	Pork	10,2	7,7	11,2	quartiles	8
A.06A.03	Lamb	Lamb	34,3	33,7	67,7	quartiles	7
A.06A.04	Livestock meat, other	Avg. Meat	22,2	18,5	27,5	avg	N/A
A.06B.00	Poultry	Chicken	5,8	4,7	7,4	quartiles	8
A.06C.01	Preserved meat	Ham, sausage	5,6	4,3	6,0	min–max	3
A.06C.02	Sausages	Ham, sausage	5,7	4,4	6,1	min–max	3
A.06C.03	Meat specialties	Ham, sausage	5,6	4,3	6,0	min–max	3
A.06C.04	Pastes, pâtés and terrines	Ham, sausage	5,6	4,3	6,0	min–max	3
A.06D.00	Meat imitates	Tofu	1,5	1,2	2,9	min–max	3

FDXL2	FoodExL2, Food category	Used indicator product	GHGE, $kgCO_2$-eq./ kg food	GHGE, lower boundary	GHGE, upper boundary	Type of uncertainty range	Number of used sources
A.06E.00	Meat and meat products (unspecified)	Avg. Meat	22,2	18,5	27,5	avg	N/A
A.06E.03	Game mammals	Avg. Meat	22,2	18,5	27,5	avg	N/A
A.06E.04	Game birds	Chicken	5,8	4,7	7,4	quartiles	8
A.06E.05	Mixed meat	Avg. Meat	22,2	18,5	27,5	avg	N/A
A.06E.06	Edible offal, farmed animals	Avg. Meat	22,2	18,5	27,5	avg	N/A
A.07.00	Fish and other seafood (unspecified)	Avg. Fish	3,6	2,7	4,5	25–25	N/A
A.07.02	Fish products	Avg. Fish	3,6	2,7	4,5	25–25	N/A
A.07.03	Fish offal	Avg. Fish 5%	1,1	0,6	1,1	avg	N/A
A.07.04	Crustaceans	Shrimps	9,6	7,2	12,1	25–25	N/A
A.07.05	Water mollusks	Mussels	6,7	5,0	8,4	25–25	N/A
A.07.06	Amphibians, reptiles, snails, insects	Avg. Fish	3,6	2,7	4,5	25–25	N/A
A.07.08	Tuna canned	Thuna canned	4,0	2,9	5,0	25–25	N/A
A.07.09	Tuna not canned	Thuna not canned	4,1	3,0	5,1	25–25	N/A
A.07.10	Salmon	Salmon	5,5	4,8	6,1	quartiles	5
A.07.11	Cod	Cod	4,5	3,3	5,6	25–25	N/A
A.07.12	Other fatty fish	Small pelagics (herring, sardine)	2,1	1,6	2,6	25–25	N/A
A.07.13	Other non fatty fish	Ground fish (cod, sole)	2,9	2,1	3,6	25–25	N/A
A.08A.00	Dairy products (unspecified)	Milk	1,5	1,2	1,8	quartiles	31
A.08A.01	Liquid milk	Milk	1,4	1,2	1,8	quartiles	31
A.08A.02	Milk based beverages	Milk	1,4	1,2	1,8	quartiles	31
A.08A.03	Concentrated milk	Milk powder	8,2	6,2	10,3	25–25	1
A.08A.04	Whey and whey products (excluding whey cheese)	Whey	8,2	6,2	10,3	25–25	1
A.08A.05	Cream and cream products	Cream	5,3	4,8	5,8	min–max	2
A.08A.06	Fermented milk products	Yogurt	1,6	1,2	1,9	quartiles	4
A.08A.07	Milk derivatives	Milk	1,6	1,3	1,9	quartiles	31
A.08B.00	Cheese	Cheese	8,3	6,2	10,4	25–25	N/A
A.08C.00	Milk and milk product imitates	Soya drink	1,1	0,7	1,5	min–max	2
A.09.00	Eggs and egg products (unspecified)	Egg	2,9	2,3	3,3	quartiles	7
A.09.01	Eggs, fresh	Egg	2,9	2,3	3,3	quartiles	7
A.09.02	Eggs, powder	Egg*4	9,5	7,6	10,8	quartiles	7

