

Effect of Blood Plasma Addition on Some Technological and Sensory Properties of Frankfurters

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SUMMARY: Frankfurters were manufactured using conventional manufacturing procedures. Formulations include control (with 2% soy isolate) and five test variants (with 3,125, 6,25, 12,50, 18,75 and 25% frozen raw porcine blood plasma added as replacement for ice). Weight losses of samples with 18,75 were significantly lower ($p < 0,01$) than the control sample. There were no differences in weight losses between the control and sample with 6,25% plasma (12,07 and 12,41, respectively). Samples with plasma were firmer than the control (shear force for control sample was 0,0462 kN and for sample with 25% plasma - 0,0622 kN at defined conditions). Firmness increased with increasing plasma concentrations. Samples with plasma were darker than the control sample (determined instrumentally). Juiciness and consistency of samples with plasma were better evaluated than control. Color of samples with 18,75% and 25% plasma were less desirable.

INTRODUCTION: Blood plasma use in meat products has become increasingly more popular, primarily to improve waterbinding properties, as well as consistency and fat binding properties of finished products. The important functional property of blood plasma proteins is their excellent gell forming ability induced by heat. The gel structures contributes to the consistency of sausages and act as matrix holding water, as well as fat and other components (HERMANSSON and LUCISANO, 1982). Also, blood plasma proteins demonstrate very acceptable emulsifying properties (high emulsifying and stabilizing capacities and others) similar to those of the meat (CALDERONI and OCKERMANN, 1982).

On the other hand, addition of blood plasma in higher proportions can cause unacceptable changes of color and taste of sausages (STIEBING and WIRTH, 1986).

The aim of this paper was to evaluate effect of adding different proportions of frozen, raw porcine blood plasma on some technological and sensory properties of frankfurters.

MATERIALS and METHODS: Blood was collected at the bleeding line from a local slaughter house, treated by adding sodiumtripolyphosphate (0,8% final concentration) as an anticoagulant, and separated into plasma and red cell fractions on centrifugal separator (L'electro Ecremeuse, France). After separation blood plasma (total protein content 6,9%, haemoglobin content 0,4%) was frozen at -30°C .

Frankfurters were manufactured using conventional manufacturing procedures. The basic sausage formula was 50% of beef, category B, 25% of bacon and 25% of crushed ice. Control sample was manufactured with 2% soy isolate (PURINA 500 E) and test variants with 3,125, 6,25, 12,50, 18,75 and 25% of frozen raw plasma added as replacement for ice, 1,5% of nitrite salt for curing, 0,25% of white pepper, 0,2% of garlic powder, 0,2% sweet red pepper and 0,1% of sodiumpolyphosphate were added in 100 kg sausage mix. After mincing for 6-8 min in 3-blade bowl chopper, each batch was stuffed into 23 mm collagen casings, linked (150 mm), conventionally smoked and cooked to an internal temperature of $75-76^{\circ}\text{C}$, and given a 3-min cold shower.

Weight losses average values were determined on the base of registered weight of each sausage before and after heat treatment. The significance of differences in weight losses average values was determined using student t-test.

Firmness of sausages was measured by Instron 4301 at defined conditions (shear force 0,25 kN, shear rate 100 mm/min). Color of finished product was determined by Mom Color 100 (CIELAB System).

The sensory evaluation of finished products was conducted by six-member board. The point rating ranging

system was applied. This evaluation included appearance, appearance of the composition on cut surface area, color, aroma, taste, juiciness and consistency.

RESULTS and DISCUSSION: On the basis of the analysis of the average weight losses of sausages after heat treatment considerable differences between the examined sausages can be noticed (table 1).

Average weight losses decreased with an increase of added plasma. There were no significant differences in average weight losses between sausages with 3,125 and 6,25% of plasma. In all other cases differences in average weight losses among sausages with plasma were significant ($p < 0,01$).

Compared to control sample, there were no significant differences between control sausages and sausages with 6,25% of plasma ($p>0,05$). Differences in average weight losses between control sausages and sausages with 12,5% of plasma were significant on the level $p < 0,05$. In all other cases differences between control sausages and sausages with plasma were statistically significant on the level $p<0,01$.

Our results agree with STIEBING and WIRTH (1986) and MURMANN and WENZEL (1986) who reported that addition of blood plasma reduces weight losses after heat treatment, depend of quantity of added plasma.

The results obtained after measuring of firmness of sausages (table 2) showed that the variants of sausages with plasma were firmer than the control sausages.

HERMANSSON (1978) reported that after heat treatment plasma proteins form firm, elastic gel at relatively low concentrations, while soy protein concentration has to be 1,4 - 2 times higher in order to achieve the same firmness of gel.

Firmness increased with increase of quantity of added plasma. According to POULSEN (quotation WISMER-PEDERSEN, 1980) there is linear increase of gel firmness with increase of plasma proteins concentration.

