SENSORIC AND INSTRUMENTAL METHODS FOR EVALUATION OF TEXTURE OF FINELY DISINTEGRATED MEAT PRODUCT WITH THE ADDITIVE OF SOYA ISOLATE PROTEIN

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Background

Texture is a multi-factorial discriminant, playing an important role in quality of meat and its products and simultaneously, affecting significantly the approval of the product by the consumer. To determine the texture instrumentally, various methods are emplyed. Due to their diversity, a suitable choice of the method for a given type of the product is very important (Klettner 1994, Tyszkiewicz et al. 1994). The mentioned methods include popular and widely used TPA method (Klettner 1994, Chrystall et al. 1994). Texture may be also determined by the sensoric analysis. During the recent years, a method of sensoric profiling, being also called the method of Quantitative Descriptive Analysis (QDA), has been widely recognized in studies on texture. When using the mentioned method, the particular attributes are evaluated as being divided into partial sensations. After preliminary specification of its quality, each of the mentioned properties is evaluated quantitatively in respect of its intensity (Baryłko-Pikielna 1990, Beilken et al. 1991).

Objectives

The object of the studies was the application of the methods of profile analysis: instrumental and sensoric, in evaluation of texture of finely disintegrated product, containing soya isolate proteins with various levels of additive and being introduced in a different way: in a form of powder or in a dispersed form of gel.

Materials and methods

For the studies, the model sausage was manufactured, with the following composition: pork meat 30%, tendinous beef meat 45% and fat 25%.The additive of soya proteins, being introduced instead of beef meat amounted to: 0% - control test; 0,5%, 1%, 2% and 4% (in relation to weight of raw materials). Proteins were incorporated in a form of powder or gel, with hydration 1:4. Stuffing was prepared in mechanical cutter of Seydelmann 40 Ras company.

Evaluation of texture of model products was performed by instrumental TPA method, according to modification of Chrystall et al. (1994) and by sensoric method. Using TPA method, hardness and cohesiveness and elasticity, gumminess and chewiness were determined. The test was carried out in UTM Zwick model 1445, at the level of deformation equal to 50%, cross-section of stem 1,0 cm^2 and thickness of the sample 10 mm. Intensity (in scale of 100 mm) of the following discriminants: firmness, springiness, guminess, chewiness, fatness and wetness was determined by sensoric profile analysis. Three experimental series were performed and the obtained results of the studies were subjected to Multifactor ANOVA Analysis and Multiply-Variable Analysis, using "Statgraphics 6.1." programme.

Results and discussion

The result of profile analysis of texture, using instrumental method, are given in Tab.1. The increase of the addition of soya isolate protein to model products caused a significant lowering of their hardness, elasticity, chewiness and gumminess but it did not have any significant effect on shaping of cohesiveness. The method of incorporation of soya isolate protein (powder or gel) was not statistically significant.

The results of sensoric profile analysis of texture are presented in Tab. 2. The increase of the additive of soya isolate protein in model products caused also, in relation to the control product, a significant decrease in sensation of firmness, springiness and chewiness. Together with the increase of the level of soya isolate additive, the sensation of fatness and wetness of products was increased. On the other hand, any significant influence of the level of soya protein additive on shaping the sensation of sensoric guminess, was not found. The method of incorporation of soya isolate proteins was not statistically significant in shaping of texture, being determined by sensoric profile analysis.

A very highly significant correlation between instrumental hardness and sensoric firmness and highly significant correlation between instrumental and sensoric chewiness (Tab. 3) was found. On the other hand, any significant correlation between instrumental elasticity and sensoric springiness was not stated. Hardness and chewiness, as being determined by the instrumental methods, were correlated with the most of texture sensations, determined by sensoric method. Cohesiveness and elasticity, as determined by instrumental methods, and guminess and wetness, evaluated sensorically, did not correlate with the remaining discriminants of texture. The increase of the additive of soya isolate proteins caused significant differences in evaluation of instrumental guminess. On the other hand, these changes were insignificant in evaluation of sensoric gumminess. Sensoric analysis, being based on senses of jugding panel allowed to characterize the sensation of fatness and wetness which cannot be recorded by the instrumental method.

Conclusion

1. The addition of soya isolate proteins caused significant changes in texture of the tested products whereas the method of incorporation of soya proteins - in a form of powder or gel - did not have any significant effect on shaping the discriminants of texture, irrespectively of the employed method for evaluation of texture
2. The methods of evaluation of texture: sensoric and instrumental, allow to characterize the texture of the tested products.

3. The application of sensoric method of texture' s evaluation allowed to determine the characteristic sensations of texture of the tested product, fatness and wetness, being unavailable by instrumental methods.

