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HEALTHY TRENDS AFFECT THE QUALITY OF TRADITIONAL MEAT PRODUCTS IN MEDITERRANEAN AREA

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ABSTRACT

The actual trend in the meat industry is the development of healthy meat products with reduced fat and salt contents. In high quality products such as traditional sausages which are characterized by an absence of fermentation and long ripening times, it is essential to get a meat product with a high aroma quality but at the same time healthy composition. This reduction represents an added value to the production and consumption of traditional sausages because flavour is one of the most important characteristics for consumers. The problem associated to salt and fat reduction in dry sausages is the loss in sensory properties, especially in aroma. The reason is that sodium has a synergetic effect with the food matrix, enhances the sensory characteristics and produces the release of volatile aroma compounds from the food matrix. On the other hand, fat affects the generation of volatile compounds from which it is a precursor and modifies flavour perception due to the changes in the interaction and release of volatile compounds. Few references have studied the effect of salt and fat reduction in the aroma of traditional dry cured sausages. This manuscript summarized the effect of salt and fat reduction in flavour development of traditional sausages and its effect on aroma perception. Traditional foods should be adapted to new trends without losing their identity and sensory characteristics.

Key words: flavour / fermentation / salt reduction / low fat / sausage

1 INTRODUCTION

The current trend in meat products consumption is focused on the interest of consumers in improving health through the diet. In particular, for healthier products and products with low fat and salt. Specifically, the meat industry and consumers are aware of the relationship between the levels of sodium chloride and hypertension. In addition, there is a great demand for products with reduced salt levels (Ruusunen and Puolanne, 2005). In Spain, the consumption of meat products may represent a significant portion of the sodium intake (20–30%) therefore, it is important to reduce salt levels.

NaCl is the main responsible for the total amount of sodium in meat products and it contributes approximately to 79% of the total sodium in a meat products (Breidestein, 1982). Other sources of sodium in meat products are sodium phosphate, sodium nitrite, sodium ascorbate, monosodium glutamate and hydrolyzed vegetable proteins. It is believed that it is possible to replace between 30 and 50% of NaCl content in meat products without adversely affecting the sensory characteristics of the product.

Sodium chloride is a key ingredient in the production of meat products as it contributes to the water holding capacity, colour, texture and flavour. The main challenges associated with reducing salt in the meat industry are the loss of protein functionality and flavour (Desmond, 2006). On the other hand, fat affects the quality and acceptability of dry sausages. It also contributes to flavour, texture, mouthfeel and juiciness in addition to its technological effect during manufacture as it facilitates the continuous release of moisture from inside the sausage during ripening (Wirth, 1988).

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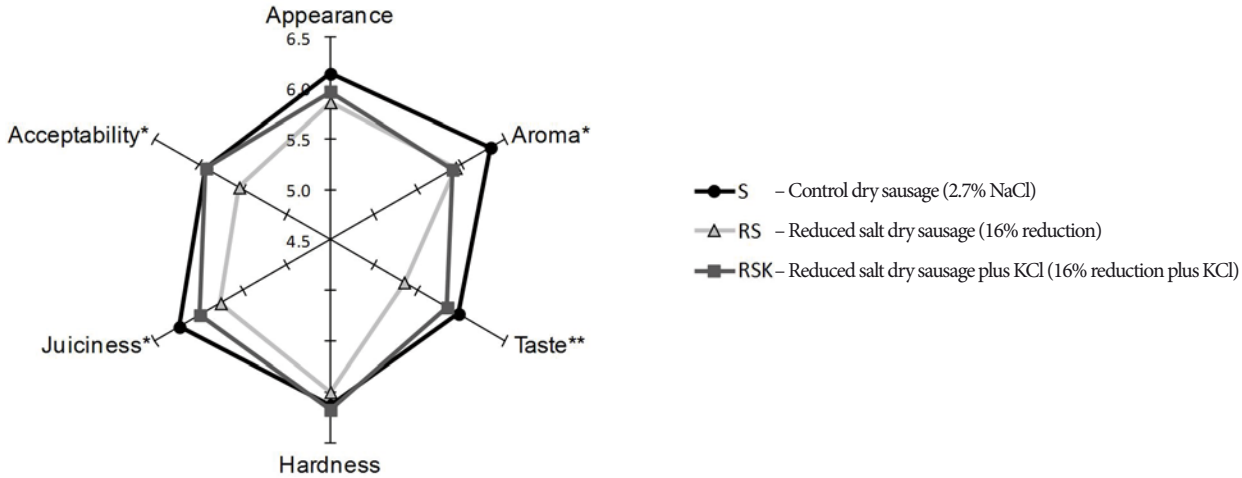

