The sensory quality of selected cooked sausages from the market

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Abstract

Totally eight samples of selected cooked sausages (A, B, C, D, E, F, G and H) selected at random from the retail network in the Czech Republic were evaluated in this study. Evaluation was performed in a sensory laboratory by 64 students from the University of Veterinary and Pharmaceutical Sciences in Brno using unstructured graphic scales 100 mm long. The cut appearance, colour, matrix, aroma, consistency, texture, saltiness, taste and overall impression were evaluated. Differences were observed between samples in all parameters studied ($P < 0.001$). Overall, samples F and H received the worst evaluation ($P < 0.001$). No difference was seen between the other samples. Significant differences between samples were also recorded during the instrumental measurement of colour and texture ($P < 0.001$). This study revealed that there are significant differences in sensory quality among selected cooked sausages on the retail network.

Kabanos, meat products, sensory parameters, taste, texture

Introduction

Meat and meat products are a highly interesting commodity in economic terms and are the most valuable agricultural products. Production and consumption of meat and meat products are on the increase globally. Global meat consumption of 41.3 kg/person/year is anticipated in 2015; 31.6 kg/person/year in developing countries and 95.7 kg/person/year in industrially developed countries (FAO 2015). Meat products are important in nutritional terms for their content of high biological value proteins containing essential amino acids and their content of biologically available minerals, vitamins and micronutrients, most importantly iron, selenium, zinc and vitamin B12 (Ledesma et al. 2016). Meat products available in the Czech Republic are of varying quality, influenced by the type of meat product, producer, raw materials, e.g. salt content, fat and secondary ingredients (Mora-Gallego et al. 2013; Aaslyng et al. 2014; Baer and Dilger 2014;), and the processing technology, e.g. smoking technology (Ledesma et al. 2016). It is also true that a higher price is not always a guarantee of higher quality (Brychta et al. 2014). The sensory quality of meat products is influenced primarily by the surface appearance and cut surface appearance, aroma, taste, juiciness, tenderness to the bite and overall texture (Saláková et al. 2013). In more general terms, a large role is also played by the method of packaging and its attractiveness.

General requirements for the quality of meat products are given in the Decree No. 326/2001 Coll., as amended. Requirements for the quality and composition of selected meat products are specified in an appendix to this decree. Selected cooked sausages stuffed in natural or artificial ring form belong to the group heat-treated meat products in which a minimal thermal effect corresponding to the action of a temperature of + 70 °C for 10 minutes has been attained in all parts of the product. There is a relatively wide range of selected cooked sausages on the retail network in the Czech Republic, though requirements for the quality and composition are specified in greater detail only for Kabanos. The basic

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raw material for its production is beef, pork and veal meat, with the use of mechanically separated meat and mechanically separated poultry meat being prohibited. Its consistency must be supple and cohesive, the colour of the slice must be meaty pink, the grains of the raw materials from 6 to 10 mm in size irregularly scattered. Small hollows and sporadic small collagen grains are permitted. The product should have the aroma and taste of fresh smoked meat and should be appropriately salty and spicy. The product should be tender to the bite after cooling and juicy after heating.

The aim of this study was to compare the sensory quality of various samples of selected cooked sausages selected at random and purchased from retail stores in the Czech Republic with a view to selected sensory parameters supplemented by instrumental analysis of colour and texture. (Plate I, Fig. 1)

Materials and Methods

Eight samples of selected cooked sausages (A, B, C, D, E, F, G, H) chosen at random from four producers were purchased in retail stores in the Czech Republic. The samples were given a random three-figure numerical code to preserve anonymity (Plate I, Fig. 1). Sensory assessment took place in a specially equipped laboratory (in accordance with the Czech National Standard CSN ISO 8589) at the Department of Meat Hygiene and Technology at the University of Veterinary and Pharmaceutical Sciences in Brno (Plate I, Fig. 2). The samples were heated in water before the sensory assessment was performed. A total of sixty-four students from the University of Veterinary and Pharmaceutical Sciences in Brno who had taken the course of the Sensory Analysis of Foods and who can be considered as trained took part in the assessment. Unstructured graphic scales of 100 mm in length with a written description at both ends were used for the sensory assessment (CSN ISO 4121). The left-hand end of the scale indicated a completely satisfactory situation in relation to the given indicator; the right-hand end of the scale represented an entirely unsatisfactory situation in relation to the given indicator. The appearance of the cut face, colour, matrix, aroma, consistency (to touch), texture (to the bite), saltiness, taste and overall impression were assessed. White bread was used in the tasting. Water was available to the assessors. (Plate I, Fig. 2)

The instrumental evaluation of colour was performed using a Konica Minolta CM-5 spectrophotometer (Konica Minolta, Japan). The instrument was set to a D65 light source and a standard observer angle of 10°, 8 mm measurement slit. Measurement took place in the SCI mode. The instrument was calibrated to black and white light. Each sample was measured five times on the cut side. The parameters L* – lightness, a* – redness, b* – yellowness, C* – chroma and h° – hue were evaluated.