Table 1: Average weight losses of frankfurters after heat treatment (%)

| Quantity of plasma (%) | Average value | Standard deviation | Variation coefficient |
|------------------------|---------------|--------------------|-----------------------|
| 3.125 | 12.92a | 0.4491 | 3.48 |
| 6.25 | 12.41ab | 0.3152 | 2.54 |
| 12.50 | 11.46c | 0.1683 | 1.47 |
| 18.75 | 10.38 | 0.1267 | 1.22 |
| 25 | 9.30 | 0.1460 | 1.57 |
| Control | 12.07bc | 0.2273 | 1.88 |

Table 2: Effect of addition of blood plasma on the firmness of frankfurters

| Quantity of plazma (%) | Firmness (kN) |
|------------------------|---------------|
| 3.125 | 0.0486 |
| 6.25 | 0.0489 |
| 12.5 | 0.0512 |
| 18.75 | 0.0538 |
| 25 | 0.0556 |
| Control | 0.0480 |

a, b - means in the same column followed by a common letter do not differ ($p>0,05$)
c - means in the same column followed by letter are significantly different ($p>0,05$)
- - in all other cases differences among examined sausages are significant on the level $p < 0,01$

The color of all sausage variants with plasma was darker than the color of control sample (Table 3). With increasing concentration of added plasma sausages were darker.

Average reflectance and lightness of sausages with plasma were lower than the same values of control sample. Dominant wave length of sausages with plasma and proportion of red and green color were higher.

compared to control sausages. There were no significant differences in purity of color among sausages.

Table 3: Effect of blood plasma on the color of frankfurters

| Quantity of plazma (%) | C | I | E | L | A | B |
|------------------------|-------|-----|-------|-------|-------|-------|
| | y | l | p | a | b | L |
| 3.125 | 31.86 | 596 | 19.27 | 14.72 | 18.28 | 63.04 |
| 6.25 | 31.82 | 598 | 21.12 | 14.98 | 18.19 | 62.47 |
| 12.5 | 30.42 | 603 | 20.87 | 15.25 | 17.80 | 61.78 |
| 18.75 | 29.65 | 608 | 19.76 | 15.38 | 17.64 | 60.89 |
| 25 | 28.75 | 614 | 19.00 | 15.75 | 17.00 | 60.07 |
| Control | 32.65 | 594 | 25.95 | 14.67 | 18.36 | 63.54 |

y - average reflectance (%)

l - dominant wave length (nm)

p - purity (%)

a - proportion of red and green color

b - proportion of blue and yellow color

L - lightness

We assume that the differences in the color between control sausages and sausages with plasma, as well as differences among sausages with plasma, were caused by somewhat higher haemoglobin content in plasma.

Organoleptical evaluation (Table 4) showed that variant with 12.5% of plasma has been rated best. Namely, sensory properties of this variant have been rated higher than sensory properties of other variants. There were

Table 4: Results of sensory analysis of frankfurters

| | | Coeff. of importan ce | Quantity of plasma (%) | | | | | Control |
|--|---|--------------------------|------------------------|-------|-------|-------|-------|---------|
| | | | 3.125 | 6.25 | 12.5 | 18.75 | 25 | |
| Appearance | 1 | | 4.67 | 4.75 | 4.75 | 4.75 | 4.67 | 4.75 |
| Appereance and composition on cut surface area | 2 | | 4.17 | 4.42 | 4.32 | 4.33 | 4.17 | 4.33 |
| Color | 3 | | 4.42 | 4.33 | 4.42 | 4.25 | 4.25 | 4.33 |
| Aroma | 2 | | 4.50 | 4.25 | 4.25 | 4.25 | 4.42 | 4.25 |
| Taste | 4 | | 4.33 | 4.25 | 4.33 | 4.33 | 4.33 | 4.25 |
| Juiciness | 4 | | 4.17 | 4.33 | 4.42 | 4.25 | 4.17 | 4.33 |
| Consistency | 4 | | 4.25 | 4.33 | 4.50 | 4.25 | 4.08 | 4.42 |
| Generally estimation quantify as: | | | | | | | | |
| summ of points - | | | 30.51 | 30.68 | 30.92 | 30.41 | 30.09 | 30.66 |
| - average value | | | 4.31 | 4.34 | 4.39 | 4.30 | 4.25 | 4.34 |
| - % of max. possible quality | | | 86.25 | 86.80 | 87.84 | 85.98 | 84.92 | 86.90 |

no significant differences between the control variant and sausages with 6.25% of plasma. To be precise, appearance of the composition on cut surface area has received higher points, while the consistency of control sausages has received lower points.

Variants with 18.75% and 25% of plasma were rated lowest compared to all other variants. Juiciness, consistency and color desirability the sausages stated above, somewhat decreases.

CONCLUSIONS: For the following results it was able to conclude that the use of blood plasma reduced weight losses, and improved firmness of sausages. Color of sausages with plasma was somewhat darker than the color of control sausages, mostly due to high haemoglobin content. Sensory properties of sausages with lower proportions of plasma were better or same rated compared to control sausages. Color, juiciness and consistency of sausages with higher proportions of plasma (18.75 and 25%) were less desirable.

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