Figure 1: *Consumer sensory acceptability of salt reduced slow fermented sausages*

In the last decade many studies have been done to reduce salt and fat in meat products however, poor attention has been focused on traditional fermented products and there are few studies that might indicate the effect of salt and fat reduction in the flavour of long maturated (traditional) sausages. These traditional sausages are not subject to the initial stage of fermentation (heating) and also have a high aroma quality, as is the case in traditional Spanish, Italian, French sausages (Montel *et al.*, 1998). This topic (salt and fat reduction) constitutes a priority for small and medium enterprise (SMEs) due to the European trends to promote healthy habits.

2 EFFECT OF SALT REDUCTION

The reduction of NaCl in meat products is possible from a technological point of view as it has been reported in dry cured ham (Armenteros *et al.*, 2011, 2012ab). But there is little information on dry sausages. Ruusunen and Puolanne (2005) indicated that a decisive factor in fermented sausages is to regulate the fermentation process and to that end, the limit concentration of NaCl should not be less than 2%. It should be noted that all the studies about salt reduction in sausages have been carried out in 4–6 cm calibre and subjected to an initial fermentation stage. Therefore few studies have been focused on long maturated sausages with large diameter (7–9 cm). In this traditional method, low amounts of sugar are used and the ripening is performed at low temperature therefore, the rate of acid production is low.

Salt reduction in fermented meat products has been done using different salt as substitutes, KCl and divalent salts, but mainly KCl is the salt widely used as substitute although it provides metallic and bitter tastes when it is used at equal or higher than 40% (Gelabert *et al.*, 2003).

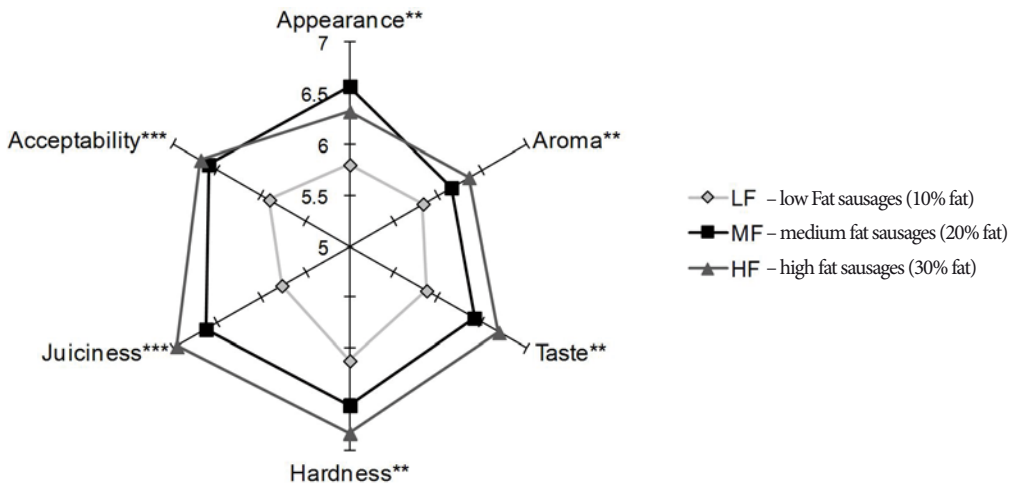

Figure 2: *Consumer sensory acceptability of fat reduced slow fermented sausages*

