EFFECT OF THE USE OF ENTIRE MALE PIGS AND SALT REDUCTION IN FERMENTED SAUSAGES

S. Corral[1], A. Salvador[1] and M. Flores[1]

[1] Instituto de Agroquímica y Tecnología de los Alimentos (IATA-CSIC), 46980 Paterna, Valencia, Spain

Abstract – The aim of this work was to determine the quality of fermented sausages manufactured with back fat from entire male pigs and the effect of salt reduction (sodium replacement by KCl). For this purpose, physicochemical parameters (weight losses, pH, a_w, color and texture parameters) and consumer acceptability were analysed. Salt reduction showed a lower effect on the parameters analysed than the use of boar backfat. The use of boar backfat produced high weight losses, low pH, low a* and b*, high hardness and chewiness and low springiness and cohesiveness. However, consumer acceptability was not affect by salt reduction neither by the use of boar backfat.

Key Words – boar taint, reduced salt, sausage.

I. INTRODUCTION

Male piglet used for pork production are usually surgically castrated to reduce aggressive and sexual behavior and to avoid mainly boar taint taste and odor which is unpleasant for consumers. However, surgical castration of male piglets had to be carried out with prolonged analgesia and/or anaesthesia since 2012 and its use will be stopped by the end of 2018 due to a European initiative [1]. Several advantages involve the use of entire male pig such as its faster growth, eat less food, convert food to liveweight gain more efficiently and produce leaner carcasses than castrates [2]. However, negative aspects are also present such as a lower kill out percentage, higher proportion of dark, firm and dry meat, lower bacon yield and less favorable joint proportions [3].

Two compounds are mainly responsible for boar odor, androstenone and skatole [3]. Boar odor can be mask in dry fermented sausage due to the chemical and biochemical changes which take place along ripening process, smoke, use of spices or its cold consumption [4]. However, only Stolzenbach *et al.* [4] and Meier-Dinkel *et al.* [5] studied the effect the use of boar fat on the sensory quality in dry fermented sausages from northern Europe. However, few studies have dealt with Mediterranean slow fermented sausages.

In addition, a major concern in the production of healthy meat products is salt reduction [6]. Salt can affect flavor perception and therefore, the final quality. Therefore, the purpose of this study was to evaluate the quality of fermented sausages manufactured with back fat of entire male pig and salt reduction.

II. MATERIALS AND METHODS

Four treatments of dry fermented sausages were manufactured with back fat of castrated male or entire male and different salt contents; control treatment with back fat of castrated male (C) and entire male (MC) with equal 2.7g/kg salt content; and the same treatments (RS and MRS) but reduced in 25% salt content using KCl [6]. Three replications of the experiment were carried out.

Weight losses, pH, a_w, color (L*, a*, b*), TBARS, and texture profile analysis (TPA) were performed at the end of the ripening process [6].

A sensory analysis was carried out with 94 untrained consumers according to Corral *et al.* [6]. The consumers evaluated the overall quality using 9-box hedonic scale (1extremely dislike – 9 extremely like). Data acquisition was performed using Compusense® five release 5.0 (Compusense Inc., Guelph, Ontario, Canada).

Effect of back fat castrated/entire male and salt reduction on pH, a_w, weight losses, texture parameters color and sensory acceptability were performed by a two factor analysis of variance (ANOVA) using statistic software XLSTAT 2009.4.03 (Addinsoft, Barcelona, Spain). Fisher test was used to evaluate differences among treatments.

III. RESULTS AND DISCUSSION

Fig. 1 shows the pH, a_w and weight losses values. The salt reduction produced differences in pH, a_w

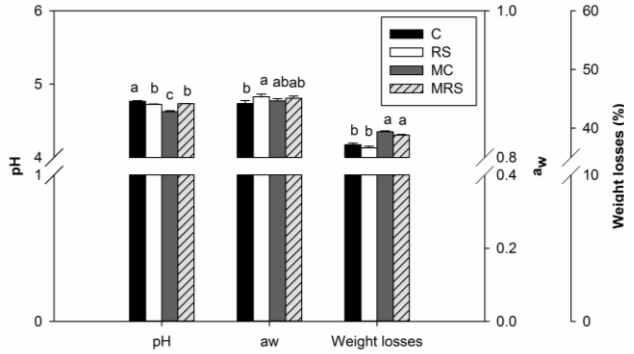

Figure 1. Effect of back fat of entire male pig and salt reduction on pH, aw and weight losses in dry fermented sausages.

