EFFECT OF DIRECT REDUCTION OF SODIUM CHLORIDE ON FRANKFURT SAUSAGE

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Abstract – Besides being desirable, because of health problems related to high sodium intake, salt (NaCl) reduction could has adverse effects on the quality and safety attributes of meat products. The objective of this study was to evaluate the main alterations in an emulsified meat product with different levels of NaCl without addition of other ingredients / processes. Five sausage formulations were produced with 1%, 1.25%, 1.50%, 1.75 and 2% NaCl. The samples were evaluated for: Water activity (Wa), yield, color, emulsion stability and hardness. The reduction of the salt content caused Wa and emulsion stability reduction, texture changes and red color loss.

Key Words – Health, Meat product, Salt.

I. INTRODUCTION

The reduction of salt (sodium chloride) in food is a topic that has been widely discussed, especially in meat products. Horita et al. (2014) [1], reported that meat products, including sausage, account for 20 to 30% of the total daily intake of this compound. In addition to NaCl, the sodium content in meat is 10-20% higher because of additional sources of Na such as sodium phosphates, sodium nitrite and sodium naturally present in meat [2].

The removal of salt in meat products has adverse effects on quality and safety attributes, because of that many researchers have explored ways to circumvent these problems. Such approaches include the addition of new ingredients, processes or technologies. However, in this study the main alterations related to an emulsified meat product with different levels of NaCl without addition of other ingredients / processes was evaluated. A better understanding of emulsion behavior at various stages of salt reduction will help to direct the studies that seek to circumvent this problem.

II. MATERIALS AND METHODS

Five sausage formulations were processed according to the following formulation: 60% beef, 10% pork fat, 2% starch, 0.5% spices, 0.05% sodium erythorbate, 0.25% sodium tripolyphosphate and 0.015% sodium nitrite. The salt content in each of the formulations was 1% (F1), 1.25% (F1.25), 1.50% (F1.50), 1.75% (F1.75) and 2% (F2%). Water was added to the formulations in the amount required to complete 100% in each batch (8 kg).

Water activity was determined by the AQUALAB equipment (Decagon Devices, Pullman, WA), in triplicate. The ***yield***, expressed as a percentage, was determined by the ratio between the weight of cooked products and raw products multiplied by 100. Samples were cut for internal ***Color*** evaluation. The parameters L * (lightness), a * (redness) and b * (yellowness) of the CIELAB system were measured with a spectrophotometer (MiniScan XE, HunterLab brand) using the illuminant D65 with observation angle Of 10º and cell opening of 30 mm. The determination of the ***Emulsion stability*** was performed according to the method of PARKS and CARPENTER (1987) [3]. The ***hardness*** (instrumental texture) of the samples was measured with a texture analyzer (TAXT2i, Stable Micro Systems) in eight samples (eight replicates) for each treatment.

III. RESULTS AND DISCUSSION

The results found for each treatment are shown in Table 1.

The main parameters affected by salt reduction were: Wa, redness (a*), emulsion stability (%) and hardness. NaCl is well recognized as a water activity reducer, which is why it acts in the preservation of products, reducing microbial growth. This effect can be observed in Table 1, that shows a linear reduction of Wa values with increasing salt concentration. There was no clear variation in the yield of treatments, however, according to Tamm et al (2016), the

yield increases with increasing salt content due to better water binding. The emulsion stability was measured by the amount of liquid released per treatment. It was possible to verify great influence of the concentration of salt in this parameter. The F2% was almost four times more stable than the F1%.
Changes in texture were also observed. In frankfurters, and others emulsified meat products, the texture is related to the fat and water-holding capacities of the meat. In the presence of salt, myofibrils are swollen and that improves the water binding via subsequent gelation [1]. When the NaCl level present in the formulation is low, the amount of soluble myofibrillar proteins is also reduced because of the reduced ionic strength, thereby decreasing the gel strength [1]. The increase in the hardness (F1,25%) is attributed to the reduction of bound water when salt amount is reduced. To loose water can turn the texture firm, dry and non-structured [2].
With the increase of the salt concentration, it was also observed an increase in the intensity of redness (a*); There was no change in the values of b * and L *, although the samples F1% and F1.25% presented slightly higher values of L *.

Table 1 - Results of physical analyses for each treatment

	F1%	F1.25%	F1.50%	F1.75%	F2%
Wa	0.98 ± 0.00	0.98 ± 0.00	0.97 ± 0.00	0.97 ± 0.00	0.96 ± 0.00
Yield (%)	98.13 ± 0.10	99.63 ± 0.07	99.62 ± 0.08	98.98 ± 0.07	98.79 ± 0.08
L*	54.57 ± 0.83	55.31 ± 1.29	52.63 ± 0.49	53.56 ± 0.93	53.74 ± 0.51
a*	16.53 ± 0.83	16.99 ± 0.64	18.27 ± 0.11	18.04 ± 0.35	18.30 ± 0.08
b*	13.26 ± 0.71	12.28 ± 0.59	13.50 ± 0.23	13.39 ± 0.34	13.76 ± 0.12
Emulsion stability (%)	29.65 ± 1.03	15.05 ± 0.81	9.84 ± 0.53	7.88 ± 0.61	7.73 ± 0.57
Hardness (Kg)	1.34 ± 0.14	2.36 ± 0.11	1.06 ± 0.28	1.08 ± 0.23	1.53 ± 0.31

IV. CONCLUSION

Based on these results, the functionality of proteins, especially in relation to water binding capacity, is the main challenge to be overcome in the search for meat products with reduced NaCl content.

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