Effect of different type of smoke on the sensory profile of Frankfurters

M. Lušnic Polak[1], A. Kuhar[1], L. Demšar[1], T. Polak[1]

Original scientific papar

SUMMARY

The objective of present research was to determine sensory profile of frankfurters smoked with five different types of woodchips: beech as a control, birch, cherry, apple and plum. Texture parameters were determined and instrumental measurements of colour on the surface and cross-section of frankfurters were performed. Results obtained shown that colour and texture parameters of frankfurters changed significant with different types of woodchips. From a sensory point of view, different smoke type affects especially the odour and aroma characteristics. The most similar to control group were frankfurters smoked with birch woodchips and as less harmonious was assessed smoke from plum woodchips.

Keywords: *smoking, different types of smoke, woodchips, frankfurters, sensory profile*

INTRODUCTION

In addition to drying and salting, smoking is one of the oldest preservation processes for meat, meat products and fish (Roseiro et al., 2011). The purpose of smoking is penetration of smoke components in meat. Smoke is formed due to the partial burning of wood during smoking process. In general, wood consists of 50 % cellulose, 25 % hemicellulose and 25 % lignin (Pöhlmann et al., 2012). During pyrolysis of cellulose and hemicellulose forms significant amounts of carbonyl compounds, which are responsible for brown colour on the surface of smoked meats. The pyrolysis of lignin forms some phenolic compounds which give characteristic aroma and act as antimicrobial and antioxidative compounds for smoked sausage (Hitzel et al., 2013; Škaljac et al., 2014). The use of different type of smoke can affects the physical qualities and sensory properties of smoked meat products (Ayo et al., 2008; Gomes et al., 2013; Malarut and Vangnai, 2018).

Therefore, the objective of present research was to study the influence of different types of smoke on the instrumental measured colour and texture parameters, as well as sensory profile of frankfurters. For the smoking process woodchips of beech (as a control), birch, cheery, apple and plum tree were used.

MATERIAL AND METHODS

Preparation of frankfurters

All experimental groups of frankfurters were composed of 30 % beef, 16 % pork, 24 % sunflower oil, 30 % ice, 1.7 % nitrite salt, 0.7 % phosphate mixture (Aroma UK) and 0.2% spice mix (Aroma Mix). Minced meat together with additives was transferred into Stephan UMC 5 electronic (Stephan Nahrungsmittel und Verfahrenstechnik, Germany) and homogenized until temperature increased from - 2 to 6 °C. Then cooled sunflower oil (0 °C) and spice mix were added and homogenized up to final temperature of 14 °C, approximately 20 minutes. During homogenization, ice was added gradually. The emulsified sausage batter was stuffed into collagen casings (Edicos, Spain) with diameter of 18 mm. Five experimental groups of approximately 2 kg were produced in three production replications. Smoking process was carried out in

1 **dr. sc. Mateja Lušnic Polak, assistant, Ana Kuhar, MSc student, prof. dr. sc. Lea Demšar, full professor, doc. dr. sc. Tomaž Polak, assistant,** University of Ljubljana, Biotechnical faculty, Jamnikarjeva 101, 1000Ljubljana

Autor za korespondenciju: mateja.lusnic@bf.uni-lj.si

a cooking chamber Fessman. Frankfurters were smoked for 8 min at 50 °C for each type of woodchips (beech as a control, birch, cheery, apple and plum). After smoking process, frankfurters were cooked to an internal temperature of 72 °C. Cooled frankfurters were vaccum packed and stored in a refrigerator at 4 °C until further analysis.

Methods

Instrumental analysis of colour on the surface and cross-section of cold and reheated frankfurter samples were determined with Chroma Meter CR-400 (Konica Minolta); the L* a* b* parameters were measured (L* (lightness), a* (redness) and b* (yellowness)).

