EFFECT OF SODIUM REDUCTION ON EMULSION STABILITY AND MICROSTRUCTURE OF BOLOGNA-TYPE SAUSAGES

Manoela A. Pires[1], Julliane C. Barros[1], Paulo E. S. Munekata[1], Larissa T. Carvalho[1], Juliana C. Baldin[1], Yana J. Polizer-Rocha[1], Isabela Rodrigues[1] and Marco A. Trindade[1]*

Department of Food Engineering, Faculty of Animal Science and Food Engineering, University of São Paulo, Pirassununga, Brazil

*Corresponding author email: manoela.pires@usp.br

Abstract – The aim of this study was to evaluate the effects of different levels of sodium chloride reduction on the sodium content, emulsion stability and microstructure of Bologna-type sausages. Four different treatments were processed: Control (2% NaCl), T20, T40 and T60 (sausages with 20, 40 and 60% replacement of NaCl with a commercial substitute PuraQ®Arome Na4, respectively). The results showed that up to 40% sodium chloride reduction did not affect samples characteristics. However, replacement of 60% sodium chloride with PuraQ®Arome Na4 reduced ($p<0.05$) the emulsion stability, also affecting Bologna microstructure. One can conclude that a 40% replacement of salt in the tested conditions could be indicated, in order to obtain a healthier product with lower sodium content.

Key Words – healthier meat product, SEM, emulsion stability.

I. INTRODUCTION

The quantity of sodium intake is associated with the intake of processed meat products such as Bologna sausage. However, reducing or replacing sodium is a major challenge for the meat industry, especially in emulsified meat products, due a number of functional properties of salt, which affect physicochemical parameters, microstructure and the shelf-life of the product [1] [2] [3]. This study aims to develop Bologna sausages with the highest level of sodium reduction maintaining appropriate technological characteristics.

II. MATERIALS AND METHODS

Four Bologna sausage formulations were processed according to Trindade et al. (2010) [4], replacing sodium chloride by PuraQ® Arome Na4 (Corbion-Purac, Brazil), as follows: Control (bologna with 2% NaCl), T20, T40 and T60 (bologna sausages with 20%, 40% and 60% sodium chloride replacement, respectively). Treatments were prepared using lean beef meat (55%) and pork backfat (30%), purchased in the local market. The same quantity of condiments and additives were added to all products: 5% starch, 1% spice mix (containing sodium tripolyphosphate, sodium erythorbate, spices and natural flavors), 0.25% curing salt and 7.375% cold water.

The *sodium content*, expressed as a percentage, was determined in an atomic absorption spectrophotometer (Model AA100). The determination of the e*mulsion stability* (ES) was performed according to the method of Parks and Carpenter (1987) [5]. The *microstructure of emulsion* was determined by scanning electron microscopy (SEM) on the equipment TM3000 (HITACHI, Japan).

III. RESULTS AND DISCUSSION

The sodium content was significantly lower ($p \leq 0.05$) in Bologna sausages with reduced NaCl (0.788 to Control, 0.660 to T20; 0.515 to T40; and 0.447% to T60). Thus, the reduction of 40% and 60% of sodium chloride led to 34.64% and 43.27% sodium reduction compared to the control. Seganfredo et al. (2016) [6] tried to replace 20 and 30% of sodium chloride in Toscana sausages, using the same substitute, obtaining 7.5% and 14.7% of reduction. The reduction of 60% NaCl affected the emulsion stability (T60 equal to 85.61% of ES compared to 94.26% ES in the Control sample) and microstructure of products. Changes in the microstructure of the Bologna with 60% sodium can be observed in Figure 1, which presented more irregular porous surface than the Control. Felisberto et al. (2015) [7] added prebiotic fiber to reduced-sodium

Bolognas and concluded that the emulsion stability was affected, also observing an irregular porous surface in the microstructure using SEM methodology.

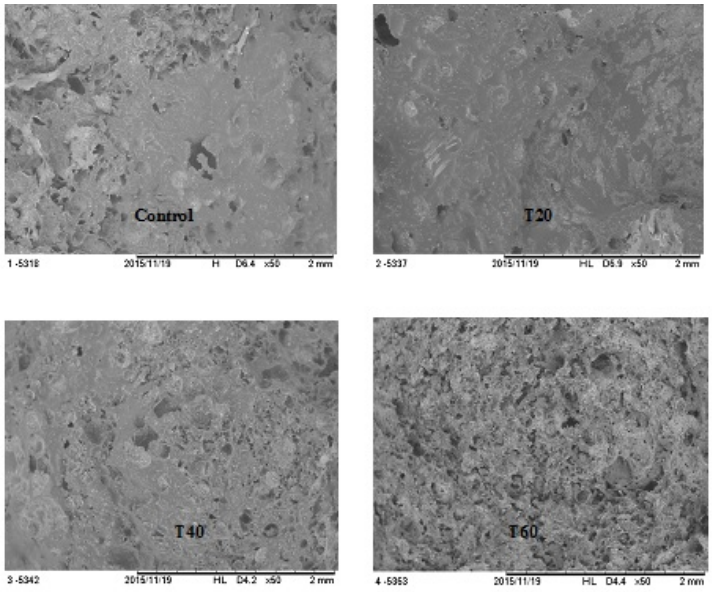

Figure 1. Scanning electron micrographs (SEM) of Bolognas

IV. CONCLUSION

One can conclude that 40% of salt replacement in the tested conditions could been indicated, in order to obtain a healthier product with lower sodium content, maintaining good microstructure and emulsion stability.

ACKNOWLEDGEMENTS

The authors thank FAPESP and CAPES for the financial support.

REFERENCES

[1] Desmond, E. (2006). Reducing salt: a challenge for meat industry. *Meat Science*, 74, 188-196.
[2] Ruusunen, M., Vainionpaa J., Puolanne E., Lyly M., Lahteenmak L., Niemisto M. & Ahvenainen R. (2003). Effect of sodium citrate, carboxymethyl cellulose and carrageenan levels on quality characteristics of low-salt and low-fat bologna type sausages. *Meat Science*, 64, 371-381.
[3] Saldaña, E., Behrens J.H., Serrano J.S., Ribeiro F., Almeida de M.A. & Contreras-Castillo C.J. (2015). Microstructure, texture profile and descriptive analysis of texture for traditional and light mortadella. *Food Structure*, 6, 13-20.
[4] Trindade, M. A., Thomazine M., Oliveira J.M., Balieiro J.C.C. & Favaro-Trindade, C.S. (2010). Estabilidade oxidativa, microbiológica e sensorial de mortadela contendo óleo de soja, armazenada a 0ºC durante 60 dias. *Brazilian Journal of Food Tecnology*, 13, 165-173.
[5] Parks, L. L., & Carpenter, J. A. (1987). Functionality of six nonmeat proteins in meat emulsion systems. *Journal of Food Science*, *52*(2), 271-274.
[6] Seganfredo, D., Rodrigues S., Kalschne D.L. & Sarmento C.M.P. (2016) Partial substitution of sodium chloride in Toscana sausages and the effect on product characteristics. *Semina: Ciências Agrárias*, 37 (3), 1285-1294.
[7] Felisberto, M.H.F., Galvão, M.T.E.L., Picone,C.S.F., Cunha, R.L. & Pollonio, M.A.R. (2015). Effect of prebiotic ingredientes on the rheological properties and microstructure of reduced-sodium and low-fat meat emulsion. *Food Science and Technology*, 60, 148-155.