The instrumental measurement of texture was performed on an INSTRON 5544 instrument (Instron Corporation, USA). A texture profile analysis (TPA) was performed to simulate the chewing of a piece of food in the mouth. Cylindrical samples of coiled sausages of 25 mm in diameter and 20 mm height were compressed in two cycles to a compression ratio of 50%. The cross-head speed was 50 mm/min. The maximum force during the first compression was evaluated – the toughness of the sample. Cohesiveness and gumminess were evaluated as a secondary texture parameters. Each sample was measured a total of six times (Plate I, Fig. 3).

The results obtained were statistically processed by single-factor analysis in the program ANOVA (Microsoft Office EXCEL 2010).

Results and Discussion

Significant differences ($P < 0.001$) between samples were determined during comparison of the results of sensory evaluation (Plate II, Fig. 4). Sample A received the best evaluation for cut surface appearance (89.64 ± 13.46), with sample H receiving the worst evaluation (36.48 ± 21.42; $P < 0.001$). This parameter was significantly influenced by the matrix of the meat product ($r = 0.96$). Colour of cut surface received the best evaluation in sample E (83.19 ± 14.74) and the worst in sample H (38.05 ± 19.83; $P < 0.001$). Evaluation of colour is principally influenced by whether the given sample is from a finely comminuted product or a product with a certain granularity (mosaic). Colour is also influenced by correct pre-salting and salting of the meat to ensure adequate stability (Kameník and Král 2012). Ascorbic acid and ascorbates are used to improve colour and colour stability. Protein additives may have a negative effect on colour (Steinhauser et al. 1995). Cut surface colour has a significant influence on the final overall impression made by the product ($r = 0.89$). When matrix was evaluated, sample A came out best (88.69 ± 14.98) and sample H the worst (26.04 ± 18.43; $P < 0.001$). Matrix is, first and foremost, a question

of production technology. In particular, few small cavities and small collagen particles are required. Evaluation is again dependent on whether the sample is from a finely comminuted product or a product containing meat or fat particles of a certain size. Aroma received the best evaluation in sample B (87.67 ± 16.69), while the lowest score was received by sample H (56.13 ± 27.36; $P < 0.001$). The seasonings and flavourings used and the method of smoking meat products play the largest role in terms of aroma. The composition of the smoke used for smoking may differ. This smoke is estimated to contain as many as 10 000 various constituents, of which around 500 contribute to the aroma of smoked products (Steinhauser et al. 1995). Aroma is subsequently closely associated with the taste of the selected cooked sausage ($r = 0.89$). The best consistency as evaluated by touch was shown by sample A (88.24 ± 12.43), the worst consistency by sample F (58.10 ± 24.37; $P < 0.001$). Our experiment revealed a close relationship between cut surface appearance and consistency ($r = 0.93$). Texture received the best evaluation in sample D (83.53 ± 15.08) and the worst in sample F (54.62 ± 30.23; $P < 0.001$). Texture (consistency) is influenced by a number of factors, particularly salting (Steinhauser et al. 1995; Kameník & Král 2012), protein and saccharide additives, and polyphosphates (Steinhauser et al. 1995). The correlations determined ($r = 0.95$) between the sensory assessment of texture and saltiness may point to the influence of salting on the texture of selected cooked sausages. The best evaluation of saltiness was for sample D (72.16 ± 26.21), the worst for sample F (50.95 ± 29.45; $P < 0.01$). Saltiness is influenced primarily by the content of salt, though also by the fat content which may prevent active taste substances from penetrating to taste receptors in the oral cavity (Pokorný et al. 1998). The best taste was found in sample B (78.41 ± 18.09), the worst in sample F (51.73 ± 31.08; $P < 0.001$). The evaluation of taste is a considerably subjective affair and may be influenced by a large number of various components in a meat product. Sample D (68.27 ± 22.31) came out on top in the evaluation of overall impression, followed by samples B, E, G, A, C and F, with sample H receiving the worst assessment of overall impression (39.43 ± 18.69; $P < 0.001$). Our experiment showed that taste made the greatest contribution to overall impression ($r = 0.94$), followed by aroma and consistency ($r = 0.91$), colour ($r = 0.89$), texture (0.78), saltiness ($r = 0.77$) and cut surface appearance ($r = 0.73$), with matrix making the smallest contribution ($r = 0.57$) (Table 1). The overall evaluation revealed that samples F and H received a far worse assessment than the other samples ($P < 0.001$). No statistically significant difference was found in terms of overall evaluation between samples A, B, C, D, E and G. (Plate II, Fig. 4)