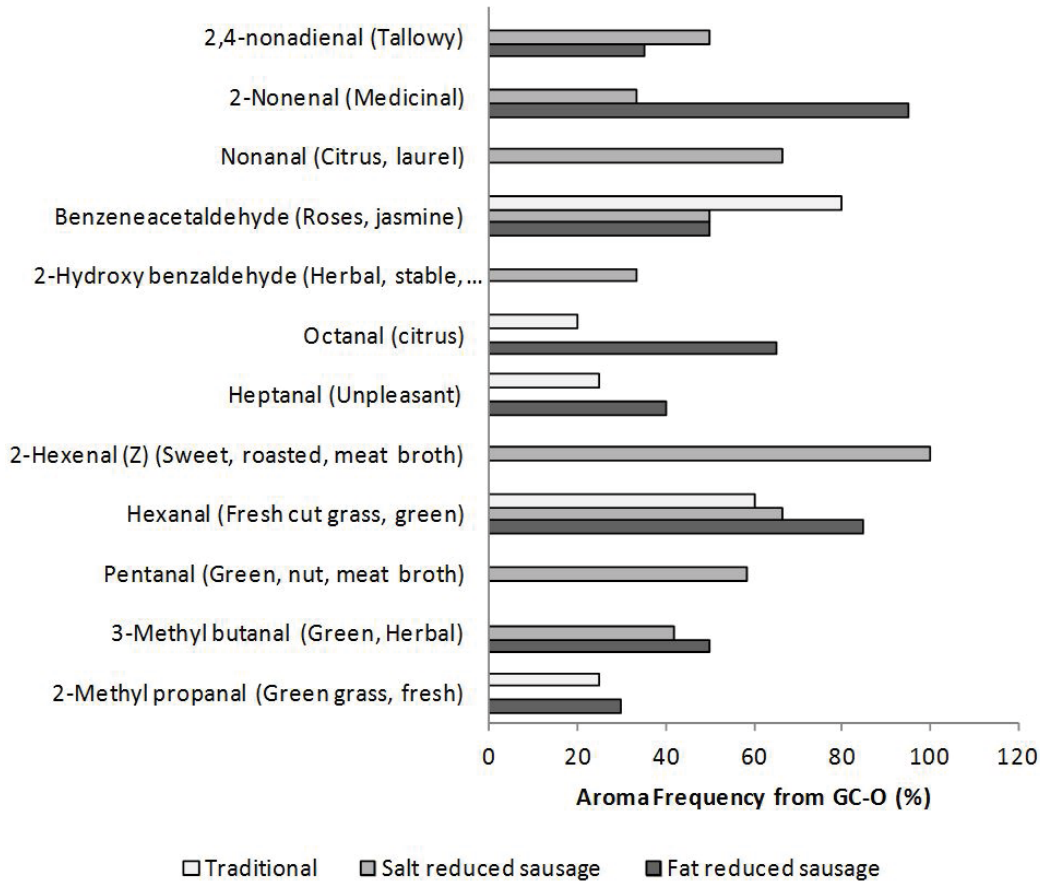

Figure 3: *Aldehydes compounds detected as aroma compounds by olfactometry techniques (aroma description shown in brackets) in traditional, fat reduced and salt reduced fermented sausages*

Moreover, other sensory characteristics may be affected during salt reduction such as texture and aroma. In this sense, the production of salt reduced fermented sausages has been recently studied by several authors (Campagnol *et al.*, 2011, Guardia *et al.*, 2008). Recently the effect of salt reduction on the generation of aroma compounds was studied in slow fermented sausages (Corral *et al.*, 2013). Small salt reductions (16%) produced sensory changes appreciated by consumers (Fig. 1). A reduction of 16% of the salt content produced a decrease in the acceptance of aroma, taste, juiciness and acceptability while the reduction and substitution using KCl avoided the negative effects but it was not able to increase the aroma acceptance of the sausages.

In general, few studies have reported an effect on the aroma when salt is reduced, also taken into consideration that these studies were performed using 25% reduction or higher (Campagnol *et al.*, 2011). However, we have observed that consumers are able to appreciate aroma differences, nevertheless, traditional fermented sausages should be adapted to new trends without losing their sensory characteristics.

3 EFFECT OF FAT REDUCTION

On the other hand, fat reduction is also important, especially in fermented meat products. Dry cured sausage is the group of cured meat products where the reduction of fat is more difficult (Wirth, 1988). The fat content of dry sausages is determined by the back fat added thus reducing the fat content produces an increase in lean portion. The role of fat in sausages is to keep together the meat mixture and it promotes the continuous moisture release. Furthermore, fat content increases during the manufacturing process due to the loss of moisture from the sausage. One of the problems that can occur in the production of dry cured sausages with reduced fat is that there are greater losses of moisture which can cause problems on the surface. Therefore, drying conditions should be controlled to regulate the loss of moisture.

Moreover, fat reduction can cause problems in the flavour of meat products (Jimenez Colmenero, 1996); it affects the generation of volatile compounds for which the fat is a precursor, modifies the flavour perception due to the changes in the interaction and release of volatile

