The development and sensory evaluation of fresh meat sausages containing beef offal

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Abstract

The main aim of this part of the research was to determine the acceptability of the cooked meat sausages containing beef offal in comparison to the control sample. Four of the offal-containing fresh sausages were selected, together with a control. Treatments 1 and 2 contained beef trimmings, beef hearts, intestines and spleen, whereas Treatments 3 and 4 contained beef liver, stomachs and lungs. Spices, rusk and a soy concentrate were also added. The control sample only contained beef trimmings, rusk and spices. Thawing and cooking losses were measured for five replications of the five treatments. A 12-member trained, black panel assisted to develop the standardized score sheet with an 8-point category scale, to evaluate aroma, appearance, texture, flavour and mouth coating. The consumer panel evaluated aroma, flavour and texture. ANOVA was used to test for the panel and product main effects as well as the panel-by-product interaction ($p<0.05$). Principal Component Analysis was done on trained panel results to identify attributes that discriminated between the different samples. **Trained panel:** Samples I and J were similar to the control sample in aroma intensity; Sample J had the most intense appearance of juiciness. **Consumer panel:** Aroma, flavour and texture attributes of the control and J samples were acceptable. Proximate chemical analysis for cooked sausages was also determined.

Objectives

The objective of this part of the research was to determine the acceptability of the cooked meat sausages containing beef offal in comparison to the control sample, using a black trained panel and a consumer panel to evaluate the sensory attributes of the products.

Materials and methods

Source of raw fresh meat sausages containing beef offal

Representative samples of the five raw sausages consisting of the control and four raw, frozen meat sausages containing beef offal, were randomly selected, from five replications. They were thawed, cooked and analyzed for sensory descriptive and consumer evaluation. The control sample only contained beef trimmings, rusk and the standard mixture of spices. Formulations 1 and 2 contained beef trimmings (B), spleen (S), intestines (IN), heart (H) with rusk (R) or Multibase™ (MB), that is "BSINHR" and "BSINHMB", whereas formulations 3 and 4 contained beef trimmings (B), liver (L), stomachs (ST) and lungs (L) with rusk or Multibase™ - that is "BLSTLR" and "BLSTLMB."

Sensory evaluation

Trained panel

A black twelve-member, trained panel was used to evaluate the sensory quality attributes of the cooked, offal-containing sausages: aroma intensity, appearance, texture, flavour and mouth-coating, using an eight-point category scale (1 = extremely bland/weak and 8 = extremely intense/strong).

Consumer panel

An untrained consumer panel of a total of 63 members evaluated the five cooked meat sausages, for overall acceptability (aroma, flavour and texture) on a five-point hedonic scale (1 = dislike extremely and 5 = like extremely).

Statistical methods for sensory analysis

Data were analyzed, using the statistical programme GenStat® (Payne, 2003). Factorial ANOVA was used to test for the panel-by-product interaction (MacFie, 2006). Means per row were separated using Fisher's protected t-test. The least significant difference was based at 5% level ($p\leq0.05$). Principal component analysis

(PCA) was done to determine (identify) the smallest number of the latent variables, which are called principal components to identify factors differentiating the sausage samples.

Results and discussion

Descriptive sensory results

Table 1 shows the statistical results in terms of the significant differences between the sensory attributes measured for each sausage sample tested by the trained panel. The control sample was found to correlate positively with flavour sausage and aroma intensity which was expected and it had the most intense aroma intensity, sausage aroma and flavour and texture chewiness and consistency. Aroma liver and aroma offal were found to be most intense in sample K and L and least intense in the control sample, which was expected. No significant difference was found between any of the samples in terms of mouth coating. Sample J was found to have the most intense juicy appearance.

Principal Component Analysis (PCA) for sensory analysis

PCA was performed to illustrate the graphical representations (Figures 1 and 2) of the relationship between the sensory attributes relationship of five different formulations of cooked control (with no offal) and offal-containing fresh sausages. Figure 1 graphically represents the position of the different formulations of cooked meat sausages containing beef offal and the control, relative to the attributes that were rated the highest in each sausage product. The control sample (bottom right of graph) contrasted with sample K and L the most (bottom left of graph), meaning that the control sample differs significantly from these samples (K and L) (Figure 1).