Table 1. Correlations between evaluated quality parameters

Correlation coeficient	Cut surface appearance	Colour	Matrix	Aroma	Consistency	Texture	Saltiness	Taste
Colour	0.75	-	-	-	-	-	-	-
Matrix	0.96	0.63	-	-	-	-	-	-
Aroma	0.58	0.87	0.39	-	-	-	-	-
Consistency	0.93	0.84	0.82	0.74	-	-	-	-
Texture	0.60	0.60	0.38	0.70	0.76	-	-	-
Saltiness	0.49	0.51	0.27	0.63	0.72	0.95	-	-
Taste	0.53	0.76	0.32	0.89	0.77	0.79	0.80	-
Overall impression	0.73	0.89	0.57	0.91	0.91	0.78	0.77	0.94

The instrumental measurement of colour confirmed the significant differences ($P < 0.001$) in the colour of the samples found during sensory evaluation. This instrumental measurement did not, however, evaluate acceptability or pleasantness of colour, but was

an objective evaluation of colour parameters, the values of which are shown in Table 2. Significant correlations between the sensory evaluation of colour and the individual colour parameters evaluated instrumentally were probably not found for this reason.

Significant differences were found between the samples of selected cooked sausages in the texture parameters evaluated instrumentally ($P < 0.001$), which corresponds to the results of sensory assessment. Nevertheless, particularly significant correlations were not found between the sensory and instrumental evaluation in this case, either. The differences in texture parameters (Table 2) are influenced primarily by the processing of the meat products, as they included both finely comminuted products made only with a filler and products with various degrees of comminution. The composition of the selected cooked sausage itself also plays a large role.

Table 2. Values of selected parameters in selected cooked sausages measured instrumentally

Indicator/Sample	A	B	C	D
Toughness (N)	42.42 ± 5.50	80.38 ± 12.12	35.54 ± 4.66	80.05 ± 9.46
Cohesiveness (-)	1.27 ± 0.01	1.22 ± 0.02	1.26 ± 0.01	1.24 ± 0.05
Gumminess (N)	23.70 ± 6.60	97.60 ± 13.28	44.64 ± 5.68	99.03 ± 12.48
L*	68.72 ± 0.18	63.25 ± 2.80	70.74 ± 0.24	68.19 ± 0.69
a*	13.83 ± 0.30	14.38 ± 1.43	8.23 ± 0.14	13.50 ± 0.83
b*	19.56 ± 0.37	14.18 ± 1.29	18.27 ± 0.17	17.64 ± 1.45
C*	23.96 ± 0.45	20.21 ± 1.78	20.04 ± 0.17	22.22 ± 1.65
h°	54.75 ± 0.33	44.61 ± 2.13	65.75 ± 0.40	52.53 ± 0.80
Indicator/Sample	E	F	G	H
Toughness (N)	39.47 ± 20.50	45.14 ± 4.19	47.69 ± 7.90	43.24 ± 5.75
Cohesiveness (-)	1.33 ± 0.26	1.25 ± 0.04	1.27 ± 0.01	1.30 ± 0.14
Gumminess (N)	51.60 ± 24.01	56.32 ± 5.93	60.35 ± 9.59	55.95 ± 8.62
L*	66.75 ± 3.06	53.26 ± 8.84	61.99 ± 0.34	66.77 ± 2.58
a*	8.94 ± 1.49	16.39 ± 0.96	13.65 ± 0.09	11.80 ± 1.16
b*	8.84 ± 2.68	17.19 ± 1.40	16.99 ± 0.33	15.72 ± 0.79
C*	12.61 ± 2.85	23.78 ± 1.12	21.80 ± 0.30	19.67 ± 1.14
h°	43.87 ± 5.46	46.31 ± 3.12	51.22 ± 0.44	53.17 ± 2.43