Texture properties of cold frankfurter samples were measured with apparatus Texture Analyser TA.XT Plus. The Warner Bratzler (WB) HDP/BSV contact attachment was used to measure the maximum force required for the cross-section of the sample (cutting strength). For the TPA (Texture Profile Analysis), the frankfurter samples with diameter 18 mm and height 30 mm were compressed twice to 50 % of the original height (time = 5 s between two compression cycles) and the piston (P100) of 100 mm diameter was used. From the curve force depending on time different texture parameters were calculated: hardness, fracturability, adhesiveness, cohesiveness, springiness, gumminess, chewiness and resilience.

Sensory evaluation was carried out by a panel of five qualified and experienced panellists in the field of meat and meat products. The analytical-descriptive test (Golob et al., 2005) was used. The analysis were performed by scoring the sensory attributes on a structured scale from 1 to 7 points (1-7) or scale from 1 to 4 to 7 (1-4-7), where a higher score indicated greater expression of a given property and a score of 4 points was considered optimal. These sensory profiles of frankfurters samples were assessed using 26 descriptors that were presented in four groups (Gašperlin et al., 2014). The first group related to the visual attributes and the cross-section: colour intensity and colour uniformity. The second group related to the texture: rigidity of the casings and hardness of the emulsion. These properties were estimated tactile and during chewing. The third group related to the olfactory attributes, like odour intensity, odour harmony, odour intensity of beech, birch, cheery, apple, plum smoke and presence of off odour. The fourth block related to the aroma attributes, such as saltiness, aroma intensity, aroma harmony, aroma intensity of beech, birch, cherry, apple, plum smoke and presence of off aroma. The visual attributes were evaluated on cold frankfurter samples. Other properties, like texture, odour and aroma, were evaluated on reheated samples (in a hot water at temperature of 90 °C).

Data analysis

The data were analysed for normal distributions using the UNIVARIATE procedure (SAS/STAT). The differences according to smoke type (beech, birch, cheery, apple, and plum woodchips) were analysed through a general linear model procedure and Duncan test (SAS/STAT), with a 0.05 level of significance.

RESULTS AND DISCUSSION

Table 1 Effect of different smoke type on the texture parameters of frankfurters

Test	Parameter	Smoke of different woodchips					P_S	P_R
		Beech	Birch	Cherry	Apple	Plum		
TPA	Hardness (N)	38.2	46.2	40.2	40.1	46.1	Ns	***
	Fracturability (N)	26.6^{a}	17.0^{a}	5.6^{b}	16.4^{a}	18.8^{a}	**	***
	Adhesiveness (Nxs)	0.00^{a}	-0.01^{a}	-0.04^{a}	-0.12^{b}	-0.01^{a}	*	***
	Springiness	0.97	0.99	0.97	0.96	0.95	Ns	***
	Cohesiveness	0.46^{ba}	0.48^{ba}	0.51^{a}	0.44^{b}	0.45^{b}	Ns	***
	Gumminess (N)	17.2^{b}	22.3^{a}	19.9^{ba}	17.5^{b}	20.8^{ba}	**	***
	Chewiness (N)	16.6^{b}	22.0^{a}	19.2^{ba}	16.8^{b}	19.7^{ba}	**	***
	Resilience	0.19	0.21	0.22	0.18	0.18	Ns	***
WB	Cutting strength (N)	$71.3b^{a}$	60.7^{dc}	54.1^{d}	79.0^{a}	$68.2b^{c}$	***	***

*Significance: ***P ≤ 0.001 very high statisticaly significant, **p ≤ 0.01 high statistically significant, *P ≤ 0.05 statistically significant, Ns – P > 0.05 statistically not significant; P_S – statistical probability of smoke type effect; P_R – statistical probability of production repetition effect; means with different superscript letters ($^{a, b, c}$) within row differ significantly (P ≤ 0.05; significance of differences between smoke types).*

