Environmental impact of canteen meals: comparison of vegetarian and meat based recipes

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ABSTRACT

It is generally known that agricultural production of meat is one of the main contributors to the environmental impacts of food consumption. However, the assessment of the actual potential to reduce the environmental impact by choosing a vegetarian diet is complicated because meat cannot be directly replaced with vegetables or other products. Thus, in LCA studies it is difficult to compare the impacts of a certain amount of meat directly with another product.

We compared 10 different choices of canteen meals in order to overcome this obstacle. Therefore, public canteens in the city of Zurich provided recipes of typical meals with and without meat. One typical portion of such a lunch was chosen as the functional unit for comparison.

The comparison shows clear benefits from choosing a vegetarian meal. In average, the global warming potential of meat meals was 3 kg CO_2-eq compared to 0.9 kg CO_2-eq for the vegetarian choice. Also other environmental impacts of vegetarian meals are considerable lower. The results allow us to draw conclusions on the influence of different parameters on the overall environmental impact of canteen meals. For instance, it facilitates the estimation of the influence of the vegetable provenance on the LCA of a meal.

The presentation will describe the approach and present the results from this comparison. The results have been used by the WWF Switzerland in order to promote a vegetarian day in canteens.[1]

Keywords: food, environmental impact, canteen meals, vegetarian, meat

1. Introduction

Food consumption contributes considerable amounts to the total global greenhouse gas emissions. The main part of the environmental impact arises from the agricultural production of meat. A vegetarian diet is therefore seen as an instrument to reduce the environmental impact and greenhouse gas emissions from food consumption. The comparison of meat products with vegetarian alternatives however is complicated because vegetable or other products cannot always one-to-one substitute meat.

In order to overcome this obstacle, we assessed the environmental impact of 10 different choices of meat based and vegetarian canteen meals. The meals represent both composed meals with main and side dishes as well as and one-pot dishes. Canteen kitchens of hospitals, retirement homes and other public institutions of the city of Zurich, Switzerland, provided the recipes for these meals.

2. Life cycle inventory analysis

The life cycle inventories of the five meat based meals and five vegetarian meals were chosen from the list of different canteen meals. The functional unit is one serving of the main dish with sides, which allows for a comparison of composed dishes with stews and other one-pot dishes. The composition of the meals is shown in table 1.

[1] http://www.wwf.ch/de/tun/tipps_fur_den_alltag/essend/aktuell/

Table 1: Meat and vegetarian meals investigated in the study

Meat meals	Vegetarian meals
Chop of pork with roesti and carrots	Spaetzle with vegetables
Braised meat beef with french fries	Curry with vegetables and rice
Lamb stew with french fries vegetables	Lasagne with vegetables
Sliced veal in cream with roesti and carrots	Sliced tofu in cream with roesti and carrots
Chicken drumstick, fried with French fries and courgette	Risotto

The amounts of ingredients are taken from the recipes. For a minority of ingredients the LCI data had to be estimated using similar ingredients (Jungbluth *et al.* 2010).

The electricity input for cooling, food storage and material use for kitchen equipment is not accounted for in this study. A rough estimation of the electricity consumption for the meal preparation however is included in the study. The electricty consumption is derived from the environmental report of SV service, a Swiss canteen meal provider (SV (Schweiz) AG 2008). We attributed the same values to all main and side dishes. Meals with a main and a side dish therefore obtain an increased value of electricity demand in contrast to a one-pot dish.

3. Impact Assessment

The impact assessment has been carried out for greenhouse gas emissions (Solomon *et al.* 2007) and for environmental impacts based on the ecological scarcity method 2006 (Frischknecht *et al.* 2009).

Meat based meals cause an average global warming potential of 3 kg CO_2-equivalents per serving, whereas the supply of a vegetarian meals emits 0.9 kg CO_2-equivalents (see Figure 1). The difference mainly arises from the high environmental impact due to meat production (see Figure 2). Only a small amount of greenhouse gas emissions can be attributed to the side dishes. On the other hand, the evaluation of the global warming potential of the individual meat based meals reveals a high variance of greenhouse gas emissions from meat production. Meals based on beef or veal cause relatively high emissions in comparison to the use of pork or poultry. Consequently, beef or veal meals reach a global warming potential of more than 4 kg CO_2-equivalents. Meals containing poultry or pork range from 1.5 to 2 kg CO_2-equivalents.

Similarly, the vegetarian meals show some differences within their category. Risotto or lasagne cause less than 1 kg of greenhouse gas emissions. Spaetzle and the vegetarian alternative of veal in cream, tofu in cream, range between 1 and 1.5 CO_2-equivalents.