Figure 2 graphically represents the PCA loadings of the attributes and is an indication of the correlation of the sensory attributes for cooked sausages. Only attributes with correlation coefficient (r) values >0.8 were investigated. The PCA explained 93.05 % of the total variation in the data. The first principal component **PC1** (x-axis) as seen from Figure 2 accounted for 69.6 % of the total variation in the data and was characterized by liver flavour (with the correlation coefficient between the scores and the attributes of -0.990), liver aroma (r= -0.975), offal flavour (r= -0.916), mouth coating (r= -0.855) in a descending order, displaying negative loadings. Sausage flavour (r= +0.986) and aroma intensity (r= +0.911) in a descending order, displayed a positive loading.

Consumer panel results

No significant differences were found between samples C, I, J and K in terms of the aroma attribute and all differed significantly from L.

Conclusions

In conclusion, the sensory attributes for samples I and J were acceptable to both black trained and consumer sensory panel. Sample J had the most intense appearance of juiciness.

References

Payne, R.W. 2003. GenStat® for Windows®, Introduction. 7th ed. VSN International, ISBN 1-904375-08-1.

Macfie, H. 2006. Emerging issues and methods in sensory and consumer science. Department of Agricultural Economics, Extension and Rural Development. University of Pretoria, 30 January-02 February.

Table 1. Means for sensory attribute data from descriptive sensory analysis of the control and cooked meat sausages containing beef offal

Sensory Attributes	SEM	F. prob.(p)	LSD (5%)	CV%	Control C	BINSHR I	BINSHMB J	BLSTLR K	BLSTMB L
Aroma intensity	0.19	0.015	0.55	16.0	5.34^{a}	4.92^{abc}	5.10^{ab}	4.59^{bc}	4.51^{c}
Aroma liver	0.18	<0.001	0.51	30.6	2.58^{c}	3.64^{ab}	3.39^{b}	4.10^{a}	3.73^{ab}
Aroma offal	0.21	<0.001	0.59	29.7	2.63^{c}	3.15^{bc}	3.27^{b}	4.17^{a}	4.58^{a}
Appearance juiciness	0.15	<0.001	0.42	23.3	4.76^{bc}	5.14^{b}	5.66^{a}	4.51^{c}	4.98^{b}
Texture consistency	0.12	<0.001	0.35	15.3	5.78^{a}	4.02^{d}	4.49^{c}	4.80^{bc}	4.90^{b}
Texture chewiness	0.09	<0.001	0.27	13.8	5.51^{a}	4.20^{d}	4.53^{c}	4.81^{b}	4.80^{b}
Flavour sausage	0.17	<0.001	0.47	14.7	5.81^{a}	4.71^{bc}	5.15^{b}	4.56^{c}	4.51^{c}
Flavour liver	0.18	<0.001	0.52	29.2	2.41^{c}	4.02^{a}	3.48^{b}	4.48^{a}	4.27^{a}
Flavour offal	0.19	<0.001	0.55	27.0	2.19^{c}	3.19^{b}	3.07^{b}	4.12^{a}	4.44^{a}
Mouth – coating	0.09	0.554	NS	28.8	2.70	2.85	2.90	2.88	2.85

Means per row followed by a different letter were significantly different at the 5 % level, 1 = extremely intense/strong, 8 = extremely bland /weak SEM is the standard error of the means, LSD is the t-test least significant difference, CV% is the percentage coefficient of variation

Control (C), BINSHR (I), BINSHMB (J), BLSTLR (K) BLSTLMB (L)

B=Beef trimmings, IN=Intestines, S= Spleen, H= Heart, R= Rusk, L= Liver, ST= Stomachs, L= Lung and MB= Multibase

