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Impact of nutritional information on consumers' acceptance of cheese with reduced sodium chloride content



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ABSTRACT

The sensory acceptance of cheese with different sodium chloride contents and the influence of nutritional information on consumers' acceptance and declaration of willingness to purchase the cheeses were assessed. Three samples of cheese with different contents of sodium chloride and two types of nutritional information and nutritional claims were used. No significant differences in acceptance were found between cheeses with different sodium chloride contents, despite minor differences in results of descriptive analysis. NaCl content and information type did not affect the respondents' acceptance ($P > 0.05$), and a significant interaction between these factors was not found. Nevertheless, more people expressed their willingness to purchase the cheese with the claim of reduced NaCl content than without such a claim. There is thus an opportunity to use 15% less sodium chloride in cheese without consumers' rejection. Moreover, there is a need to use nutritional claims to increase willingness to buy such cheese.

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1. Introduction

The frequency of heart disease and hypertension is growing, despite the great number of efforts to stop this process. The leading cause of the defeat of these attempts is the global shift in lifestyle, which includes diet providing increased salt intake (Appel et al., 2012; Doyle & Glass, 2010; Sleator & Hill, 2007). Reducing salt intake represents one of the most worthy objectives for advancing public health worldwide (Drake, Lopetcharat, & Drake, 2011). Chloride salt (NaCl) is a main source of sodium in a diet. It is estimated that at least 75% of sodium intake in the industrialised diet originates from NaCl added to manufactured foods (Gibson, Armstrong, & McIlveen, 2000; Mattes & Donnelly, 1991). Thus, it is reasonable to target first the reduction of salt in processed foods. As cheese consumption is increasing worldwide, including in Poland, reduction of salt in cheese as a sodium carrier needs to be taken into consideration (Cruz et al., 2011; Drake et al., 2011).

Changing the composition of food products is one of the methods of influencing the diet. A decrease in NaCl intake could be achieved by using mineral salt replacers as an alternative to this compound or by reducing the amount of NaCl in the product (Dotsch et al., 2010; Grummer, Bobowski, Karalus, Vickers, &

Schoenfuss, 2013). It was indicated, that cheese made with potassium chloride (KCl) had the least negative effect on flavour compared with calcium and magnesium chlorides (Grummer, Karalus, Zhang, Vickers, & Schoenfuss, 2012). Replacing NaCl with KCl enables the food to maintain the salty taste, which is important from the consumers' perspective (Gomes et al., 2011; Grummer et al., 2013; Karimi, Mortazavian, & Karami, 2012). Decreasing the NaCl level in food can have a significant influence on consumer acceptance because of the changes in taste (Cruz et al., 2011; Drake et al., 2011), flavour or texture (Ayyash, Sherkat, & Shah, 2012; Rulikowska et al., 2013). Apart from adding saltiness, salt enhances mouthfeel and balance while suppressing off-flavours, and enhances overall palatability (Breslin & Beauchamp, 1997).

Reformulation can bring the desired effect only when the product with a modified composition will meet the consumer's acceptance (Bruhn, 2007; De Steur et al., 2010; Frewer, Scholderer, & Lambert, 2003; Van Trijp & Van der Lans, 2007). The increasing attention that costumers pay to health and safety of food is regarded as an important factor influencing the acceptance of products with increased health benefits (Guerrero et al., 2009; Kühne, Vanhonacker, Gellynck, & Verbeke, 2010; Pieniak, Verbeke, Scholderer, Brunso, & Olsen, 2008).

Product acceptance depends on the assessment of a variety of qualities of the food. Research has shown that innovative milk products with substitutes for milk fats are acceptable, if there is no difference in physico-chemical characteristics (Kühne et al., 2010; Verbeke, 2006). However, despite considerable research into the

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effects of food reformulation on health, consumers' reactions to the modified taste which results from a reduced level of salt has not been determined.

Sodium is currently the main focus of public health policies that aim to prevent diseases associated with excessive intake of this nutrient (McLean, Hoek, & Hedderley, 2012; Wyness, Buttriss, & Stanner, 2012). To reduce salt consumption, nutrition labelling may be used as a cost-effective intervention to improve population nutrition (Campos, Doxey, & Hammond, 2011). There have been many studies of nutrition labels (Agarwal, McCoy, Graves, Gerard, & Clark, 2011; Felicio et al., 2013; Grimes, Riddell, & Nowson, 2009; Petersen et al., 2013) and specific labels that highlight the sodium contents of high- and low-sodium products have been created (McLean et al., 2012).

The number of consumers who report reading the salt content of food products is lower in comparison with other nutrients (Marshall, Bower, & Schroder, 2007). Few studies have examined consumers' ability to interpret information regarding salt labelling on food products (Grunert, Wills, & Fernández-Celemín, 2010; Sacks, Rayner, & Swinburn, 2009; Van Kleef, van Trijp, Paeps, & Fernández-Celemín, 2007). Consumers criticise the use of scientific terminology on nutrition food labels. Nevertheless, results of various studies showed that degrees of understanding of nutrition labels were even higher than degrees of usage (Grunert et al., 2010; Petersen et al., 2013) and, in addition, consumers were not interested in salt reduction (Newson et al., 2013).

