



Impact of reducing fat, salt and sugar in commercial foods on consumer acceptability and willingness to pay in real tasting conditions: A home experiment



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ABSTRACT

Decreasing obesity or cardiovascular disease can be achieved by eating healthier foods with reduced contents of fat, salt and sugar. However, these ingredients have a significant impact on the sensory quality of the food products that contain these ingredients, especially cooked sausage, chorizo, dry sausage, cheese and muffins. In this study, consumer appreciation of these five commercialized products (non-reformulated versions) and their respective reformulated versions with reduced contents of salt, fat and sugar was tested. An original home experiment was performed to assess consumer appreciation in natural consumption conditions. The experiment was divided into two steps that correspond to a pleasantness rating and a willingness to pay task. The two measurements were expected to yield comparable results with two aspects of consumer appreciation. Non-reformulated and reformulated versions were compared with a store brand and a trademark in a ranking task to evaluate their pleasantness positioning on the market. This latter experiment, which was conducted in a laboratory, enabled the validation of the home experiment. The results indicated that the cooked sausage reformulation did not maintain consumer appreciation and reduced its positioning on the market. For cheese and muffins, the reformulation did not affect the product pleasantness. The reformulation of dry sausage and chorizo not only maintained consumer appreciation but also increased pleasantness, which was consistent with a higher reservation price of approximately 12% compared to the other samples. For most products in this experiment, new technologies contributed to significant reduction in fat, salt or sugar whilst maintaining consumer appreciation.

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1. Introduction

To satisfy the expectations of European Nutrition claims, agri-food companies have to decrease the amount of salt, fat and sugar in 30% of their products. However, these ingredients are known to contribute to consumer appreciation; therefore, changing the formulation process may endanger the sensory quality of these products (Brauss, Linforth, Cayeux, Harvey, & Taylor, 1999; Drewnowski & Greenwood, 1983; Drewnowski, Nordensten, & Dwyer, 1998; Goh et al., 2011; Zoulias, Oreopoulou, & Kounalaki, 2002). A major challenge is to maintain consumer appreciation and consumption while offering healthier food products for the consumer. Overcoming this challenge was the main goal of the FP7 European project TeRiFiQ (289397), which provides the results presented in this paper. As a starting point, food rich in fat, salt and sugar were

selected (such as cooked sausage, chorizo, muffin, dry sausage, and cheese; see EFSA (2008), European Commission. (2007), European Parliament. (2006). Then, different reduction strategies, such as modification of the industrial process (Desmond, 2006; Emorine, Septier, Thomas-Danguin, & Salles, 2013), changes to the physicochemical and rheological properties of matrices (Mosca, Andriot, Guichard, & Salles, 2015; Safa, Gatellier, Lebert, Picgirard, & Mirade, 2015), the use of emulsions (Chapeau, Silva, Schuck, Thierry, & Floury, 2016; Lobato-Calleros et al., 2008; Oppermann, Renssen, Schuch, Stieger, & Scholten, 2015; Perez-Moral, Watt, & Wilde, 2014), the use of replacers (Katsiari, Voutsinas, Alichanidis, & Roussis, 1997; Kloss, Meyer, Graeve, & Vetter, 2015) or the addition of aromas (Lawrence, Salles, Septier, Busch, & Thomas-Danguin, 2009; Syarifuddin, Septier, Salles, & Thomas-Danguin, 2016), were applied. These technologies constitute valuable solutions for helping professionals who wish to reduce salt, sugar and fat contents; however, sensory studies are required to investigate consumer acceptability. As a final part of

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the project, this study evaluated 1) if reformulation maintained the sensory quality of the products and consumer acceptability considering pleasantness and willingness to pay and 2) if the reformulated products maintained their competitiveness according to other products on the market. To address the first objective, the commercialized non-reformulated versions (**NR**) of the products were compared with the non-commercialized reformulated versions (**R**) of the products. For the second objective, “NR” and “R” versions were compared with other brands (a trademark and a store brand).

The challenge of this study was to assess the perception of the products in the most natural consumption conditions. As soon as “the most expensive but most realistic situation is when consumers take the product home and try it under normal circumstances on several occasions” (Lawless & Heymann, 2010), the strategy was to set up a home experiment. Thus, participants had to taste separately the “NR” and “R” versions at home. Instead of other home-experiments (e.g. HUT), very few questions were asked 1/ to maintain the most natural situation and 2/ to prevent the consumer to focus on the sensory characteristic of the samples that may endanger the following experiments. The paradigm of this home experiment required two steps. In the first step, a consumer had to taste the product and evaluate its pleasantness. Pleasantness measurements are usually performed to determine how intrinsic and extrinsic characteristics interact in the global perception and assess total product quality (Lange, Martin, Chabanet, Combris, & Issanchou, 2002; Schifferstein, Kole, & Mojet, 1999; Siret & Issanchou, 2000). In the second step, a willingness to pay procedure was adapted to assess product valuation and product acceptability. Incentive measurements, such as auctions and the Becker–DeGroot–Marschak (BDM) mechanism (Becker, Degroot, & Marschak, 1964), are employed to reveal consumer willingness to pay. Willingness to pay experiments present subjects with real purchase decisions and enable them to reveal their true preferences and values for different goods (Ginon, Combris, Loheac, Enderli, & Issanchou, 2014; Ginon, Lohéac, Martin, Combris, & Issanchou, 2009; Lange et al., 2002; Noussair, Robin, & Ruffieux, 2004a, 2004b; Vickrey, 1961).

