

# **Sustainable meat consumption to meet climate and health goals- implications of variations in consumption statistics**

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## **ABSTRACT**

In order to develop recommendations for sustainable meat consumption, e.g. from climate and health perspectives, there is a need for a correct understanding of how much meat is produced and actually consumed. The purpose of this paper is to contribute to the understanding of critical issues regarding meat consumption statistics, its implication on LCA and recommendations of sustainable meat consumption levels. Depending on the way of presenting data, meat consumption levels per capita may differ by a factor two. This illustrates the importance of specifying the functional unit and clearly define if it refers to meat including or excluding bones, including losses along the food chain, or after weight reduction by cooking, for a correct utilisation and interpretation of meat consumption data and LCA's of meat. The need for reductions in current meat consumption to meet climate and health goals is estimated to 0-75% and 0-50%, respectively, depending on the region.

Keywords: meat consumption, statistics, LCA, climate, health

## **1. Introduction**

Food production has been identified as one of the most important drivers of environmental pressures (EIPRO, 2006). To meet climate goals substantial mitigation efforts in the agriculture sector, estimated to account for about one third of anthropogenic greenhouse gas (GHG) emissions (Garnett, 2011), will be needed. Results from life cycle assessments (LCA) normally show that animal based foods are more climate intensive compared to plant based foods (FAO, 2006; 2009; Garnett, 2009). Due to population growth and a transition towards increased consumption of animal based products, global demand for livestock products are projected to double by 2050 compared to the year 2000 (FAO, 2006). Reduced meat consumption has been suggested to be a necessary measure for mitigating food related GHG emissions (Garnett, 2011) and to have positive effects on public health in regions with affluent diet (McMichael et al, 2007). However, how much meat consumption needs to be reduced to reach a sustainable level, e.g. including both environmental and health aspects, is still uncertain.

In order to develop recommendations for sustainable meat consumption, e.g. based on LCA studies, there is a need for reliable data and a correct understanding of how much meat is available for consumption and how much meat is actually consumed. Because different methods are used to produce data on meat consumption and because there is more than one definition of meat consumption (Hallström and Börjesson, 2012), divergent information on how much meat is consumed is circulating in the literature and in media. For a correct utilisation and interpretation of meat consumption statistics, e.g. in LCA, it is essential to be aware of how statistical data on meat consumption is developed and presented.

The purpose of this paper is to contribute to the understanding of critical issues regarding meat consumption statistics, its implication on LCA and recommendations of sustainable meat consumption levels. The paper describes factors contributing to discrepancies in meat consumption data and illustrates the importance of correct definition of the functional unit, while exploring estimates of sustainable meat consumption levels regarding climate change and dietary recommendations.

## 2. Methods

Information about factors contributing to discrepancies in meat consumption statistics and their respective impact on data are based on the findings in an assessment by Hallström & Börjesson (2012). In order to illustrate how identified factors may contribute to discrepancies in data and to make relevant comparisons with goals for increased sustainability in meat consumption, meat consumption statistics provided by the FAOSTAT (data from 2007) is processed and categorised by using conversion factors stated in the literature.

## 3. Results

### 3.1 Factors contributing to discrepancy in meat consumption data

Food consumption can be measured top-down, e.g. based on data of the agricultural supply or bottom-up e.g. based on data from Household Budget Surveys or Individual Dietary Surveys (Naska et al., 2009; Westhoek et al., 2011). Factors identified to contribute to discrepancies between meat consumption data are whether the weight of bones is included, whether food waste in stages along the food chain is accounted for, whether the weight refers to raw or cooked meat and whether ingredients of non-meat origin in mixed processed meat products and ready meals are accounted for (Hallström and Börjesson, 2012). Depending on the method used to produce meat consumption statistics the data may refer to the available supply, the purchased amount or the amount of meat actually consumed. Meat consumption data can further be expressed either in carcass weight, as a sum of pure meat and products of higher degree of processing (e.g. mixed charcuteries and prepared meals) or in cooked amounts. Methods to adjust for bones and food losses at different stages of the food chain also vary among different ways of presenting meat consumption statistics.