FDXL2	FoodExL2, Food category	Used indicator product	GHGE, $kgCO_2$-eq./ kg food	GHGE, lower boundary	GHGE, upper boundary	Type of uncertainty range	Number of used sources
A.10.00	Sugar and confectionary (unspecified)	Sugar	0,5	0,4	0,8	min–max	3
A.10.01	Sugars	Sugar	0,5	0,4	0,8	min–max	3
A.10.02	Sugar substitutes	Sugar	0,5	0,4	0,8	min–max	3
A.10.03	Chocolate (Cocoa) products	Milk chocola-te	3,1	2,3	3,9	25–25	1
A.10.04	Confectionery (non-chocolate)	Sugar	0,4	0,3	0,7	min–max	3
A.10.05	Dessert sauces	Jam, glass jar	1,5	1,1	1,9	25–25	N/A
A.10.06	Molasses and other syrups	Sugar	0,5	0,4	0,8	min–max	3
A.10.07	Honey	Honey	1,1	0,9	1,3	min–max	2
A.11A.01	Animal fat	Butter	9,5	7,9	10,2	quartiles	5
A.11A.02	Fish oil	Avg. Fish 5%	0,3	0,2	0,4	25–25	N/A
A.11B.01	Vegetable fat	Olive oil	3,1	2,0	4,2	min–max	3
A.11B.02	Vegetable oil	Olive oil, glass bottle	3,4	2,2	4,6	min–max	3
A.11B.03	Fats of mixed origin	Olive oil, glass bottle	3,4	2,2	4,6	min–max	3
A.11B.04	Margarine and similar products	Margarine	1,7	1,4	2,1	min–max	3
A.12.00	Fruit and vegetable juices (unspecified	Orange juice	0,9	0,8	1,1	min–max	2
A.12.01	Fruit juice	Orange juice	0,9	0,8	1,1	min–max	2
A.12.02	Concentrated fruit juice	Orange juice	0,9	0,8	1,1	min–max	2
A.12.03	Fruit nectar	Orange juice	0,9	0,8	1,1	min–max	2
A.12.04	Mixed fruit juice	Orange juice	0,9	0,8	1,1	min–max	2
A.12.05	Dehydrated/powder ed fruit juice	Orange juice	0,9	0,8	1,1	min–max	2
A.12.06	Vegetable juice	Tomato	0,5	0,3	0,7	50–50	N/A
A.12.07	Mixed vegetable juice	Orange juice	0,9	0,8	1,1	min–max	2
A.12.08	Mixed fruit and vegetable juice	Orange juice	0,9	0,8	1,1	min–max	2
A.13A.02	Tea (Infusion)	Tea	0,3	0,2	0,3	quartiles	4
A.13A.03	Coffee (Beverage)	Coffee	0,6	0,5	0,8	min–max	3
A.13A.04	Coffee imitates beverage	Coffee	0,6	0,5	0,8	min–max	3
A.13A.05	Cocoa beverage	10% of milk chocolate	0,5	0,3	0,6	25–25	1
A.13B.00	Soft drinks	Coca-Cola	0,3	0,2	0,4	25–25	1

