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FOOD CONSUMERS LCA: FORM CONSUMERS SURVEY TO ENVIRONMENTAL IMPACT ASSESSMENT

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ABSTRACT

Food consumption is one of the most influential stages when classifying the impact of a food product. However, it is generally difficult to take this stage into account because most consumers do not follow a unique buying pattern. Therefore, the aim of this study is to perform a detailed consumer study and a LCA in order to describe consumer behavior from an environmental point of view. For this research, we have selected a dish prepared with fish as an unit and a study because of its versatility. Overall, it is concluded that heating is the most influential stage on the impact assessment due to electricity use. Moreover, heating in microwave is the most environmentally friendly choice.

INTRODUCTION

It is widely accepted that Life Cycle Analysis (LCA) is an useful tool which measures the potential environmental impact of a food product. Moreover, it has been established that the food consumption is one of the most influential stages when classifying the impact of food (Jungbluth et al, 2000). However, it is generally difficult to take this stage into account on a conventional LCA due to variability of the data.

Most consumers do not follow a unique buying pattern mainly due to the wide variety of purchase options that exist today. Consumers can not only choose where to make their purchase (super, hyper, on-line), also the selling format (individual or family package, etc.), the conservation mode, or the product packaging. All these variables affect significantly the final environmental impact of products (Vazquez-Rowe et al, 2013)

Although LCA provides the data on environmental impacts that environmentally conscious consumers need, the form in which it is provided is yet highly inaccessible. Published LCA reports are extremely technical, featuring long lists of environmental pollutants and abounding with technical terms. They are not directed at lay people who need to get a quick overview of the most important issues and make decisions on a day-to-day basis. So, developing accessible information is thus a key priority. Before that, it is necessary to know the consumer behavior in terms of environmental impact.

The main objective of this article is to perform a detailed consumer study and a LCA which describes consumer behavior from an environmental point of view. For this study, we have selected a dish prepared with fish as a unit because of its versatility as a product.

MATERIALS AND/OR METHODS

With this frame, an online survey to food consumer has been made in order to describe the consuming behaviour about prepared dishes based on fish. After that, data provided by the study have been translated to environmental impact throughout a life cycle assessment.

Consumer Survey

The questionnaire was conceived as a thorough assessment of the habits and beliefs of individual consumers among the Spanish population. The questionnaire was anonymous in order to guarantee a higher level of participation and honesty. The number of questions was forcefully limits, there by requiring a pondered choice of the questions and of the wording. For this reason, each question was debates by a multidisciplinary team composed of marketing, survey and consumer behaviour specialists, representatives of commercial companies, statisticians and people experienced in the LCA sector. Finally, the survey was divided into four main sections: buying, storage, preparation and final disposal habits.

The next step after formulation of the questionnaire was to choose an adequate dissemination media for the survey. In order to reach a large universe and different geographical regions of the country, a web online medium was the natural option. Mundosabor® allows simple writing procedures in order to make the questionnaire available in the internet. Afterwards, it is only necessary to send the questionnaire among consumer community registered and selected in the database Mundosabor® Platform.

To face this challenge we examined consumers' habits and beliefs about food consumption. Questionnaires were posted to 400 randomly selected adults, with 180 questionnaires completed. They were required to be ready-to-eat fish dish consumers. Analyses were conducted with R-project statistical software (v 2.11.0).

Life Cycle Assessment

- Goal and scope definition: The object of this study is a cradle-to-gate attributional life cycle assessment of the consumption of an individual portion of a ready-to-eat fish meal.

  The life cycle inventory only takes into account the consumer stage of the product; fishing, processing and retailing stages are out of the study since no specific product have been selected.

  The first step is buying the dish at the supermarket or store. Then the consumers transport either by car, public transport or walking from supermarkets to home. Once at home, consumers store the product for a specified time in the refrigerator until consumption. So, different heating scenarios were analysed to compare different behaviours. Since there are different products on the shopping cart, mass allocation has been followed for this study.

- Data Quality: Foreground inventory data are provided in a questionnaire by Mundosabor® Platform and it is referred to 2012 year. Foreground data include: (i) transport distance and vehicle type to the store; (ii) time needed for heating (iii) way of washing up (machine or by hand); and (iv) recycling rates.

  The primary source of background inventory data used in this study is the ecoinvent data v2.2 (ecoinvent Centre 2010), which contains inventory data of many basic materials,

energy carriers, waste management and transport services.

- Selected impact categories: A number of impact categories from ReCiPe methodology have been selected for the impact assessment: Global Warming potential (GWP); Ozone layer Depletion potential (ODP); Terrestrial Acidification Potential (TAP); Freshwater Eutrophication Potential (FEP); Human Toxicity Potential (HTP); Photochemical Oxidation potential (POP); Particulate Matter formation potential (PMF); Terrestrial Ecotoxicity potential (TET); Freshwater Ecotoxicity potential (FET); Marine Ecotoxicity potential (MET): Water Depletion Potential (WDP); Fossil Depletion potential (FDP)
- Inventory: Once the consumer study concluded, the obtained data was adapted into energy, water and material input and output for an LCA system.

RESULTS AND DISCUSSION

Consumer survey

The survey about environmental impact assessment relation with the consumer behaviour in the Spanish population was successfully carried out, thereby yielding a total of 173 valid filled questionnaires. This total number of answers was analysed and characterized.