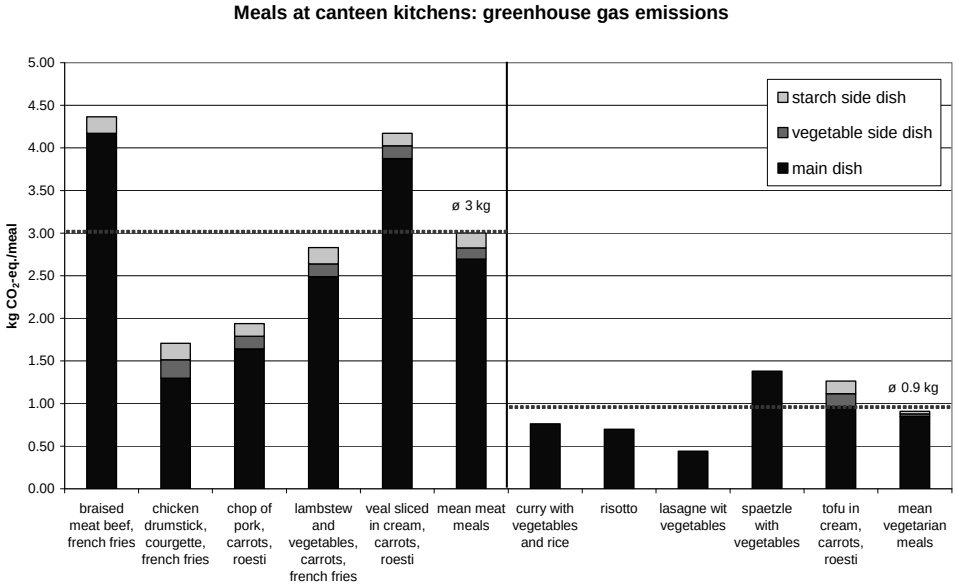

Figure 1: Global warming potential of different meals

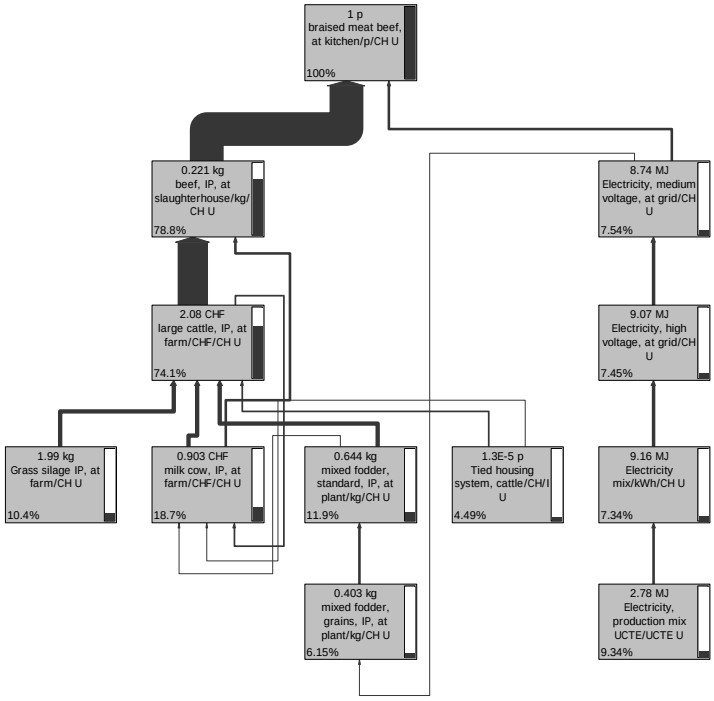

Figure 2: Major life cycle of the provision of a meat based meal (braised meat beef) and LCIA with the global warming potential (GWP 100a).

The impact assessment according to the ecological scarcity 2006 method (Frischknecht *et al.* 2009) shows similar patterns (Figure 3). The meat-based meals have an average environmental impact of 6622 Ecopoints per meal and the vegetarian meals account for 2085 Ecopoints. The environmental impact of the side dishes becomes more important, because of the higher weightning of vegetable production.

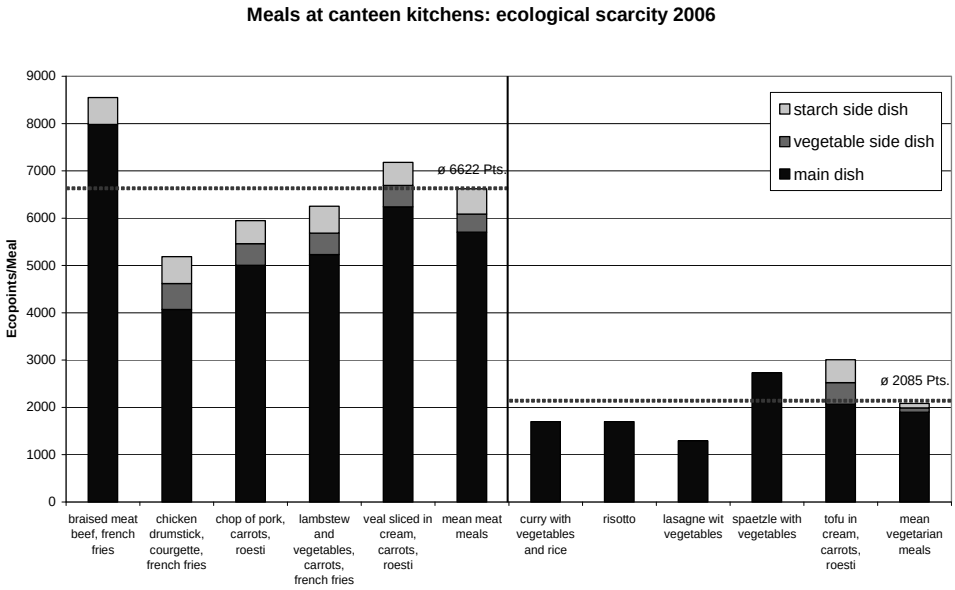

Figure 3: Total environmental impacts of meals evaluated with the ecological scarcity method 2006

4. Conclusions

The average global warming potential and the environmental impact of meat based meals are considerable higher than for vegetarian meals. The meat-based meals cause 2 kg greenhouse gas emissions or 4000 Ecopoints more compared to an average vegetarian meal. Consequently, a vegetarian diet makes a significant contribution to the reduction of the global warming potential due to food consumption.

Although the results show major differences between the meat based and the vegetarian meals, the expression of a relative difference has to be handled carefully. The LCI for instance excludes the electricity demand for food storage and consideres only rough assumptions for the energy demand for the meal preparation. Considering these additional energy demands the overall environmental impact of canteen meals will be higher. The absolute difference between the meals however should remain unchanging.

As is a high variance within the meat or vegetarian meals, the difference between two individual meals can be smaller or higher than the difference resulting from the average values.

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