To assess the second objective, which was to evaluate whether reformulated foods maintain their competitiveness on the market, a direct comparison of the versions was performed using a rank test. For each type of food product, consumers had to rate the pleasantness of “NR”, “R”, a store brand and a trademark. The experiment was conducted in a laboratory, without packaging and in the controlled conditions of sensory rooms. Ranking tasks enable the direct comparison of samples and is appropriate for comparing the pleasantness of products in the same perceptual space (SSHA, 1998). Therefore, this experiment was performed to cross-validate the results of the experiment that was conducted at home regarding the position of the “NR” version vs the “R” version and assess the pleasantness positioning of these two versions compared with other brands on the market.

The great originality of this paper belong first to the different methods used to assess the product appreciation. The experimental design enables cross validating home and classic tasting conditions in lab with very similar product versions (reformulated vs non-reformulated). At home, the one-shot evaluation of pleasantness and willingness to pay is supposed to reflect real tasting situation leading, or not, to a subsequent purchase. This paradigm is particularly relevant at the final stage of product developments to assess whether a new formulation maintains their appreciation and valorisation. This is the case of the present study where the reformulated products are expected to be ready for commercialization. Inexpensive food products were delivered in shopping-bags to contextualise the experiment and enrolled participants in the most ecological conditions. This provides another originality of the

present work since experimental economics studies conducted at home and involving inexpensive food products are underrepresented in the literature.

2. Materials and methods

The study was divided into two experiments. Experiment 1 was conducted at home, where two measurements were performed to reveal consumer acceptability: pleasantness rating and willingness to pay mechanism. The objective of the experiment was to evaluate “NR” and “R” versions in real consumption conditions. Experiment 2 corresponded to a ranking task in a laboratory setting and evaluates these products positioning compared to other brands of the market.

2.1. Participants

Participants were randomly selected from a panel of volunteer consumers (ChemoSens Platform’s PanelSens database¹). A total of 144 subjects, who are described in Table 1, were recruited from the vicinity of Dijon (France) for Experiment 1 (at home). A total of 135 subjects of Experiment 1 also agreed to participate in Experiment 2 (in a laboratory). Consumers were selected only if they significantly participated in purchasing food products for their use or for their family. They declared to have no aversion to pork products, cooked sausage, and cheese or baked goods and self-reported no problems with their sense of smell or allergies. They were asked for their consumption frequencies regarding these products and the variable was considered in models. Even if the participants significantly eat more frequently dried sausage and cheese than the other products, consumption frequency did not explain the results. The selected participants signed an informed consent form at the beginning of the study; the objective of the experiment was not revealed at this time. The subjects received a fee of 20€ (Experiment 1) or 30€ (Experiments 1 & 2). The experiments were performed in accordance with the Declaration of Helsinki for Medical Research Involving Human Subjects and ethical rules enforced by French law; the protocol has been viewed and approved by the human research ethics committee (Comité de Protection des Personnes Est-1, No. 2013/64 – IDRCB 2013 – A01084-41 on 11/21/2013 and Agence Nationale de la Santé et du Médicament, No. B 131283-81 on 11/20/2013).

2.2. Food samples

For Experiment 1, five food product types were obtained from the European industrial partners of the TeRiFiQ project. They consisted of mini dry sausages (Boadas), cooked sausage (Leiv Vidar), soft chorizo (Boadas), “Trappist” semi hard cheese (Orval) and muffins (Millba). For each food products, two versions were compared: a non-reformulated version (**NR**), which was already commercialized, and a reformulated version (**R**), which was reduced in salt (NaCl), fat or sugar and not commercialized (for details of the reduction, refer to Table 2). The two versions were strictly identical in terms of shape, colour and weight. The reductions strategies used were more or less specific of each product. To prevent the effect of packaging on consumer beliefs and to ensure natural conditions, both versions were packed in the commercialized packaging of the NR version (Table 2). Therefore, the participants had no external cues to discriminate between the two versions of the samples and were confident in their ability to taste an ordinary industrial food that they may find on the market. Both versions provided the same, and worst, legal nutritional information. In

¹ Declared to the Commission National Informatique et Libertés (#1148039).

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