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Ready-to-serve vs. home-made lasagne: An LCA with a focus on food waste in different production chains

Executive Summary

Authors

Karin Flury, Sybille Büsser, Niels Jungbluth

ESU-services Ltd.
Margrit Rainer-Strasse 11c, CH – 8050 Zürich
flury@esu-services.ch
www.esu-services.ch
Tel. +41 44 940 61 35; Fax +41 44 940 67 94

Commissioner (and Executive Summary)

Graham Houlder
Director Sustainability
Graham.Houlder@alufoil.org
Tel. +31 681 794 747; Fax +49 479 625 290
Am Bonneshof 5
40474 Düsseldorf
Germany
www.alufoil.org

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Authors	Karin Flury, Sybille Büsser, Niels Jungbluth ESU-services Ltd., fair consulting in sustainability Margrit Rainer-Strasse 11c, CH-8050 Zürich www.esu-services.ch Phone +41 44 940 61 35, Fax +41 44 940 67 94 flury@esu-services.ch
Commissioner	European Aluminium Foil Association e.V. (EAFA) Graham Houlder Am Bonneshof 5, D - 40474 Düsseldorf Graham.Houlder@alufoil.org Phone +31 681 794 747; Fax +49 (211) 4796 25 290
Steering Group	Hans Jürgen Schmidt, Hydro Gerald Rebitzer, Amcor
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Executive Summary

Background and Goals

Ready-to-serve meals packed in aluminium containers 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.

A detailed LCA study investigates and compares the environmental impacts of the preparation of ready-to-serve lasagne and home-made lasagne over the full life-cycle (Flury et al. 2012). The food losses and the energy consumption are examined in more detail.

A simplified environmental life cycle assessment (LCA) on lasagne including the disposal phases is elaborated. It quantifies the food and energy uses and analyses the resulting environmental impacts of a ready-to-serve lasagne and of the same meal prepared at home. The study is partly based on a former study which only investigated the ready-to-serve lasagne (Büsser & Jungbluth 2009).

Object of Investigation

As a basis for the lasagne recipe, the composition of Trattoria Lasagne al Forno of a large UK retailer and typical to the UK market is used. The composition/recipe is assumed to be the same for the ready-to-serve and for the home-made lasagne in order to avoid any bias introduced by differences in the recipes.

Functional Unit

The functional unit is defined as **"the preparation of two portions (800 gram) of lasagne Bolognese ready to be consumed in a household"**. Five different options are considered: The preparation of ready-to-serve lasagne (chilled or frozen, oven or microwave) and of home-made lasagne Bolognese heated in the oven. In the following results are shown for the reference flow of 1 kg.

The weight of all inventories refers to the weight before heating in the household.

The life cycle inventories for both types of lasagne Bolognese encompass the whole food supply system starting with the cultivation of the wheat and tomatoes and animal husbandry ending with lasagne Bolognese served at home.

A commercial LCA software (SimaPro, 7.3.3) is used to calculate the life cycle inventory analysis and to document the data (SimaPro 2012).

The life cycle assessment is elaborated according to the ISO standards 14040 and 14044. ISO 14040 foresees a critical review under these pre-conditions. As this has not yet been conducted this study does not fulfil this requirement according to the ISO standard.

The results of this study are generally not transferable to other packaging systems or types of recipes, meals or products.

Food losses over the production chain

Food losses occur over the whole life-cycle of a food product. Data is based on available average data and on specifications of the food industry. The background data used in this study already include losses in the agricultural stage, including the processing of the harvest. In Fig. 1, the losses refer to the amount acquired to provide 1 kg of lasagne at the household.

The overall losses of the ready-to-serve lasagnes are 24 % and in the chain of the home-made lasagne 26 % of the ingredients are lost. The losses include avoidable and unavoidable food waste as well as the loss of moisture when cooking the sauce Bolognese. No principle differences in the amount of wastes in the life cycles of chilled and frozen lasagne have been found in the available literature.

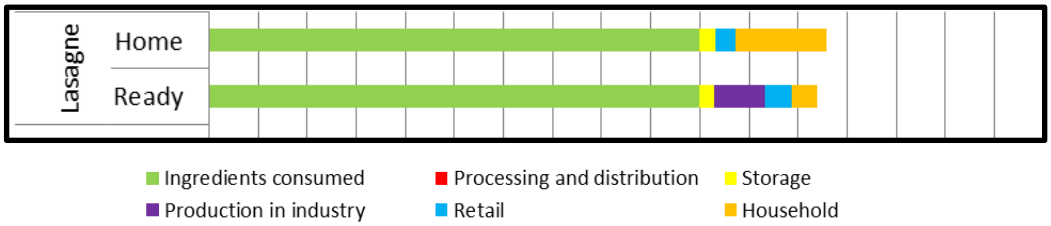

Fig. 1 Comparison of food losses in the production chain of the ready-to-serve lasagne and in the supply chain of the home-made lasagne. "Lasagne" indicates the total losses of all ingredients needed for the provision of 1 kg of lasagne at the household. The remaining losses refer to the provision of 1 kg of the respective ingredient in the final lasagne at the household.