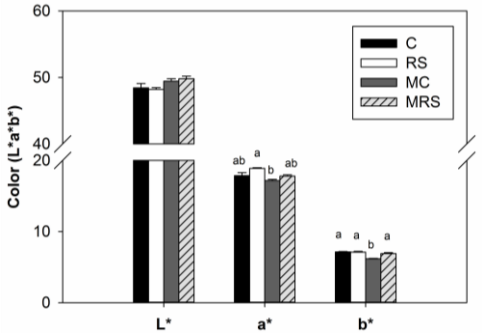

Figure 2. Effect of back fat of entire male pig and salt reduction on colour in dry fermented sausages.

and weight losses while boar fat only in weight losses and pH. The highest weight losses were found in the two treatments manufactured with boar fat probably due to the fact that backfat from entire male contains more water, more protein and less lipid than backfat from castrates and gilts [7]. Small differences of a decimal were found in pH values, being not important for these products as reported by Meier-Dinkel *et al.* [5]. RS treatment shows the highest a_w value as previously indicated by Corral *et al.* [8].

The color of sausage was measured obtaining L*, a* and b* coordinates (Fig. 2). Redness and yellowness (a* and b* coordinates, respectively) were affected by boar fat and redness also by salt reduction. RS showed a higher redness than MC as salt reduction could have an effect on *Micrococcaceae* that has nitrate reductase activity implicated in the color development of fermented sausages [9]; although other authors [6] did not observed salt reduction effect on colour parameters. According to boar fat, it is not clear its effect on colour, Babol & Squires [7] reported a high pale in entire male while others [10] did not found this effect. In our study, only MC showed the lowest yellowness.

Sausage TPA parameters showed that hardness and consequently chewiness were affected by the use of boar fat and salt reduction while springiness and cohesiveness by boar fat (Fig. 2). As aforementioned [7], backfat from entire male produced the highest hardness and chewiness. In addition, a reduction of these parameters was observed in salt reduced treatments [11]. Backfat from entire male is easily separated from other tissues due to the high level of unsaturation [7]. This fact can be the reason for the lowest cohesiveness found in sausages manufactured with boar fat.

Finally, a sensory analysis was performed with 94 consumers composed of 62 women and 32 men. 41% of them consume dry sausage between 2-3 times/per month and 85% of them were aware of animal welfare. No significant differences were found among treatments in the overall acceptability by consumers (Fig. 4). Corral *et al.*

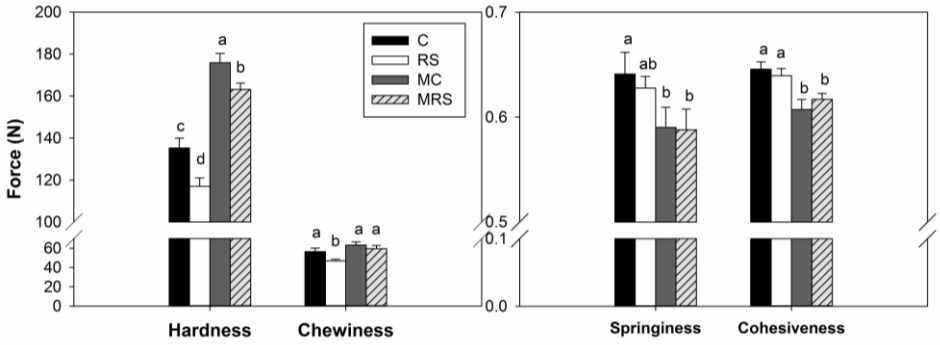

Figure 3. Effect of back fat of entire male pig and salt reduction on texture in dry fermented sausages.