FDXL2	FoodExL2, Food category	Used indicator product	GHGE, $kgCO_2$-eq./ kg food	GHGE, lower boundary	GHGE, upper boundary	Type of uncertainty range	Number of used sources
A.14.00	Alcoholic beverages (unspecified)	Wine, glass bottle	1,6	1,2	3,6	quartiles	5
A.14.01	Beer and beer-like beverage	Beer, glass bottle	1,0	0,7	1,2	min–max	2
A.14.02	Wine	Wine, glass bottle	1,6	1,2	3,6	quartiles	5
A.14.03	Fortified and liqueur wines	Wine, glass bottle	1,6	1,2	3,6	quartiles	5
A.14.04	Wine-like drinks (e.g. Cider, Perry)	Cider, glass bottle	1,9	1,1	2,8	50–50	1
A.14.05	Liqueur	Wine, glass bottle	1,6	1,2	3,6	quartiles	5
A.14.06	Spirits	Whiskey, glass bottle	1,7	1,1	2,4	min–max	2
A.14.07	Alcoholic mixed drinks	Spirits, glass bottle	1,5	0,9	2,1	25–25	1
A.15.00	Drinking water (unspecified)	Water	0,0	0,0	0,0	-	-
A.15.01	Tap water	Water	0,0	0,0	0,0	-	-
A.15.03	Bottled water	Bottled water	0,2	0,2	0,3	25–25	1
A.15.04	Water ice (for consumption)	Water, frozen	1,1	0,8	1,3	25–25	N/A
A.16.00	Herbs, spices and condiments (unspecified)	Black pepper, dry	1,5	0,8	2,2	50–50	1
A.16.01	Herbs	Black pepper, dry	1,5	0,8	2,2	50–50	1
A.16.02	Spices	Black pepper, dry	1,5	0,8	2,2	50–50	1
A.16.03	Herb and spice mixtures	Black pepper, dry	1,5	0,8	2,2	50–50	1
A.16.04	Seasoning or extracts	Black pepper, dry	1,5	0,8	2,2	50–50	1
A.16.05	Condiment	Wine (vine-gar), glass bottle	1,5	1,1	3,4	quartiles	5
A.16.06	Dressing	Olive oil, glass bottle	3,4	2,2	4,6	min–max	3
A.16.07	Chutney and pickles	Tomato, glass jar	0,9	0,6	1,2	50–50	N/A
A.16.08	Savory sauces	Tomato, glass jar	0,9	0,6	1,2	50–50	N/A
A.16.09	Flavorings or essences	Sugar	0,5	0,4	0,8	min–max	3
A.16.10	Baking ingredients	Sugar	0,5	0,4	0,8	min–max	3

FDXL2	FoodExL2, Food category	Used indicator product	GHGE, $kgCO_2$-eq./ kg food	GHGE, lower boundary	GHGE, upper boundary	Type of uncertainty range	Number of used sources
A.19A.00	Composite food (unspecified)	Composite food (including frozen products) (unspecified)	4,2	3,3	5,1	avg	N/A
A.19A.01	Cereal-based dishes	Cereal-based dishes	4,3	3,6	5,8	avg	N/A
A.19A.02	Rice-based meals	Rice-based meals	2,2	1,7	2,6	avg	N/A
A.19A.03	Potato based dishes	Potato based dishes	7,0	5,9	8,8	avg	N/A
A.19A.04	Beans-based meals	Beans-based meals	5,4	4,3	6,5	avg	N/A
A.19A.07	Vegetable-based meals	Vegetable-based meals	1,8	1,4	2,2	avg	N/A
A.19A.09	Mushroom-based meals	Mushroom-based meals	3,5	2,3	4,9	avg	N/A
A.19A.10	Ready to eat soups	Ready to eat soups	0,5	0,3	0,6	avg	N/A
A.19A.11	Prepared salads	Prepared salads	1,0	0,7	1,3	avg	N/A
A.19A.12	Cheese-based meals	Cheese-based meals	3,9	3,0	4,7	avg	N/A
A.19B.01	Meat-based meals	Meat-based meals	9,7	8,1	12,5	avg	N/A
A.19B.02	Fish and seafood based meals	Fish and seafood based meals	2,0	1,5	2,4	avg	N/A
A.19B.03	Egg-based meal (e.g., omelet)	Egg-based meal (e.g., omelette)	3,3	2,6	3,8	avg	N/A
A.20.00	Snacks, desserts, and other foods (unspecified)	Cakes, pastries	1,9	1,5	2,4	quartiles	27
A.20.01	Snack food	Snack food (Potato*4)	0,9	0,5	1,3	50–50	1
A.20.02	Ices and desserts	Cream, frozen	6,0	5,4	6,6	min–max	2
A.20.03	Other foods	Snack food (Potato*4)	0,9	0,5	1,3	50–50	1

7. References

Apple

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