Texture parameters of frankfurters smoked with different types of woodchips are presented in Table 1. Parameters determined with TPA, like fracturability, adhesiveness, gumminess and chewiness differed significantly (P ≤ 0.01) with different types of smoke used. Minimal differences were observed in hardness. In contrast, Malarut and Vangnai (2018) showed that sausage smoked with beech woodchips had significantly higher hardness values compared to other woodchips used (Eucalyptus, Neem and Copper pod woodchips). The hardness value of sausage could be explained with the occurrence of casing hardening from compounds in smoke derived from cellulose pyrolysis. These compounds react with proteins, which causes protein crosslinking and result in hardening of the sausage casing (Ledesma et al., 2016). In our case, fracturability of frankfurters smoked with cherry woodchips was considerably lower (3-4 times) compared to frankfurters smoked with other types of woodchips. Adhesiveness was more expressed at frankfurters smoked with apple woodchips compared to control group, where beech woodchips was used. The highest gumminess (22.3 N) and chewiness (22.0 N) were observed at frankfurters smoked with birch woodchips. Cutting strenght (WB) differed significantly with different smoke type, the highest value was observed at frankfurters smoked with apple woodchips (79.0 N), followed by beech woodchips (71.3 N) and the lowest at frankfurters smoked with cherry woodchips (54.1 N).

Table 2 Effect of different smoke types on the colour parameters of frankfurters

Sample	Value	Smoke of different woodchips					P_S	P_R
		Beech	Birch	Cherry	Apple	Plum		
Cold	L*surface	56.13 ±3.49^{d}	58.12 ±4.94^{c}	61.69 ±1.61^{b}	61.10 ±2.33^{b}	63.19 ±1.08^{a}	***	***
	a*surface	18.85 ±3.15^{a}	18.25 ±2.50^{a}	15.79 ±1.40^{b}	15.16 ±3.36^{b}	15.59 ±1.98^{b}	***	***
	b*surface	33.98 ±2.01^{a}	33.20 ±4.63^{a}	29.00 ±2.11^{b}	30.55 ±1.89^{b}	29.41 ±2.96^{b}	***	***
	L*cross-section	74.77 ±1.84^{b}	76.83 ±2.67^{a}	75.95 ±1.06^{ab}	76.33 ±2.17^{a}	76.70 ±0.60^{a}	**	***
	a*cross-section	11.48 ±0.44^{a}	10.25 ±0.86^{c}	11.31 ±0.24^{a}	10.78 ±0.28^{b}	10.85 ±0.35^{b}	***	***
	b*cross-section	10.62 ±0.30^{a}	9.67 ±0.68^{c}	10.15 ±0.13^{b}	10.01 ±0.22^{b}	10.13 ±0.24^{b}	***	***
Reheated	L*surface	53.86 ±5.26^{c}	56.02 ±6.03^{c}	58.21 ±4.46^{b}	58.41 ±3.31^{b}	62.05 ±2.14^{a}	***	***
	a*surface	19.76 ±1.79^{a}	18.76 ±4.05^{a}	17.30 ±2.38^{b}	16.66 ±2.01^{b}	14.04 ±2.46^{c}	***	***
	b*surface	33.04 ±1.23^{ab}	33.90 ±3.80^{a}	31.73 ±2.92^{b}	32.89 ±2.49a^{b}	29.38 ±3.62^{c}	***	***
	L*cross-section	74.76 ±1.84^{b}	76.83 ±2.67^{a}	75.95 ±1.06^{ab}	76.33 ±2.17^{a}	76.70 ±0.60^{a}	**	***
	a*cross-section	11.48 ±0.44^{a}	10.25 ±0.86^{c}	11.31 ±0.24^{a}	10.78 ±0.28^{b}	10.85 ±0.35^{b}	***	***
	b*cross-section	10.62 ±0.30^{a}	9.66 ±0.69^{c}	10.15 ±0.13^{b}	10.01 ±0.22^{b}	10.12 ±0.25^{b}	***	***

*Significance: ***P ≤ 0.001 very high statisticaly significant, **P ≤ 0.01 high statistically significant, *P ≤ 0.05 statistically significant, Ns – P > 0.05 statistically not significant; P_S – statistical probability of smoke type effect; P_R – statistical probability of production repetition effect; means with different superscript letters ($^{a, b, c}$) within row differ significantly (P ≤ 0.05; significance of differences between smoke types).*