Packaging of Ready-to-Serve Lasagne Bolognese

In general, it is observed that both plastic and aluminium containers exist for chilled and frozen ready-to-serve lasagne, whereby chilled lasagne are generally packed in flow packs and frozen lasagne in cardboard boxes. In this case study only aluminium containers are investigated.

For the aluminium container 22 grams for an 800 gram portion package are modelled as indicated by EAFA[1]. The weight of the other packaging parts is shown in Tab. 1. The disposal of the packaging of the ready-to-serve lasagne is considered too. Around 50 % of the aluminium packaging is assumed to be deposited on a landfill, the rest is recycled.

Tab. 1: Weight of packaging of 800 g and 1 kg of ready-to-serve lasagne. Losses not considered.

Type	**Unit**	**Material weight (800 g packaging)**	**Extrapolated material weight (1000 g packaging)**
Aluminium container	g	22	28
Paper Sleeve	g	20	25
Plastic Lidding Foil	g	1	1.3

General assumptions

Average transport distances are applied. All vegetables are assumed to be grown in season and not be grown in heated greenhouses. The domestic storage for the cooled ingredients and the chilled ready-to-serve lasagne is assumed to be one day. The storage in the freezer is for 30 days. The preparation of the ready-to-serve lasagnes is assumed to take place as described on the package.

Impact Assessment of Ready-to-Serve and Home-Made Lasagne Bolognese

The environmental impacts of the ready-to-serve and the home-made lasagne Bolognese preparation over the full life cycle are evaluated and compared.

The relative comparison of the environmental impacts of the different lasagnes Bolognese under study shows that from an environmental point of view a chilled ready-to-serve lasagne is comparable to a home-made lasagne. The frozen ready-to-serve lasagne causes higher impacts throughout all categories considered. From an environmental point of view it is preferable to heat the ready-made lasagne in the microwave (Fig. 2).

[1] Personal communication, Graham Houlder, EAFA, June 2012

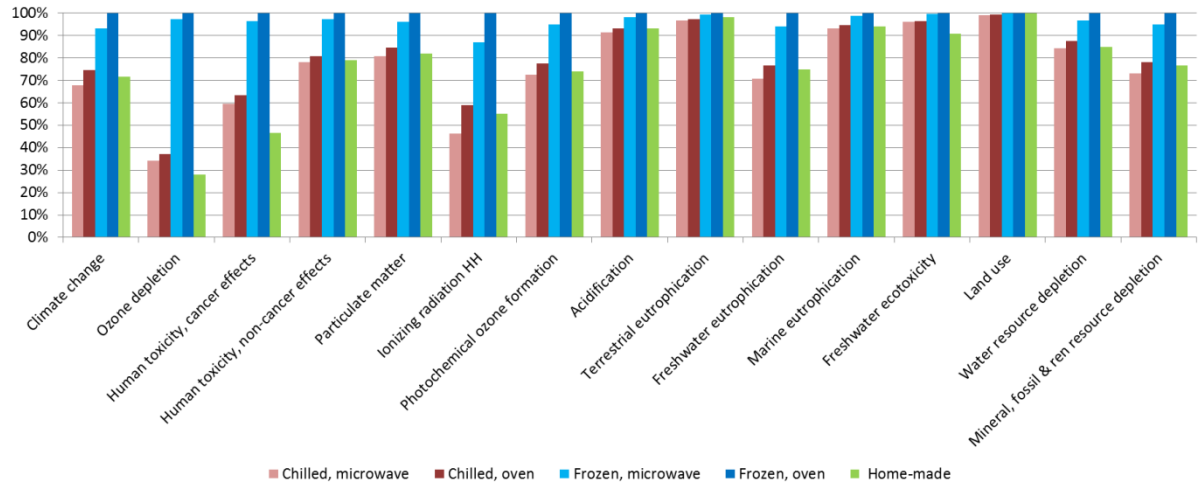

Fig. 2: Comparison of the environmental impacts of the different lasagnes Bolognese under study. The comparison is based on a relative scale. Assessed based on the recommendations of the ILCD (Hauschild et al. 2011).

Greenhouse gas emissions

The cultivation and breeding of the ingredients contribute the most to the total greenhouse gas emissions of the different lasagnes (Fig. 3). The supply of the ingredients accounts for ca. 5 kg CO_2-eq per kilogram of lasagne served. There is no significant difference between the ready-to-serve lasagnes and the home-made one.

Whilst the GWP of primary packaging of the ready-to-serve lasagne is dominated by the aluminium container (88 %); it causes only a minor part (2 % - 5 %) of the total greenhouse gas emissions.

