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FOOD LOSSES IN THE LIFE CYCLE OF LASAGNE BOLOGNESE: READY-TO-SERVE VS. HOME-MADE

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ABSTRACT

A considerable amount of food waste is caused in households due to bad storage, poor planning and consumer's preference for fresh food. Food waste due to bad handling in industrial processes on the other hand is minimal. This leads to the question whether overall food losses of a ready-made meal are lower than for a meal freshly prepared at home. This question was investigated in an LCA study comparing ready-made and home-made lasagne Bolognese. The aim of the study was to examine what possible differences in the food losses imply for the environmental impacts of equivalent lasagnes. The data needed were derived from literature, own measurements and supplemented by data from the food industry. Contrary to the expectations, the amount of total food waste was estimated to be about the same for both products. The losses occurring in the production chain of the ready-made lasagne are driven by losses in the food industry and returned products reaching the expiry at the point of sale. In case of the home-made lasagne, the major losses are caused at the household. The environmental impacts of the two types of lasagne are comparable. In both cases, the major contribution to the impacts derives from the food ingredients.

INTRODUCTION

Ready-made meals are sold and consumed in most European markets. Consumers tend to buy them primarily for their convenience and with little thought as to how their environmental performance compares to home preparation using fresh ingredients. Differing factors could be the handling of food wastes at different stages in the life cycle or different energy consumption rates due to the preparation at scale and the efficient preservation of ready-meals under chilled conditions. To examine possible differences and the consequences for the environmental performance, an LCA case study has been conducted (Flury et al. 2013). The study investigates and compares the environmental impacts of the preparation of a ready-made lasagne Bolognese and a home-made lasagne Bolognese over the full life-cycle. The food losses and the energy consumption for the processing and preparation are examined in more detail.

METHODS

As a basis for the lasagne recipe, the composition of Trattoria Lasagne al Forno by a major UK retailer was used. The composition is assumed to be the same for both lasagnes in order to avoid any bias introduced by differences in the recipes. Investigated are a chilled ready-made and a freshly prepared home-made lasagne Bolognese. This study considers the cultivation, preparation, storage and distribution of the ingredients and the respective preparation of the lasagnes. It represents an average European production and supply chain. The home-made lasagne is prepared from ingredients bought in a supermarket. They are from conventional, seasonal production. The ready-made lasagne is packed in an aluminum tray. The functional unit is defined as **"the preparation of two portions (800 g) of lasagne Bolognese ready to consume in a household"**. The weight of all inventories refers to the weight before the heating in the oven. As both alternatives have the same portion size, left-overs on the plate are not considered.

The supply chains of both types of lasagne are modeled based on a previous study of Büsser & Jungbluth (2009). It is supplemented with industry data, information on food wastes (Gustavsson et al. 2011, Kranert et al. 2012, Lorrayne 2008) and own measurements. Background data are based on ecoinvent v2.2 (ecoinvent Centre 2010), updates thereof (LC-inventories 2013) and the ESU database for food production and consumption (Jungbluth et al. 2013). SimaPro 7.3.3 is used to calculate the life cycle inventory analysis, impact assessment, to run a Monte-Carlo simulation and to document the data (PRé Consultants 2012).

In the full study, the results are analysed for a representative range of impact categories. Presented in this short article is the Global Warming Potential (GWP) according to Solomon et al. (2007).

RESULTS

The overall mass of food losses in the ready-made production chain (24 %) is comparable to the ones in the supply chain of the home-made lasagne (26 %). The stages where the main food losses occur varies however (Figure 1). While the highest losses in the supply chain of the ready-made lasagne occur during the preparation in the food industry, most ingredients for the home-made lasagne are wasted at the household. In the food industry, food losses occur when the manufacturing is shifted to another type of product and the facilities need to be emptied and cleaned. Losses at the point of sale are a bit higher for the ready-made lasagne than for the ingredients of the home-made lasagne as it is always a whole lasagne that is disposed of in case of damage or expiry and not only single ingredients. In the absence of any studies proving otherwise, the central storage between agricultural stage and food industry or retail, respectively, is assumed to be the same for both chains, resulting in similar food losses. In general, food losses vary considerably for different types of ingredients.

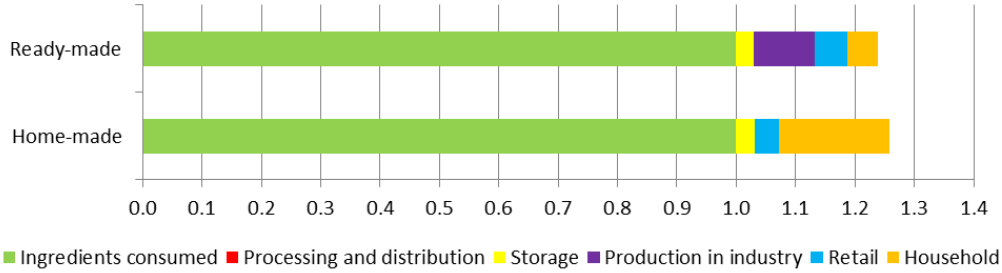

Figure 1. Comparison of cumulated relative food wastes in the different stages of the supply chains of ready-made and home-made lasagne Bolognese. The value 1 on the x-axis refers amount of ingredients in the lasagne provided at household.

The slightly higher food losses in the chain of the home-made lasagne consequently result in a higher contribution of the ingredients to the overall GWP of the lasagne (Figure 2). The packaging of the ingredients on the other hand causes less GHG emissions than the packaging of the ready-made lasagne. Only some ingredients for the home-made lasagne need to be cooled in contrast to the whole ready-made lasagne. The contribution of the distribution and selling stage is therefore lower. The industrial lasagne production and the heating of the ready-made lasagne at the household are reported separately while the preparation of the home-made lasagne includes the cooking of the sauces as well as the baking of the lasagne. The overall impacts of the production and preparation of the ready-made lasagne are slightly higher due to its considerably longer baking time. The overall greenhouse gas emissions of the ready-made lasagne and the home-made lasagne per kilogram of lasagne provided at household are comparable. They amount to 7.5 and 7.2 kg CO_2-eq, respectively.