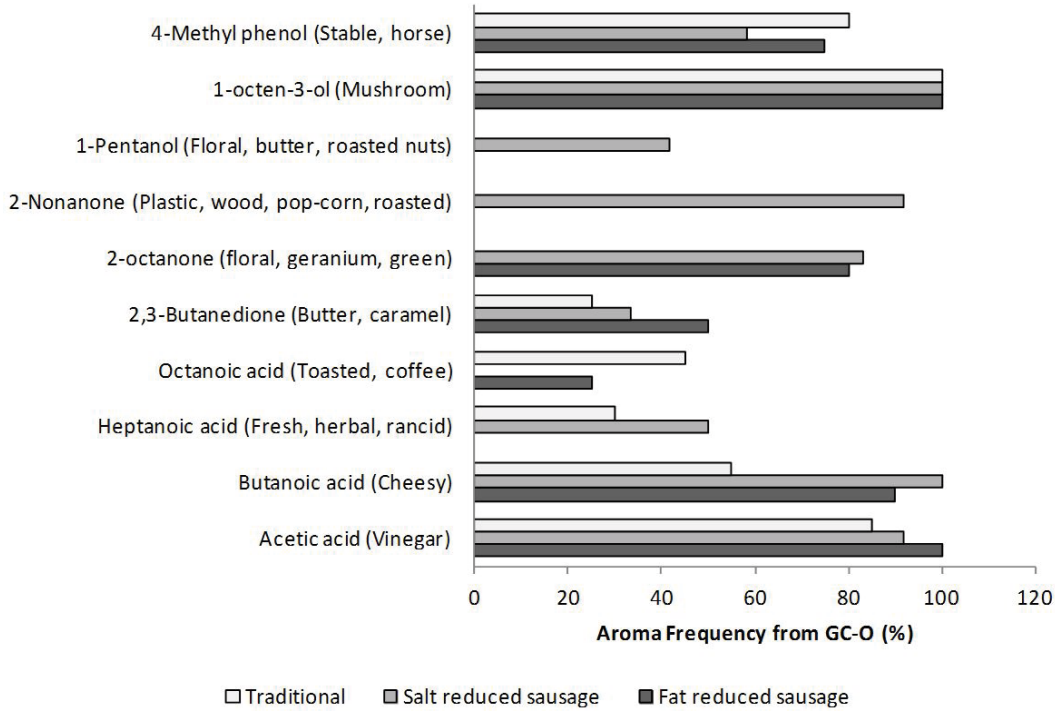

Figure 4: *Alcohol, ketones and acid compounds detected as aroma compounds by olfactometry techniques (aroma description shown in brackets) in traditional, fat reduced and salt reduced fermented sausages*

compounds and produces changes in certain ingredients such as salt, spices, flavourings and so on, due to the changes observed in the matrix.

Many studies about fat reduction in meat products have been performed in cooked products, where the main effects observed were loss of aroma and problems in the texture of the finished product (Keeton 1994). By contrast, there are few studies on dry cured sausages with low fat content (Soyer *et al.*, 2005) although recently we reported sensory differences in low and high fat slow dry sausages (Olivares *et al.*, 2010, 2011). High fat sausages are generally of highest acceptance mainly due to their aroma (Fig. 2). Although there is a limit in the production of low fat dry sausages as it has been observed that a 16% fat in the raw sausage mixture (LF) produced a decrease in consumer acceptability (Fig. 2). However, different acceptability patterns based on group of consumers have been reported that could affect the final acceptability observed (Olivares *et al.*, 2010).

4 EFFECTS OF SALT AND FAT REDUCTION ON AROMA

In both cases, when salt and fat are reduced the aroma of slow dry sausages is decreased, therefore it is essential to determine which aroma compounds are affected and the mechanism involved in this decrease to be able to look for new strategies to reduce salt and fat and produce healthy slow fermented sausages.

In aroma studies, the identification of volatile compounds present in the dry sausage is essential but it is also necessary to elucidate among the hundreds of volatile compounds which are the ones producing aroma notes. Therefore, it is essential to use olfactometry techniques together with gas chromatography and mass spectrometry for separation and identification, respectively. The olfactometry techniques elucidate the aroma notes produced by the volatile compounds identified and their potency can be determined using detection frequency technique (Pollien *et al.*, 1997). This technique was applied to three types of slow fermented sausages, traditional, salt reduced and fat reduced, and the aroma compounds were obtained and the differences among the sausages are shown in Fig. 3, 4 and 5.

Fig. 3 shows the aldehyde compounds contributing to aroma notes in dry sausages such as green and vegetable notes. It was remarkable that several of the aroma compounds were only reported in fat and salt reduced sausages such as 2,4-nonadienal and 2-nonenal, compounds derived from lipid oxidation reactions. On the other hand, other aroma compounds were present as aroma compounds in the three sausages (i.e. benzeneacetaldehyde and hexanal).