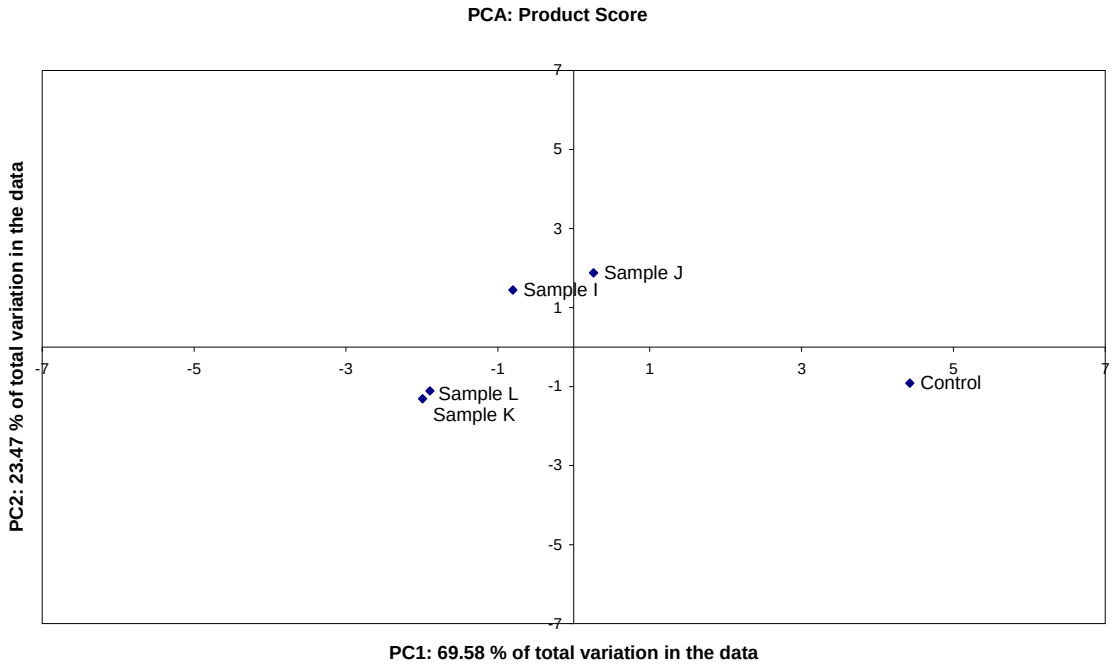

Figure 1. Graphical representation of the positioning of the control and four formulations of cooked meat sausages containing beef offal, in relation to the principal component (PC) scores of each formulation.

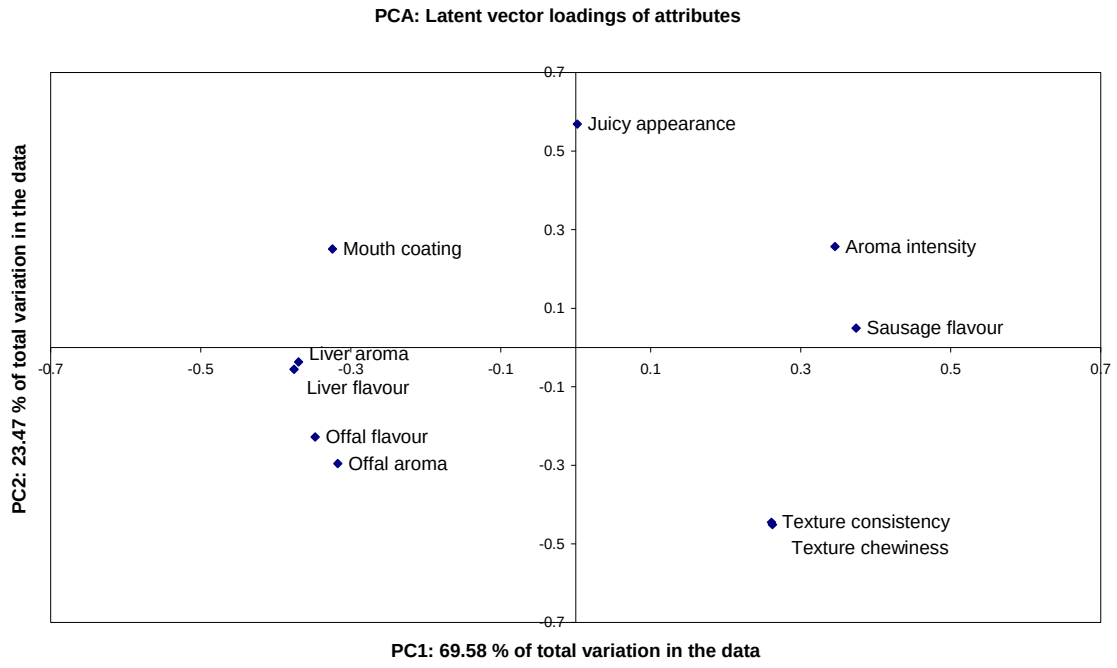

Figure 2. Graphical representation of the main attributes identified in the principal component analysis (PCA) that discriminated between the control and cooked meat sausages containing beef offal.