The quantitative example in Table 1 illustrates how meat consumption statistics may vary depending on the way of presenting data, i.e. if the data refer to the available supply of carcass including bones (A), bone-free meat (B), bone-free meat after adjustment for losses at retail and consumer level (C) or bone-free meat after adjustment for losses and weight reductions during cooking (D). Data on the available supply of carcass including bones (A) are based on meat consumption statistics from FAOSTAT (data from 2007). Bone-free meat (B) is assumed to correspond to 70% of the carcass weight. According to previous research bone-free meat represents on average 70% (Cederberg, 2009), 59 % and 77% (Sonesson, 2010) of the carcass weight in beef, pork and chicken, respectively. Based on an FAO report (FAO, 2011), a waste percentage of 15% has been assumed to adjust for losses at retail and consumer level (C) in North America, Oceania and Europe. Corresponding losses for South America and Asia are assumed to be, on average, 13%, and for Africa, 11% (where the losses in sub-Saharan Africa correspond to around 9%). Weight reduction by cooking (D) is assumed to correspond to 30% of the raw weight, a mean value of previous estimates varying between 20-50% depending on the type of meat, method and degree of cooking (World Cancer Research Fund/American Institute for Cancer Research, 2007; KF & ICA Provkök, 2000). The data presented in Table 1 refer to average meat consumption, i.e. no difference is made regarding variations in type of meat and differences in intake levels within each region. Thus, to make more reliable estimations on a regional level, specific statistics regarding the actual mix of meat consumed are needed. Also conversion factors used to quantify the data presented in column B-D are estimated averages. Thus, to improve the reliability in these data more extensive information of specific conditions is needed.

Table 1. Per capita meat consumption (kg/year) in different world regions

<b>Region</b>	<b>A<sup>a</sup> Raw meat incl. bones</b>	<b>B Raw meat excl. bones</b>	<b>C B excl. losses in distribution and at consumer level</b>	<b>D C after weight reduction by cooking</b>
North America	120	84	71	50
Oceania	115	81	68	48
Europe	77	54	46	32
South America	70	49	43	29
Asia	28	20	17	12
Africa	16	11	10	7

<sup>a</sup> Data in column A are based on FAO statistics which refer to the average quantity of meat including most bones at the slaughter exit. Available supply is quantified as the sum of nationally produced meat plus meat imports minus exports of meat, divided by the total population.

### 3.2 Reductions in meat consumption to reach a sustainable level – two illustrative examples

#### 3.2.1 Climate perspective

Due to human activities global GHG emissions have increased by 70% during the past 40 years (IPCC, 2007). Scientific evidence indicates that a temperature rise greater than 1.5-2°C compared to pre-industrialised levels, may result in adverse effects including serious impact on the environment as well as future availability of food and water (IPCC, 2007; Stern, 2006). To increase the chances of limiting global warming to 1.5-2°C degrees, global GHG emissions will have to be halved by 2050 compared to levels in 1990, and in a long term perspective be limited from approximately 6-14 tonnes of CO<sub>2</sub>e per capita per year (global average and average in developed countries, respectively) to levels of 1 to 2 tonnes of CO<sub>2</sub>e per capita per year (European Commission, 2007; UNEP, 2010). Food production and consumption account for a significant proportion of global anthropogenic GHG emissions and overall environmental impact. Estimates from developed countries indicate that GHG emissions embodied in the diet are in the range of 2-3 tonnes of CO<sub>2</sub>e per capita per year (Berners-Lee et al. 2012; Nilsson et al. 2011), equivalent to about 15-28% of the overall national emissions (Garnett, 2011). Meat has been identified as the food group responsible for the majority of GHG emissions attributable to the food sector (Carlsson-Kanyama and Gonzalez, 2009; Garnett, 2011).

From a climate perspective an average global per capita consumption of 25-33 kg of meat per year (68-90 grams per day) has been suggested as a goal to stabilise global livestock related GHG emissions until 2050 at 2000-2005 level (Garnett, 2008; McMichael et al., 2007). The suggested levels by Garnett (2008) and McMichael (2007) are quantified based on FAO data and thus refer to the available supply of raw meat including bones. From an LCA perspective, the corresponding functional unit (FU) could be translated as *kg produced raw meat including bones per capita per year*. The estimated need for reductions in current meat consumption to meet climate goals is exemplified in Table 2. In this example the level of sustainable meat consumption is assumed to be 29 kg per capita per year, which is an average of the suggested amounts.