In recent years, the traditional nutrition information in table or grid form has been supplemented by a variety of simplified nutrition labels that appeared on the front of the pack, often called front-of-pack (FOP) signposting information (Sacks et al., 2009; Van Kleef et al., 2007). Provision of this information can help consumers in comparing products according to their healthiness (Kähkönen, Tuorila, & Rita, 1996). In this context, it must be remembered that health and nutrition are only among several choice criteria, among which taste is one of the most important. As long as consumers perceive trade-off between taste and health, interest in healthy eating will be limited. Making these trade-offs disappear is mostly a question of product reformulation, not just a question of providing nutrition information (Grunert et al., 2010). Nevertheless, there is empirical evidence for the existence of a positive link between nutritional label use and healthy food choices (Barreiro-Hurlé, Gracia, & de-Magistri, 2010). It has also been shown that the use of nutrition labels has no effect on the rating of taste of food products, e.g., for a sweet pastry (Steenhuis et al., 2010).

The aim of the study was to assess the sensory acceptance of the cheese with different sodium chloride contents: standard content (cheese P), reduced by 15% (cheese P-15) and reduced by 25% (cheese P-25). Moreover, the influence of various forms of nutrition information on the label of cheese on the consumers' sensory acceptance and declaration of willingness to buy cheese was assessed.

2. Materials and methods

2.1. Products

Edam and Gouda cheeses are among the most popular cheeses in Poland; their share of sales volume of cheese is 45.8%, and in value of sales is 43.0%, primarily because of their widespread availability and lower prices compared with other cheeses (Goczał, 2011). Lowering the NaCl content in cheese, intake of which is high, gives a chance to substantially reduce the content of sodium in the diet of Poles, especially in a situation with a continuously increasing consumption of cheese.

Table 1
Composition of Edam cheese measured after 1 week of ageing.^a

Parameter	Experimental cheese		
	P	P-15	P-25
Moisture	40.32 ± 3.26	41.92 ± 3.39	40.60 ± 3.29
Fat	27.61 ± 2.78	26.73 ± 2.69	27.34 ± 2.75
NaCl	1.52 ± 0.20	1.30 ± 0.18	1.16 ± 0.15

^a Values are given as g 100 g⁻¹ and are means ± SD (*n* = 3). P, cheese with standard sodium chloride content; P-15, cheese with sodium chloride content reduced by 15%; P-25, cheese with sodium chloride content reduced by 25%.

Edam cheese with different levels of sodium chloride was manufactured by a Polish milk factory. The modified salt content in the cheese was achieved through varying time of keeping cheese in brine; cheese with standard content of NaCl (P) was dipped in brine for 48 h, while cheese with sodium chloride reduced by 15% (P-15), and cheese with sodium chloride reduced by 25% (P-25) were immersed in saline for 36 h and 24 h, respectively. Moisture content, fat and content of sodium chloride were measured (Table 1). The methods of the Association of Official Analytical Chemists (AOAC, 2000) were used to determine fat content (method 933.05), moisture (method 926.08), and sodium chloride content (971.19). All chemical analyses were performed in triplicate. The cheese samples were packed with replacement packs with label information. They were provided by the cheese producer to the sensory evaluation laboratory in refrigerated conditions. All cheese samples were at a comparable stage of their shelf-life, according to the manufacturers' labels. Next, they were cut into slices of approximately equal size and weight, and the samples were then placed in plastic, odourless, and disposable boxes covered with lids. These were conditioned at room temperature for 2 h before evaluation.

2.2. Nutrition information on cheese labels

The traditional nutrition information in tables and nutrition claims were examined. Cheese with standard content of NaCl (cheese P) was presented with two nutrition labels differed according to the types of tables: (i) a short table of nutrition facts (STNF), that contained information on energy, protein, carbohydrate and fat per 100 g of the product or (ii) an extended table of nutrition facts (ETNF), containing information on energy value, the amount of protein, carbohydrates including sugar, fats including saturated fatty acids, fibre, calcium and sodium in 100 g of the product.

Cheese with sodium chloride content reduced by 15% (P-15) was presented with a label containing (i) an ETNF or (ii) an ETNF and the statement "Contains 15% less salt!" (ETNF and S1). Presenting such a statement is not allowed in Poland according to the current state of the law, because the modification of the product composition was less than 25% of the content of sodium chloride. A 25% reduction to the comparative reference food is the limit value that allows the placement of the nutritional claim on the food package.

Cheese with sodium chloride content reduced by 25% (P-25) was presented with a label containing (i) an ETNF or (ii) an ETNF and a nutritional claim "Reduced salt content" (ETNF and S2). Both labels met the legal requirements for labelling with nutrition facts and nutritional claims.

2.3. Subjects

In the first experiment, a panel of six individuals experienced in sensory methods, performed the evaluations of three samples of cheese. Participating members held expert qualifications according to ISO 8586-2:1994 (ISO, 1994), so they were appropriately

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