References

1. Beilken S.L., Eadie L.M., Griffiths I., Jones P.N., Harris P.V. 1991 Assesment of the Textural Quality of Meat Patties: Correlation of Instrumental and Sensory Attributes. Journal of Food Science, vol. 56, 6, 1465
2. Baryłko-Pikielna N. 1990 Nowe znowelizowane metody analizy sensorycznej stosowane w pracach badawczych nad żywnością. Postęp w analizie żywności-wyd. p.red. S.Tyszkiewicza, tom II, 1
3. Chrystall B. B., Culioli J., Demeyer D., Honkiel K. O., Moller A. J., Purslow P., Schwägele F., Shorthose R., Uytterhaegen L. 1994 - Recommendation of reference methods for assessment of meat tenderness - 40 ICoMST, Hague, 5-v. 06 p. 5
4. Klettner P.G. 1994 Fleisch und Fleischerzeugnisse. Messungen der Textur oder Konsistenz mit Prüfmaschinen, Fleischwirtschaft74,(4), 378
5. Tyszkiewicz St., Olkiewicz M., Daun H., 1994 -A multiparametric method of evalution of rheological properties of solid food product, 40 ICoMST Haga, W-3, 23

Table 1

Characteristics of texture of the products, being evaluated by instrumental profile analysis

factor		discriminant				
		hardness (N)	cohesiveness	gumminess (N)	elasticity (mm)	chewiness (Nmm)
additive of soya isolate proteins	0%	13.60 ^{b}	0.32	4.33 ^{c}	4.25 ^{b}	18.39 ^{d}
	0,5%	13.54 ^{b}	0.31	4.15 ^{bc}	4.22 ^{ab}	17.75 ^{cd}
	1%	12.53 ^{b}	0.31	3.83 ^{abc}	4.17 ^{a}	16.11 ^{bc}
	2%	11.19 ^{a}	0.33	3.74 ^{ab}	4.17 ^{a}	15.33 ^{ab}
	4%	10.00 ^{a}	0.33	3.42 ^{a}	4.17 ^{a}	13.51 ^{a}
form of protein additive	powder	12.13	0.31	3.87	4.19	15.94
	gel	12.21	0.33	3.92	4.20	16.50

values of discriminants in columns, being marked with various letters, differ significantly at P≤0.05

Table 2

Characteristics of texture of the products, being evaluated by sensoric profile analysis

factor		discriminant					
		firmness	springiness	guminess	chewiness	fatness	wetness
additive of soya isolate proteins	0%	5.51 ^{c}	5.92 ^{c}	3.98	4.97 ^{c}	3.63 ^{a}	4.37 ^{a}
	0,5%	5.26 ^{c}	5.84 ^{c}	4.24	4.78 ^{bc}	3.76 ^{ab}	4.75 ^{ab}
	1%	4.76 ^{bc}	5.62 ^{bc}	4.27	4.32 ^{abc}	3.79 ^{ab}	4.81 ^{ab}
	2%	4.09 ^{ab}	4.85 ^{ab}	4.33	4.07 ^{ab}	4.35 ^{bc}	4.98 ^{ab}
	4%	3.79 ^{a}	4.64 ^{a}	4.48	3.56 ^{a}	4.65 ^{c}	5.22 ^{b}
form of protein additive	powder	4.50	5.25	4.22	4.12	3.93	4.68
	gel	4.86	5.50	4.30	4.56	4.14	4.97

values of discriminants in columns, being marked with various letters, differ significantly at P≤0.05

Table 3

Correlation of texture discriminants, evaluated by instrumental (I) and sensoric (S) methods

discriminant	hardness_I	cohesiveness_I	gumminess_I	elasticity_I	chewiness_I
firmness_S	0.6759 ***	-0.1664 ^{ns}	0.5130 **	0.3301 ^{ns}	0.6105 ***
springiness_S	0.5495 **	-0.0086 ^{ns}	0.5475 **	0.1156 ^{ns}	0.5355**
guminess_S	-0.2905 ^{ns}	0.1918 ^{ns}	-0.0860 ^{ns}	0.1571 ^{ns}	-0.1686 ^{ns}
chewiness_S	0.5242 **	-0.0854 ^{ns}	0.4627 **	0.2399 ^{ns}	-0.4958 **
fatness_S	-0.5914 ***	0.3354 ^{ns}	-0.2267 ^{ns}	-0.3295 ^{ns}	-0.4327**
wetness_S	-0.3493 *	0.0886 ^{ns}	-0.2181 ^{ns}	-0.2266 ^{ns}	-0.3196 ^{ns}

*** correlation significant at P≤0,001
** correlation significant at P≤0.01
* correlation significant at P≤0.05
ns correlation insignificant at P>0.05