Regarding buying habits, most people buy in super or hypermarket once or twice each month. The distance to the buying place was about 3km and more than 50% of people use the car. The consumers usually carry a weight of 3% of fish dish prepared in the total of the purchase. Moreover, the 42.13% of consumers stated that the packaging is the most important environmental factor in the completion of the purchase.

Surveyed Spanish consumers also display relevance characteristics in storage. More than 50% of those polled maintain the dish on the freezer for a maximum of 10 days. After the storage, they cooked or heat up the dish mainly on the microwave for six minutes. Regarding the disposal, most people do the washing up on the dishwasher and always recycle the packaging.

Life cycle impact assessment

The Global Warming Potential (GWP) of the consumption of the fish based ready-to-eat meal is about 0,35 kg CO2 eq. The electricity used for heating is the main contributor to this impact due to the combustion of coal and natural gas. Furthermore, almost all the impacts categories are mainly influenced by the cooking or heating stage (>75%) (Figure 1).

However, Ozone Layer Depletion Potential (ODP) and Photochemical oxidation Potential are mainly influenced by the exhausted fumes from passenger car engines. It is also remarkable the water depletion impact assessment on the washing up stage. However, for this specific impact a regionalized inventory and impact potential is recommended.

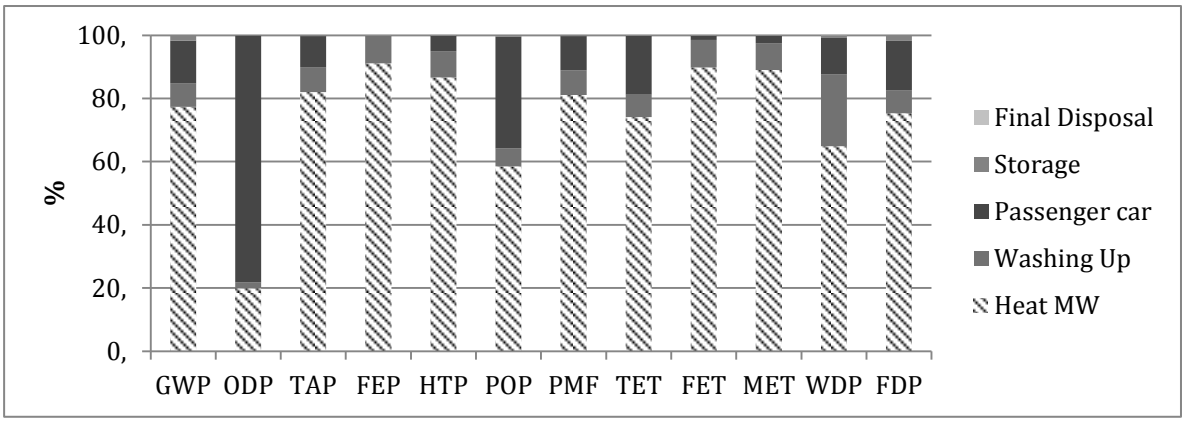

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Figure 1: Environmental impact assessment of the consumption stage of fish based ready-to-eat meal.

On the other hand, when comparing this microwave heating scenario with the oven heating or cooking scenario, a significant improvement of 30% in most of selected impacts categories have been observed (figure 2).

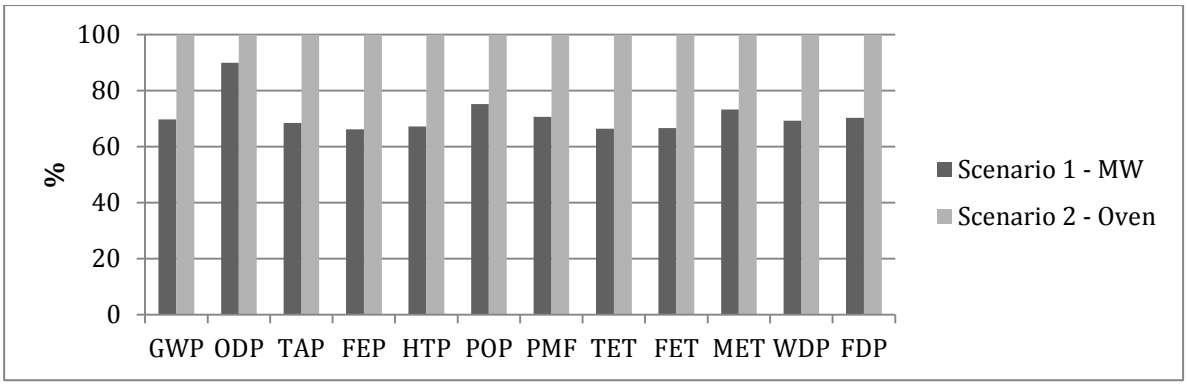

Figure 2: Comparative environmental impact assessment of the consumption stage of fish based ready-to-eat meal where in scenario 1 heating by microwave is taken into account and in scenario 2 heating in the oven.

CONCLUSIONS

On one hand, this study concluded that although most consumers are environmentally aware, most of them, do not have enough information to make a responsible food choice. On the other hand, it is shown that the heating is the most influential stage on the impact assessment due to electricity use.

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