#### 3.2.2 Health perspective

From a nutritional point of view there are no general recommendations of how much meat is considered to be optimal for health. Existing dietary guidelines are instead usually based on levels that ensure sufficient intake of critical nutrients without exceeding upper intake limits of nutrients associated to negative health effects. In dietary guidelines, meat is usually categorised with other protein rich foods and suggested portion sizes and intake levels can vary (U.S. Department of Agriculture/U.S. Department of Health and Human Services, 2010; WHO, 2003). According to dietary

guidelines in five different countries an intake between 50 and 100 g of cooked meat per day (18-37 kg per year) is suggested to provide a balanced nutrient intake (Hallström et al., 2011). To decrease the risk for cancer the World Cancer Research Fund (WCRF) further recommends that consumption of cooked red meat (e.g. beef, pork, lamb) should be restricted to maximum 500 g per week (26 kg per year, i.e. 70 g per day) and that processed meat, such as bacon, salami, sausages etc., should be avoided (World Cancer Research Fund/American Institute for Cancer Research, 2007). In addition dietary recommendations for healthy vegetarian diets, without meat, are available (U.S. Department of Agriculture/U.S. Department of Health and Human Services, 2010). The recommendations of sustainable meat consumption from a health perspective are accordingly based on the consumption of cooked meat. The corresponding FU in an LCA could then be translated as *kg consumed cooked meat per capita per year*. The estimated need for reduction in current meat consumption to meet health goals is exemplified in Table 2. In this example the level of healthy meat consumption is set to 26 kg per capita per year, which is in line with suggested amounts in dietary guidelines. The amount includes red and white meat but complies with the recommendation by the WCRF which refers to a maximum intake of red meat.

Table 2. Estimated need for reductions in meat consumption to meet climate and health goals<sup>a</sup>

Region	Reduction needed in % to meet climate goals	Reduction needed in % to meet health goals
North America	76	48
Oceania	75	46
Europe	62	19
South America	59	13
Asia	None	None
Africa	None	None

<sup>a</sup> To quantify the reductions in meat consumption needed to meet climate goals, data from column A in Table 1 has been compared with a consumption level of 29 kg per capita per year (FU: produced raw meat including bones). To quantify reductions needed to meet health goals data in Table 1, column D has been compared with a consumption level of 26 kg per capita per year (FU: consumed cooked meat).

#### 4. Discussion

Statistics on meat supply, based on the production of raw meat including bones, are often the basis in describing the need for reduction in meat consumption to meet climate goals. In describing the need for reduction in meat consumption from a health perspective, on the other hand, data on the actual intake expressed as uncooked or cooked meat should preferably be used. From an LCA perspective, these two types of statistics represent two different functional units. There is an obvious risk of mixing those different functional units when broadening the perspective in LCA's, including, for example, a nutrition and health perspective.

Depending on the type of statistics and way of describing data, the meat consumption level per capita may differ by a factor two, or more. If meat consumption statistics are used wrongly it may result in an incorrect functional unit, which may influence the results and conclusions substantially. It is therefore crucial to specify the functional unit in, for example, LCA's of meat and dietary recommendations and clearly define if it refers to raw meat including or excluding bones, including losses in distribution and consumer level, or after weight reduction by cooking.

This paper indicates that the reductions needed in meat consumption to meet climate goals are considerable in all regions except Asia and Africa. In most regions there also seems to be a room for reduced consumption from a health perspective. The estimated needs for reduced meat consumption to reach a sustainable level are rough estimates which will vary depending on the consumption levels set as a sustainable target. In order to development recommendations for sustainable food consumption the level of sustainable meat consumption needs to be studied more extensively in the future.

## 5. Conclusion

- Depending on the type of statistics and way of presenting data, meat consumption levels per capita may differ by a factor two, or more.
- For a correct utilisation and interpretation of meat consumption data and LCA's of meat it is crucial to specify the functional unit, i.e. to clearly define if it refers to raw meat including or excluding bones, including losses along the food chain, or after weight reduction by cooking.
- The need for reductions in current meat consumption to meet climate and health goals is estimated to 0-75% and 0-50%, respectively, depending on the region.
- The level of sustainable meat consumption needs to be studied more extensively in the future.

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