N – Newton; L* – lightness; a* – redness; b* – yellowness; C* – chroma; h° – hue

Conclusions

The sensory quality of foods is one of basic indicators of overall quality. A comparison of sensory parameters of selected cooked sausages clearly demonstrated differences in the quality of selected cooked sausages retailed in the Czech Republic. No legislative demands for the sensory properties are made for selected cooked sausages, with the exception of Kabanos. A wide range of selected cooked sausages is, however, available to customers, most of whom will not buy a product of inferior quality more than once. Producers should pay greater attention to the sensory parameters of their products, and they should also, for example, use sensory laboratories to compare their own products with products of other manufacturers. It would also help improve product quality if minimum sensory requirements and requirements for the composition of selected cooked sausages were incorporated into the legislation.

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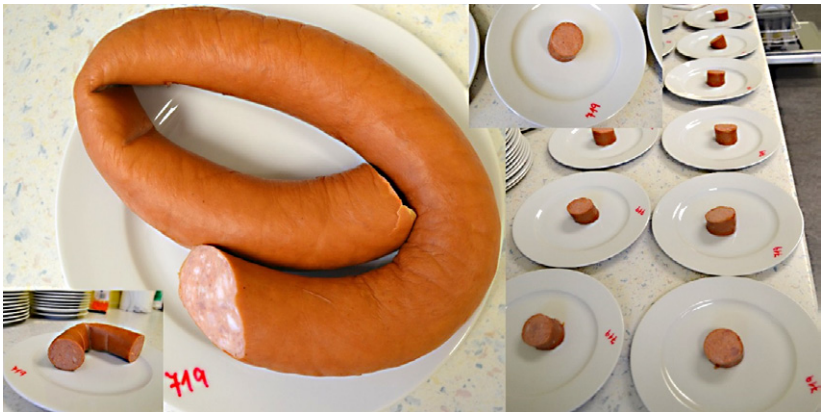

Fig. 1. Preparation of samples for the sensory assessment

Fig. 2. Sensory assessment of a selected cooked sausage in the laboratory

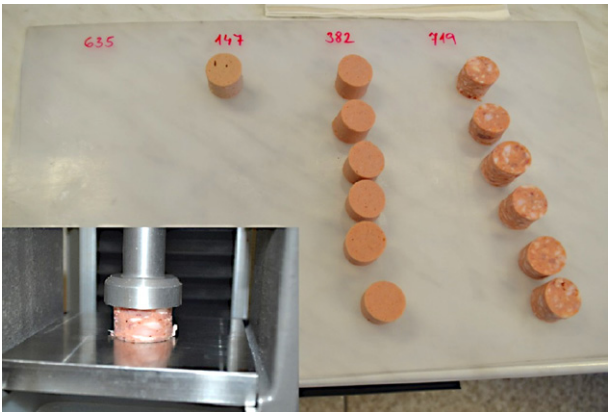

Fig. 3. The measurement of texture on an INSTRON 5544 instrument

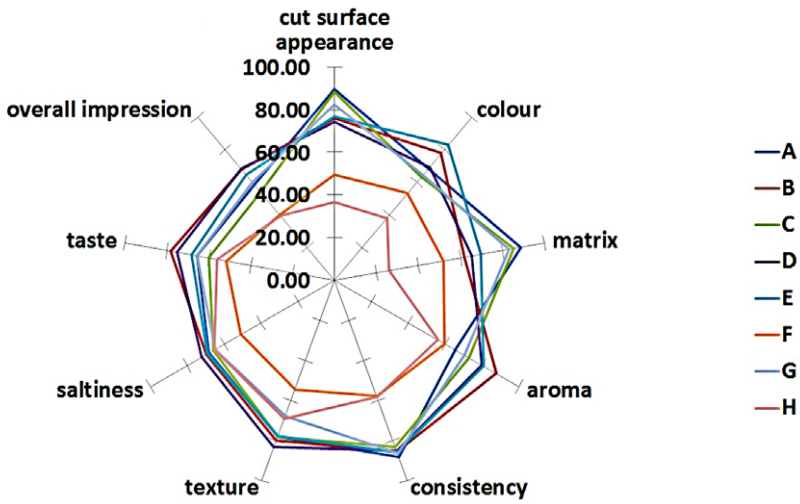

Fig. 4. Results of sensory evaluation of selected cooked sausages