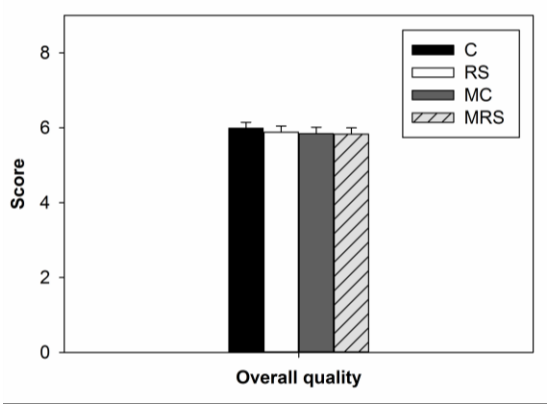

Figure 4. Effect of back fat of entire male pig and salt reduction on sensory overall quality in dry fermented sausages.

[6] reported that overall acceptability of low salt dry sausages substituted by KCl did not product significant differences respect to unreduced salt sausage. On the other hand, ripening process could have masked the boar odor achieving an acceptable product manufactured with boar fat and reduced salt. Although, it should be taken into account that all consumers are not sensitive to boar odor [7] and the use of untrained consumers could produce a high data variability which could have hidden the results from those sensitive to boar odor.

IV. CONCLUSION

Boar fat showed a higher effect on the parameters analysed than salt reduction producing high weight losses, low pH, low a* and b*, high hardness and chewiness, low springiness and cohesiveness. However, an acceptable dry sausage was achieved.

ACKNOWLEDGEMENTS

Financial supports from AGL2012-38884-C02-01 from MINECO (Spain). PROMETEO 2012-001 (GVA, Spain) and FEDER funds are fully acknowledged.

REFERENCES

1. European Declaration on alternatives to surgical castration of pigs (2010). http://ec.europa.eu/food/animal/welfare/farm/initiatives_en.htm
2. European Food Safety Authority, 2004. Welfare aspects of the castration of piglets. The EFSA Journal 91, 1–18. Retrieved February 2, 2008, from http://www.efsa.europa.eu/EFSA/Scientific_Opinion/report_ahaw03_ej91_pigcast_v2_en1,0.pdf
3. Lundstörm, K., Matthews, K. R. & Haugen, J. E. (2009). Pig meat quality from entire males. Animal 3: 1497-1507.
4. Stolzenbach, S., Lindahl, G., Lundström, K., Chen, G. & Byrne, D. V. (2009). Perceptual masking of boar taint in Swedish fermented sausages. Meat Science 81: 580-588.
5. Meier-Dinkel, L., Sharifi, A. R., Frieden, L., Tholen, E., Fischer, J., Wicke, M. & Mörlein, D. (2013). Consumer acceptance of fermented sausages made from boars is not distracted by respective information. Meat Science 94: 468-473.
6. Corral, S., Salvador, A. & Flores, M. (2013). Salt reduction in slow fermented sausages affects the generation of aroma active compounds. Meat Science 93: 776-785.
7. Babol, J. & Squires, E. J. (1995). Quality of meat from entire male pigs. Food Research International 28: 201-212.
8. Corral, S. Salvador, A., Belloch, C. & Flores, M. (2014). Effect of fat and salt reduction on the sensory quality of slow fermented sausages inoculated with Debaryomyces hansenii yeast. Food Control 45: 1-7.
9. Ibañez, C., Quintanilla, L., Irigoyen, A., Garcia-Jalón, I., Cid, C., Astiasarán, I., & Bello, J. (1995). Partial replacement of sodium chloride with potassium chloride in dry fermented sausages: Influence on carbohydrate fermentation and the nitrosation process. Meat Science, 40(1), 45-53.
10. Pauly, C., Spring, P., O'Doherty, J. V., Ampuero Kragten, S., & Bee, G. (2008). Performances, meat quality and boar taint of castrates and entire male pigs fed a standard and a raw potato starch-enriched diet. Animal, 2(11), 1707-1715.
11. Gou, P., Guerrero, L., Gelabert, J. & Arnau, J. (1996). Potassium chloride, potassium lactate and glycine as sodium chloride substitutes in fermented sausages and in dry-cured pork loin. Meat Science 42: 37-48.