The contribution of acid compounds, ketones and alcohols to the aroma in dry sausages is also characteristic (Fig. 4). They contributed to different aroma notes such as vinegar (acetic acid), butter (2,3-butanedione) and mushroom notes (1-octen-3ol). But, many of them were detected with similar aroma occurrence in the three sausages except for heptanoic acid only detected in sausages where salt and fat was reduced and 1-pentanol and 2-nonanone that were only reported in salt reduced sausages.

Finally, the contribution of sulphur and ester compounds in dry sausages is very characteristic (Marco *et al.*, 2007, Olivares *et al.*, 2011). In Fig. 5, sulphur and ester compounds contributing to different aroma notes are shown. Sulphur compounds contributed to onion and unpleasant notes while typical fruity notes were derived from ester compounds. Again several of them were in the three sausages (methional, methionol and ethyl butanoate) but other aroma compounds were only characteristic in salt reduced sausages (dimethyl trisulfide, 3-metyl-thiophene and butyl acetate) and fat reduced sausages (methyl ethyl sulphide, methyl 2-hydroxy-propionate, methyl octanoate).

5 CONCLUSIONS

In summary, aroma development in fermented sausages depends on many parameters; processing conditions, fermentation and raw materials used in formulation, because they affect the biochemical and enzymatic generation reactions (Flores and Toldrá, 2011). The reduction of salt and fat content in dry sausages affects a high number of aroma compounds. As observed by the sensory analysis, aroma is highly affected and not recovered even if salt substitutes are used (KCl). Generally, the main differences in aroma compounds when fat is reduced were observed in those aromas derived from the lipid oxidation reactions (aldehydes) while salt reduction affected the generation of aromas such as sulphur compounds. Further studies are necessary to determine which biochemical process are affected in order to select appropriate strategies to reduce the detrimental effect on sausage aroma.

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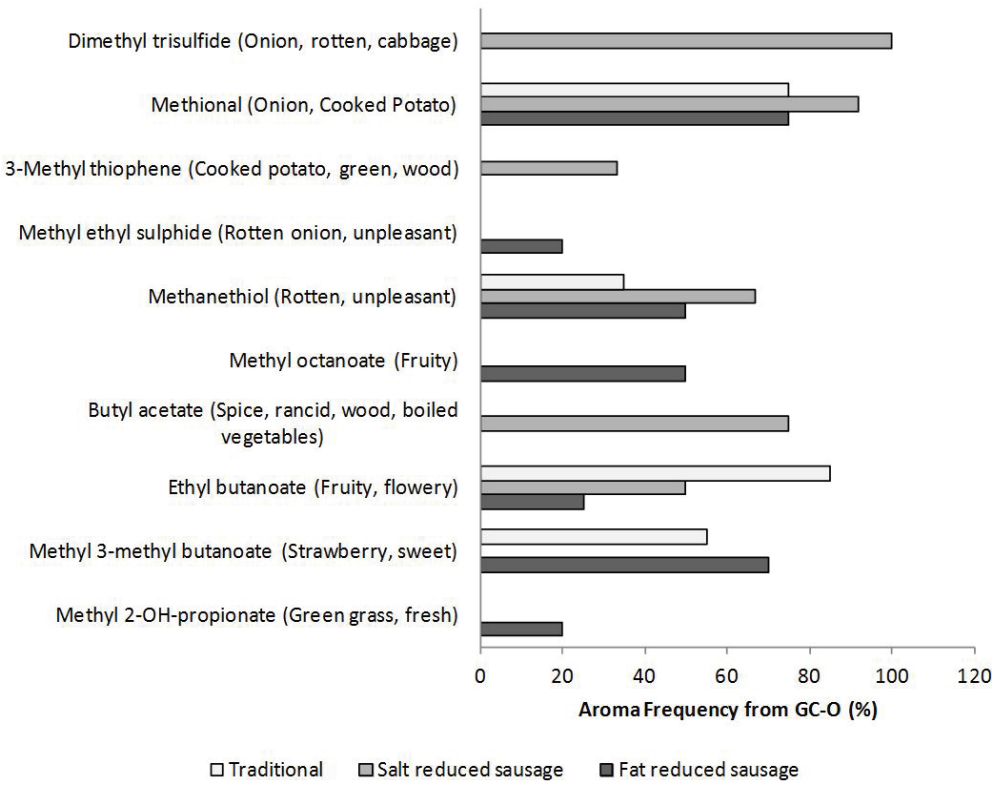

Figure 5: *Ester and sulphur compounds detected as aroma compounds by olfactometry techniques (aroma description shown in brackets) in traditional, fat reduced and salt reduced fermented sausages*

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