P-04-32

The effect of different sodium reduction strategies on the chemical, microbial and sensory quality of a traditional South African sausage (#637)

Anmeri Rautenbach, Celia Hugo, Carina Bothma, Eileen Roodt, Arnold Hugo

University of the Free State, Food Science, Bloemfontein, South Africa

Notes

Introduction

Due to recent regulations that was passed by the South African Government limiting the sodium content of various processed food products of which Boerewors is one, the meat industry now has to abide by new specified sodium levels. As from 30 June 2016 the permitted sodium content of Boerewors is 800 mg Na /100 g sausage while from 30 June 2019 the maximum permitted level of sodium is 600 mg Na/100 g sausage. The purpose of this study was to determine the implications on the overall quality and stability of Boerewors products by using different strategies to reduce the sodium content of Boerewors to 600 mg Na/ 100 g.

Methods

Three replicates of Boerewors were manufactured. The 5 treatment groups were the negative control (NC) which were formulated with 0% NaCl containing 110.03 mg Na/100 g. Three more formulations were formulated in accordance with the new Na limit of 600 mg Na/100 g sausage (mandatory from 30June 2019) and they were treated with different salt replacers. Formulation K600 was formulated to contain 600.12 mg Na/100 g (1.25 % NaCl) and potassium chloride was added as replacer. Formulation L600 was formulated to contain 599.78 mg Na/100 g (1.25 % NaCl) and lactate was added as replacer. Formulation N600 were formulated to contain only 600.38 mg Na/100 g (1.25 % NaCl) and no replacers were added. The positive control (PC), was formulated in accordance with the current Na limit of 800 mg/100 g. It was formulated to contain 816.69 mg Na/100 g (1.80 % NaCl). Boerewors samples from the different treatments were evaluated for oxidative stability (TBARS), total viable count (TVC) and colour a* value over a nine day storage period. Consumer sensory evaluation was performed on the sausages from the five different treatments. An analysis of variance procedure (NCSS 11, 2016) was used to determine the effect of added NaCl and/or replacer and the Tukey-Kramer multiple comparison test (= 0.05) was carried out to identify significant differences between the treatment means (NCSS 11, 2016).

Results

The different treatments did not show any immediate effect on the TVC and there were no significant differences between treatments on days 0 and 3 (Figure 1). On days 6 and 9 however there were significant differences between the NC and the rest of the treatments. The significant higher value of the NC shows that the addition of NaCl has an inhibitory effect on microbial growth.

No significant differences were observed in lipid oxidation as measured by TBARS between treatments on days 0, 3 and 9 (Figure 2). On day 6 there were significant differences between the treatments, with the N600 treatment having a significantly higher value than the rest of the treatments. The L600 treatment had the lowest value and can be ascribed to the fact that lactate can reduce the pro-oxidant effect of NaCl on meat products. All of the TBARS values were below that of an organoleptic threshold of 0.5 mg MDA/kg.

The gradual decrease in a*-value means a decrease in redness and can be clearly seen from day 0 to day 9. The NC showed the highest value throughout the 9 days and significant differences ($p < 0.001$) was found between the treatments. As salt levels increased, redness decreased and this can most likely be ascribed to salt having a denaturing effect on myoglobin proteins which decrease the ability to bind oxygen and give a red colour. From the treatments that contained NaCl, the L600 treatment had the highest value and thus the best red colour throughout the 9 days.

The consumer panel continuously ranked the NC group lower than the other four treatment groups for all five of the chosen sensory attributes (Table 1). For appearance, flavour, saltiness, texture and overall liking, no significant differences in rankings were found between the K600, L600, N600 and PC groups (Table 1), indicating that consumers could not detect any differences in terms of these attributes between the different treatments.

Table 1: Consumer sensory rankings of 5 Boerewors formulations based on different added NaCl and/or replacer levels.

Treatments	Neg controll	K600	L600	N600	Pos. Control	Sign. level
Appearance	$5.80^{a} \pm 1.81$	$6.97^{b} \pm 1.08$	6.72b ± 1.19	$6.59^{b} \pm 1.53$	$6.69^{b} \pm 1.33$	$p < 0.001$
Flavour	$3.84^{a} \pm 2.01$	$7.01^{b} \pm 1.36$	7.01b ± 1.16	$6.63^{b} \pm 1.50$	$6.95^{b} \pm 1.24$	$p < 0.001$
Saltiness	$3.47^{a} \pm 2.00$	$6.84^{b} \pm 1.56$	6.69b ± 1.50	$6.45^{b} \pm 1.69$	$6.56^{b} \pm 1.59$	$p < 0.001$
Texture	$5.08^{a} \pm 2.14$	$7.16^{b} \pm 1.13$	7.05b ± 1.30	$6.57^{b} \pm 1.64$	$6.85^{b} \pm 1.48$	$p < 0.001$
Overall liking	$4.03^{a} \pm 1.68$	$7.09^{b} \pm 1.30$	6.97b ± 1.10	$6.67^{b} \pm 1.46$	$6.89^{b} \pm 1.16$	$p < 0.001$

Means with different superscripts in the same row differ significantly.

