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The role of consumer purchase and post-purchase decision-making in sustainable seafood consumption. A Spanish case study using carbon footprinting

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ABSTRACT

Sustainable consumption in the food sector is a desirable goal which is often difficult to achieve depending as it does on the interaction of a broad set of factors, such as market prices or consumer preferences. In the current study, a distinction has been made between pre-purchase consumer decision-making, on the one hand, and purchase and post-purchase consumer decision-making, on the other. Purchase and post-purchase decisions are those that affect their actions directly. These include vehicle selection to purchase the products, shelf-time in the household or the cooking method employed. The main goal of this study was to evaluate the environmental profile in terms of carbon footprint (CF), of a range of scenarios with varying direct environmental decisions performed by consumers. More specifically, the CF of an iconic frozen seafood product in Spain (one package of frozen fish sticks of Patagonian grenadier) was modeled for a total of 24 scenarios of fish sticks consumption. Results showed a high variance in environmental impacts depending on the scenario chosen, proving the high variability in CF that the consumption of frozen seafood can show depending on consumer choices or needs. Additionally, results showed the relative importance of the consumption stage within the entire supply chain in terms of GHG emissions. Hence, important reductions may be achieved in the diet of an individual merely by improving the behavioral traits when purchasing and consuming food products. Consequently, consumers, if given the correct environmental guidelines through awareness campaigns, can play an active and relevant role in the reduction of the environmental profile of seafood products through behavioral modifications when purchasing and consuming them.

Introduction

Sustainable consumption, according to the Oslo definition, is a set of economic, environmental and social factors that constitute the basis for the use of services and products that provide higher quality of life while minimizing the impacts on the environment (UNCSD, 1994). While it is an option for consumers to select products based on their environmental impact, it is not always appropriate for consumers to take these decisions, given the wide range of other factors that may be influencing them. For instance, political issues, economy, price, presentation or personal preference, are some of the many factors that can influence the customer's decision (Carlsson-Kanyama, 1998; van Ittersum et al., 2003; Vermeir and Verbeke, 2008).

In the food sector, as in many other industrial sectors, household consumption patterns, while perhaps not constituting a decisive part of the environmental impact of a specific product, can cause varying impacts depending on the nature of the decisions taken prior to their intake (de Boer et al., 2006). For instance, choosing fresh hake from long liners instead of hake caught by trawlers has shown an outstanding potential environmental benefit for a wide range of environmental dimensions, including climate change and acidification (Vázquez-Rowe et al., 2011). The consumer's decision-making can be divided into two main blocks from an environmental perspective. On the one hand, purchase and post-purchase decision-making, which involves the action of the consumers directly throughout the purchase and consumption process, such as vehicle selection to purchase the products, shelf-time in the household or the cooking method employed. On the other hand, there is pre-purchase decision-making, based on the selection of different options depending on their background environmental profile.

Pre-purchase factors affecting decision-making have been widely analyzed in the literature, mainly through publications that compare the environmental burdens of different dietary choices (Carlsson-Kanyama, 1998;Eshel and Martin, 2006; Franks and

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Hadingham, 2012) or suggested the implementation of specific carbon calculators (Kim and Neff, 2009; Shirley et al., 2012). For instance, some of these studies reveal that high consumption of animal products in Western countries, including products derived from cows and pigs, contribute significantly to these nations' GHG emissions (Compassion in World Farming, 2007; Garnett, 2011; Deckers, 2012), questioning the sustainability of food consumption patterns (Carlsson-Kanyama, 1998; Carlsson-Kanyama and González, 2009). Other studies have highlighted the high variability in GHG emissions existing between different seafood products (Iribarren et al., 2010a, 2011; Ziegler et al., 2013) and fishing patterns (Vázquez-Rowe et al., 2011, 2013a). However, unlike other animal products, certain seafood products, such as mussels or small-pelagic species, show very low emissions in their supply chain (Iribarren et al., 2010b, 2011). Therefore, it seems plausible that pattern changes in the way humans obtain their protein supply will be needed to attain desired GHG emission reductions in the food and beverage sector (McMichael et al., 2007; Deckers, 2012).

However, it may be difficult for the general public to keep track of which elements of the diet have lower environmental profiles, since there are numerous exceptions that can alter the general perception (Coley et al., 2009). In fact, the concept *carbon capability* has recently been developed to analyze and understand the relation between the abilities of human individuals and their motivations and/or willingness to reduce emissions (Seyfang et al., 2007; Whitmarsh et al., 2011). If linked to consumption patterns, purchase and post-purchase decision-making by consumers would encompass all those behavioral traits that do not depend on the carbon emissions linked to a product prior to its shelf-life, including, therefore, the transportation to a retailing point or the cooking of the purchased products. While some studies have already started analyzing the environmental gains that may be attained through improving purchase and post-purchase consumption decisions (Persson and Bratt, 2001; Coley et al., 2009), this domain remains essentially unexplored.