The way of preparation significantly influences the total greenhouse gas emissions. The heating of the chilled lasagne in the oven is over six times as CO_2-intense as the heating in the microwave. In case of the frozen lasagne, the CO_2-emissions double for the heating in the microwave and increase only slightly for the heating in the oven.

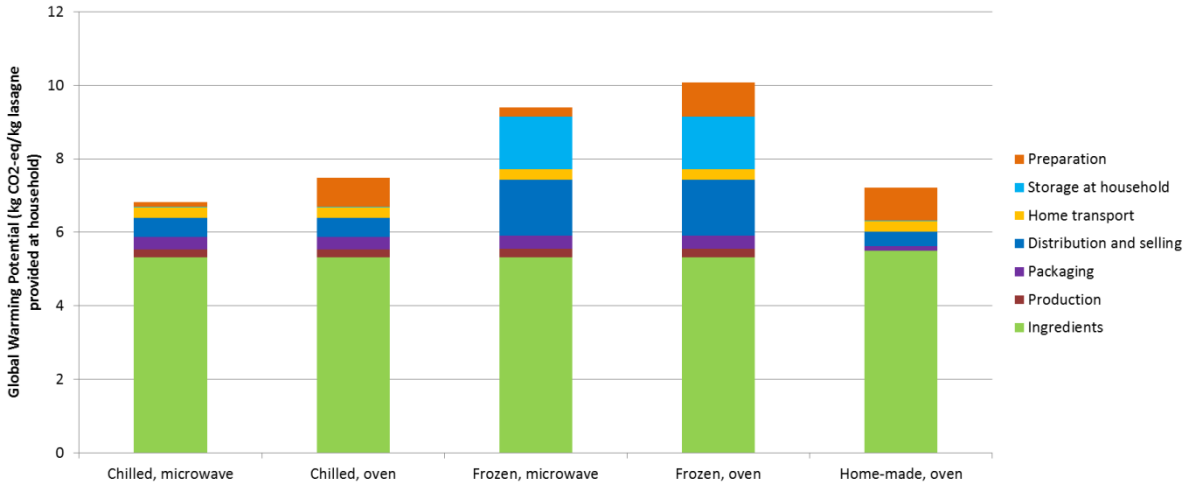

Fig. 3: Comparison of global warming potential of the different lasagnes Bolognese under study. Distinguished are different stages in the supply chain.

Interpretation - Summary of observations

The supply of the ingredients is the most significant stage in the lasagne production chain. This applies across all category indicators analysed and independent of the type of lasagne under study. Due to the same recipe and similar overall losses, the contribution of this stage does not differ significantly between the different lasagne types under study. Among the ingredients it is the beef that contributes the most to the different impact categories. It is followed by the pork and the cheese.

The aluminium container is the most significant contributor to the environmental impacts of the packaging material of the ready-to-serve lasagne. **Nevertheless, the packaging material does not cause major contributions to the environmental impacts of the whole life-cycle.**

The cold chain within the distribution and selling as well as the storage at home is very significant for the frozen lasagne. This is mainly due to the increased electricity consumption.

Conclusions

In terms of the environmental performance, there is no significant difference between chilled ready-to-serve lasagne and home-made lasagne. The study shows that, from an environmental point of view, the frozen ready-to-serve lasagne tends to poll worse than a home-made lasagne or a chilled ready-to-serve lasagne. However, it has to be considered that such a product also fulfils a slightly different function as it can be kept on stock for much longer than the chilled or home-made products. A more relevant comparison for a future study would be the performance of a frozen ready-to-serve lasagne with a home-made lasagne made from ingredients that could be kept on stock for several months.

Due to the uncertainties given in LCA studies in general, small differences should not be overstated.

The comparison of the home-made and the ready-to-serve lasagnes shows that the respective food losses occur at different stages in the production chain and in different shares. **Overall, the ready-to-serve lasagne production chain causes slightly less food waste than the home-made lasagne.** Whether the portion control influences the food losses and consequently the environmental impacts cannot be derived from this study nor from the available literature. In order to not bias the results in one or the other direction, it was assumed that both types of lasagne are prepared with the same amount of ingredients. Small differences in recipes e.g. the meat content can be very important and thus would alter the results (e.g. comparing a vegetarian Lasagne with Lasagne Bolognese).

The rough estimation of the prices of the different types of lasagne under study shows that the costs are in the same range. The common frozen ready-to-serve lasagne costs 12.4 CHF/kg; the prize of a chilled ready-to-serve lasagne is 11.2 CHF/kg and the ingredients of the home-made lasagne cost around 11.1 CHF/kg. The electricity consumed in the household is not included.

Independent of the lasagne type, a lower content of meat as well as an efficient cold chain could considerably decrease the environmental impact. A reduction in the food losses would further reduce the environmental impacts of the lasagnes as the supply of the ingredients causes the most important contributions to the different environmental impacts.

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