Conclusion

The results obtained proved to be positive for further sodium reduction to 600 mg Na/100 g product. Even though the replacers did not significantly help with improving microbial and lipid oxidative stability, all the treatments were stable over the shelf-life period with all the microbial values being within limits and no detection of rancidity. In terms of the colour parameters tested the oxidative effect of high NaCl on meat product colour was confirmed, the addition of lactate as replacer did to some extent affect the meat product colour positively. The addition of replacers could not be detected sensorily by consumers.

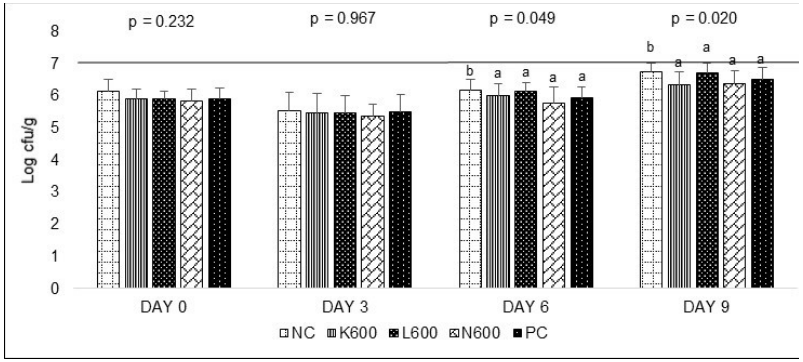

Figure 1.
TVC counts (log cfu/g) of five Boerewors formulations

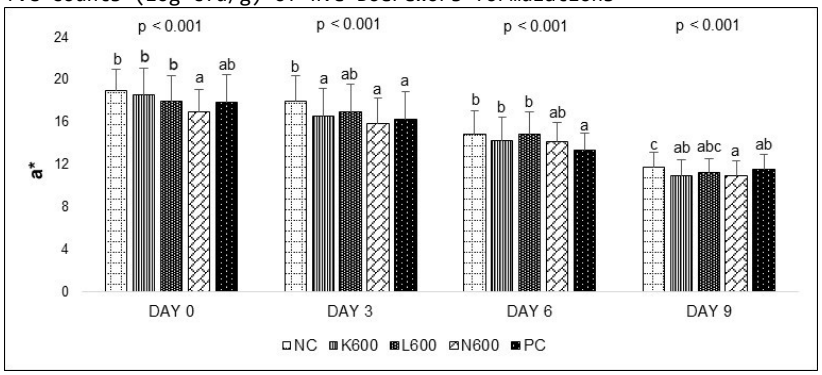

Figure 3. Redness (a*) value of five Boerewors formulations

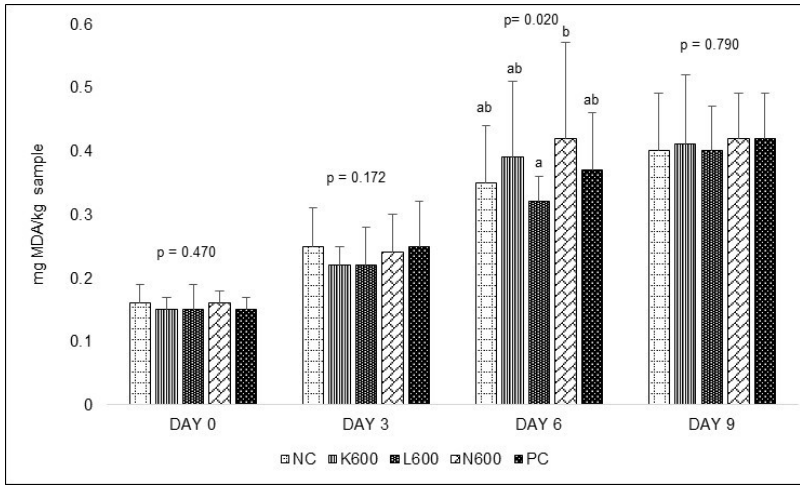

Figure 2. The effect of added NaCl level on the TBARS values of 5 Boerewors formulations

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