Seafood represents an important portion of the annual diet intake in Spain. More specifically, Spaniards consume 27.3 kg of seafood per year on average (FROM, 2010), representing approximately 12.9% of their annual spending on food products. Of this total amount, 3.3 kg corresponded to frozen seafood products, such as fish sticks, calamari rings or frozen fish fillets, mainly of hake and cod (FROM, 2010). Concerning consumption patterns, shoppers in Spain have reported an increasing interest in labels on fish products in recent years. In fact, 70.5% of consumers admitted checking the label of seafood products on a regular basis in 2010 (FROM, 2011). While their main concerns were related to expiry dates, ingredients or nutritional values, this situation provides a good starting point for including environmental sustainability data on seafood packages.

Consequently, the inclusion of eco-labels on seafood products in Spain is an achievable goal in years to come, which would be in line with similar trends already observed in other Western nations, such as the United Kingdom (Seafood Choices Alliance, 2007). For instance, Gadema and Oglethorpe (2011), basing their study on an extensive survey targeting UK supermarket consumers, detected a high level of positive attitudes towards eco-labeling (in this specific case, carbon labels). Nevertheless, it is important to take into account that the results from this study also revealed high levels of confusion between customers regarding the interpretation and understanding of these carbon labels. Moreover, given the wide range of decisions consumers may take regarding their final product selection – which do not necessarily have the best environmental profile – it may be more interesting to inform them about how their purchase and post-purchase consumption patterns and choices may influence the final environmental profile of a given product (Garnett, 2011).

While many eco-labels in the seafood sector focus on stock assessment issues, some are starting to include additional environmental parameters, such as discarding or carbon footprint – CF (Thrane et al., 2009). CF is the measure of the potential greenhouse gas (GHG) emissions that are generated by a product, process or service during its life-cycle (Carbon Trust et al., 2011). Hence, it follows the life-cycle perspective of life cycle assessment (LCA) methodology (ISO, 2006a), but limiting its analysis exclusively to the global warming potential impact category. Therefore, in this study, the direct environmental decisions made by consumers are modeled in order to (i) track the influence that these decisions may have on the CF of the target product; (ii) analyze the different environmental hotspots in each of the selected scenarios; (iii) provide an estimated lump sum of the total reduction in GHG emissions for the sale of this particular product in Spain; and, (iv) discuss the appropriateness of including consumer best-performing patterns in food product eco-labels. The product selected in this study was one package of frozen fish sticks of Patagonian grenadier.

Materials and methods

Goal and scope definition

A total of 24 scenarios regarding the consumption of fish sticks were modeled in the current research study. The research undertaken was done in collaboration with Pescanova, the main seafood processing company in Spain and one of the top 10 such companies in the world (Barciela, 2011; Vázquez-Rowe et al., 2013b). While the initial objectives of that study were limited to a business-to-business (B2B) approach, in which the system boundaries for the CF estimation of the products was limited to the gate of the processing company, the availability of data sources led to the completion of the entire life-cycle up to consumption in the household (business-to-consumer approach – B2C). Environmental impacts for the fish extraction and processing stages, as well as distribution and retailing were found to be highly stable. However, consumer patterns were identified as highly variable depending on shopping, storage and cooking methods. Hence, the scope of this case study is limited to those activities directly performed by consumers.

Patagonian grenadier (*Macruronus magellanicus*) fish sticks were the product selected due to the variety of cooking options they potentially possess. In fact, the products' package suggests three distinct cooking modes for this specific product (Pescanova, 2012). Therefore, the functional unit (FU), which is the reference unit which the energy and material flows refer to (ISO, 2006b), was set as one package of fish sticks of Patagonian grenadier[1]. The boundaries of the production systems, as seen in Fig. 1, were set from the moment when the consumer acquired the product at the retailing store (including the travel distance to the purchase point) up to the intake of the fish sticks in the household.

Data acquisition

Data were obtained from a variety of bibliographical sources. Three distinct cooking methods for fish stick preparation were considered: deep frying with sunflower oil, thermal insulation in an oven and conventional frying in a frying pan (with sunflower oil on a gas stove cooker) according to the recommendations of the wholesaler (Pescanova, 2012). Tables 1 and 2 present data regarding fish stick cooking, as well as consumer cooking preferences.

[1] One package of Patagonian grenadier contains approximately 323.5 g of edible product. Consequently, each fish stick weighs on average 32.35 g. The fish content of sticks was approximately 164.5 (50.9%).