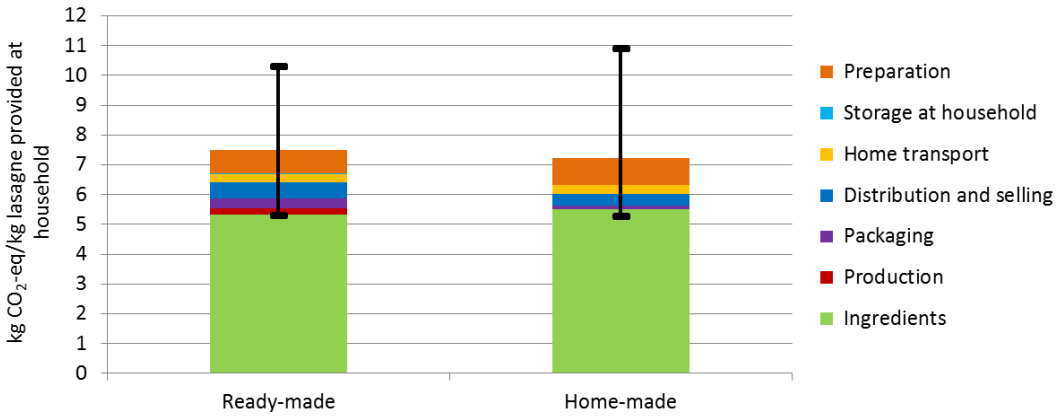

Figure 2. Comparison of the Global Warming Potential (GWP) of the ready-made and the home-made lasagne Bolognese, including the 95% confidence interval. The contribution of the different life-cycle stages is distinguished.

DISCUSSION

The easy preparation of the ready-made lasagne presumably reduces the food losses due to burning or bad seasoning. However, a considerable portion of the food losses at the household level are caused due to bad storage, bad planning and due to preferences. It cannot be assumed that ready-made lasagnes are exempt from this.

It has to be considered that so far neither much nor detailed data is available on food losses in different stages of the food supply chain. Thus, some assumption had to be taken and the resulting uncertainties mean that no clear ranking of one option over the other is possible.

CONCLUSIONS

In terms of the environmental performance, there is no significant difference between the ready-made lasagne and the home-made lasagne, despite the additional packaging and reheating of the ready-made lasagne. The food losses as well as the impacts on climate change are in the same range. Both, the food industry and the households could reduce their food losses by an increase in efficiency and better planning. A special focus on an improved management of food with a limited shelf-life could further reduce losses in the retail stage. More robust and detailed data is needed in order to better understand the food waste in the different stages. Independent of the lasagne type, a lower content of meat as well as an efficient cold chain could decrease the environmental impact considerably.

REFERENCES

Büsser S., Jungbluth N. (2009). LCA of Ready-to-Serve Bolognese Lasagne Packed in Aluminium Containers. ESU-services Ltd. commissioned by European Aluminium Foil Association e.V. (EAFA), Düsseldorf. Uster, CH.

ecoinvent Centre. (2010). ecoinvent data v2.2, ecoinvent reports No. 1-25. Swiss Centre for Life Cycle Inventories. Dübendorf, CH.

Flury K., Büsser S., Jungbluth N. (2013). Ready-to-serve vs. home-made lasagne: An LCA with a focus on food waste in different production chains. ESU-services Ltd. commissioned by European Aluminium Foil Association e.V. (EAFA). Düsseldorf. Zürich, CH.

Gustavsson J., Cederberg C., Sonesson U., van Otterdijk R., Meybeck A. (2011). Global food losses and food waste: Extent, causes and prevention. Swedish Institute for Food and Biotechnology (SIK) commissioned by Food and Agriculture Organization Of The United Nations. Gothenburg, SE.

Jungbluth N., Flury K., Doublet G., Leuenberger M., Steiner R., Büsser S., Stucki M., Schori S., Itten R. (2013). Life cycle inventory database on demand: EcoSpold LCI database of ESU-services. ESU-services Ltd. www.esu-services.ch/data/data-on-demand/.

Kranert M., Hafner G., Barabosz J., Scheider F., Lebersorger S., Scherhaufer S., Schuller H., Leverenz D. (2012). Emittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland. Universität für Bodenkultur Wien, Institut für Abfallwirtschaft. Wien, AT.

LC inventories. (2013). Corrections, updates and extensions of ecoinvent data v2.2. ESU-services Ltd. www.lc-inventories.ch

Lorrayne V. (2008). The food we waste. ISBN:1-84405-383-0. Waste and Resource Action Programme (WRAP), Oxon, www.wrap.org.uk.

PRé Consultants. (2012). SimaPro 7.3.3. Amersfoort, NL.

Solomon S., Solomon S., Qin D., Manning M., Alley R. B., Berntsen T., Bindoff N. L., Chen Z., Chidthaisong A., Gregory J. M., Hegerl G. C., Heimann M., Hewitson B., Hoskins B. J., Joos F., Jouzel J., Kattsov V., Lohmann U., Matsuno T., Molina M., Nicholls N., Overpeck J., Raga G., Ramaswamy V., Ren J., Rusticucci M., Somerville R., Stocker T. F., Whetton P., Wood R. A. and Wratt D. (2007). Technical Summary. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Cambridge University Press, Cambridge, United Kingdom and New York, USA.