Notes

**P-04-31**

## Inclusion of protein hydrolysates from deboned chicken residues in cooked sausages – Effects on technological and sensory quality (#614)

Eva Veiseth-Kent, Mari O. Gaarder, Alexandre Descomps, Diana Lindberg

Nofima AS, Ås, Norway

### Introduction

Enzymatic protein hydrolysis (EPH) has become a popular method for valorisation of by-products. The aim of this study was to assess how inclusion of three different protein hydrolysates produced from chicken bones and meat residues at two inclusion levels affected technological and sensory quality of cooked sausages produced at lab-scale.

### Methods

Deboned chicken residues were ground and divided into tree 7-kg batches for EPH. The EPH process was performed by mixing 7 kg ground residues with 14 l water and 1 % protease (A, B and C), and incubated at 50°C for 60 min. Proteases were inactivated (90°C for 15 min), and fat and undigested material was separated by centrifugation and filtration. Soluble fractions were spray-dried to gain dry powders.

The Control recipe with a mix of beef and pork consisted of 10 % protein, 18 % fat, 6 % potato starch, 1.7 % NaCl and 64.3 % water. Adjusted recipes with hydrolysates to increase the protein content to 12.5 and 15 % was made by removing equivalent parts of water. The Control sausage and the six versions with hydrolysates were produced in triplicate at random order. Sausage batters were produced using a Stephan-blender, and mixed until the batter temperature reached 15.5°C. The batter was filled into 50-ml tubes, centrifuged to remove air pockets, and allowed to stand at 4°C over night before cooking in a water bath at 80°C for 30 min, following 30-min cooling in iced water.

Cooking loss was assessed by weighing sausage batter before and after cooking, colour was measured using DigiEye, and texture was measured by a two-cycle 60-% compression test using Texture Analyzer. Sensory analysis was performed on warmed sausages in a quality descriptive analysis (QDA) with Nofima's trained sensory panel.

Statistical analysis was performed using Dunnett multiple comparisons to test whether the six recipes with hydrolysates differed from the Control recipe, while factorial ANOVA with main effects of hydrolysate and inclusion level and their interaction and Tukey pairwise comparison was used to reveal significant differences between recipes containing hydrolysates.

### Results

Inclusion of hydrolysates elevated the pH of the sausage batter both prior to and after cooking ($p < 0.000$), and this increase was proportional ($p < 0.000$) to the level of hydrolysate added (Table 1). Cooking loss was reduced with hydrolysate addition ($p < 0.000$), but no differences were seen between hydrolysates or inclusion levels.

Chemical analysis of cooked sausages revealed that the protein content was increased ($p < 0.000$) from the Control, 12.5 and 15 % recipes: 10.7, 13.1 and 15.6 %, respectively. Increase in protein content was mirrored by reduced water ($p < 0.000$) and increased ash content ($p < 0.000$) in the same groups. Colour measurements showed that the highest inclusion levels of A and B hydrolysates resulted in reduced $L^*$-values ($p < 0.000$) compared to Control (Table 1). Moreover, the $a^*$-value was increased in all recipes compared to Control ($p < 0.000$), and there was a significant effect of hydrolysate type ($p < 0.000$) and inclusion level ($p < 0.000$). Mechanical hardness was significantly increased ($p < 0.000$) compared to Control in all recipes except C at the highest inclusion level (Table 1). An interaction effect was seen for hardness ($p < 0.05$) where both inclusion levels with C clearly separated from the other hydrolysates.

No differences were found for odour attributes between the recipes ($p > 0.05$), while colour, flavour and texture attributes differed (Figure 1). The hue of the colour was increased (i.e. more red) in the highest inclusion level with B and C compared to Control ($p < 0.01$), similar to the $a^*$-value from the DigiEye analysis. Taste intensity also varied among recipes ($p < 0.01$), while even larger differences were observed for bitter taste ($p < 0.001$), with increasing bitterness as inclusion levels increased. Finally, hardness and pastiness of sausages increased and decreased, respectively, with inclusion of hydrolysates ($p < 0.001$). Interestingly, inclusion of hydrolysate C did not affect these texture attributes compared to Control.

### Conclusion

- It is difficult to assess whether the reduced cooking loss after hydrolysate inclusion is only caused by less water added in the recipes and/or if the hydrolysates have affected the water-binding properties of the batters. Thus, further investigations into this is necessary.
- Inclusion of hydrolysates increases the redness of sausages, most likely by acting as antioxidants.
- Effects of hydrolysates on texture properties seems to be hydrolysate-spe

cific, with hydrolysate C behaving similar to Control. The peptide composition of the hydrolysates may explain these differences, since hydrolysate C exhibit mostly exopeptidase activity while A and B have endopeptidase activity.

Table 1. Technological properties, instrumental colour and texture parameters.

| Quality attributes | Control | A | | B | | C | | SEM | P-values | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 12.5 % | 15 % | 12.5 % | 15 % | 12.5 % | 15 % | | Hydrolysate (H) | Inclusion level (L) | H × L |
| pH batter | 5.65 | 5.77* | 5.91* | 5.82* | 5.97* | 5.81* | 5.93* | 0.025 | 0.041 | 0.000 | 0.860 |
| pH sausage | 5.96 | 6.02* | 6.08* | 6.05* | 6.12* | 6.02* | 6.08* | 0.012 | 0.106 | 0.000 | 0.903 |
| Cooking loss, % | 1.40 | 0.61* | 0.61* | 0.65* | 0.62* | 0.62* | 0.75* | 0.064 | 0.334 | 0.412 | 0.259 |
| L* | 62.23 | 61.77 | 60.17* | 61.42 | 60.80* | 62.87 | 62.06 | 0.125 | 0.000 | 0.000 | 0.165 |
| a* | 6.73 | 7.74* | 8.65* | 7.66* | 8.72* | 8.11* | 9.00* | 0.072 | 0.000 | 0.000 | 0.583 |
| Hardness, g | 4207 | 9621*[a] | 8926*[b] | 8843*[b] | 8574*[b] | 5147*[c] | 4074[d] | 213 | 0.000 | 0.000 | 0.030 |

*Means with asterisk indicate significant difference from Control ($p > 0.000$).

[abcd]Means with different superscripts indicate significant difference between recipes with hydrolysates ($p < 0.05$).

**Table 1.** Technological properties, instrumental colour and texture parameters.

Figure 1. Sensory attributes of cooked sausages assessed by trained sensory panel.

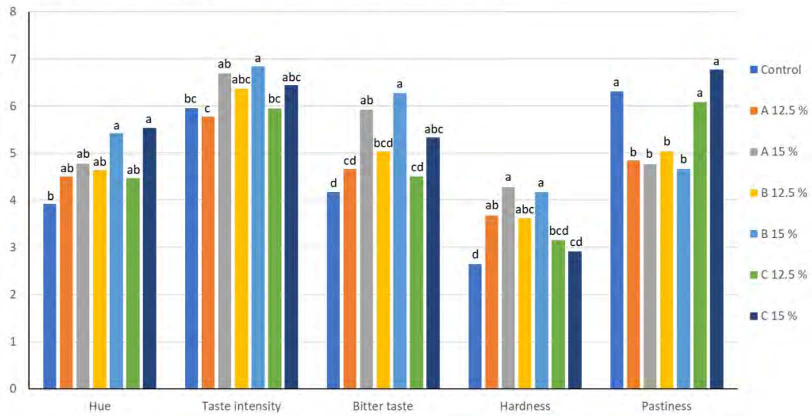


**Figure 1.** Sensory attributes of cooked sausages assessed by trained sensory panel

Notes