Instrumental measurements of colour on the surface and cross-section of cold and reheated frankfurters changed significant with different types of smoke and production repetition (P ≤ 0.001) (Table 2). Values measured on cold samples were similar compared to values measured on reheated samples. L* values (lightness) measured on the surface and cross-section of control frankfurters, smoked with beech woodchips, were generally the lowest and consequently darker compared to other types of smoke. Malarut and Vangnai (2018) determined comparable L* value (54.1) for frankfurters where beech woodchips were used for smoking process. In contrast to values L*, a* (redness) and b* (yellowness) were significantly higher (redder and more yellow) on the surface of frankfurters, smoked with beech and birch woodchips compared to frankfurters smoked with cheery, apple and plum woodchips. Similar results were observed in study of Škaljac et al. (2018), where smoking process of dry fermented sausages carried out with beech woodchips shown significant higher a* values compared to cherry and apricot woodchips. In general, it can be concluded that cross-section of frankfurters smoked with beech woodchips had the highest values of a* and b* and the lowest values had samples, smoked with birch woodchips.

Table 3 Effect of different smoke types on the sensory profile of frankfurters

Sensory attribute		Smoke of different woodchips					P_S	P_R
		Beech	Birch	Cherry	Apple	Plum		
Surface colour intensity (1-4-7)		5.1 ±1.0^{a}	4.8 ±0.9^{a}	4.1 ±0.6^{b}	4.3 ±0.8^{b}	3.8 ±0.5^{c}	***	***
Surface colour uniformity (1-7)		5.6 ±1.3	5.6 ±1.1	5.1 ±1.1	5.2 ±1.3	5.4 ±1.5	Ns	Ns
Cross-section colour intensity (1-4-7)		4.1 ±0.3^{a}	3.9 ±0.3^{bc}	3.9 ±0.2^{abc}	4.1 ±0.6^{ab}	3.8 ±0.5^{c}	*	Ns
Cross-section colour uniformity (1-7)		5.8 ±1.4	6.0 ±1.2	5.9 ±1.3	5.9 ±1.3	5.8 ±1.3	Ns	Ns
Rigidity of casings, tactile (1-4-7)		5.0 ±0.7	5.1 ±0.5	5.0 ±0.5	5.1 ±0.6	5.0 ±0.6	Ns	*
Hardness of emulsion, tactile (1-4-7)		4.3 ±0.6^{a}	4.3 ±0.6^{a}	4.2 ±0.6^{a}	4.2 ±0.5^{a}	3.9 ±0.6^{b}	*	Ns
Rigidity of casings during chewing (1-4-7)		4.9 ±0.7^{c}	5.3 ±0.5^{a}	5.2 ±0.5^{ab}	5.3 ±0.5^{a}	5.0 ±0.5^{bc}	***	**
Hardness of emulsion during chewing (1-4-7)		3.8 ±0.7^{ab}	3.9 ±0.4^{a}	3.6 ±0.5^{b}	3.7 ±0.6^{ab}	3.5 ±0.5^{b}	Ns	Ns
Odour intensity (1-4-7)		5.0 ±1.0^{a}	4.8 ±0.8^{a}	3.8 ±0.7^{b}	4.1 ±0.9^{b}	4.9 ±0.8^{a}	***	***
Odour harmony (1-7)		5.3 ±0.7^{a}	5.4 ±0.7^{a}	5.1 ±0.8^{a}	5.3 ±0.7^{a}	4.5 ±1.0^{b}	**	Ns
Odour of smoke from (1-7)	beech woodchips	2.0 ±1.4^{a}	1.5 ±1.0^{b}	1.0 ±0.1^{a}	1.0 ±0.0^{a}	1.0 ±0.0^{a}	***	***
	birch woodchips	1.8 ±1.3^{b}	2.2 ±1.3^{a}	1.0 ±0.0^{c}	1.0 ±0.0^{c}	1.0 ±0.0^{c}	**	***
	apple woodchips	1.3 ±0.7^{ab}	1.1 ±0.2^{bc}	1.1 ±0.3^{abc}	1.4 ±0.6^{a}	1.0 ±0.0^{c}	*	Ns
	cherry woodchips	1.0 ±0.0^{b}	1.1 ±0.4^{b}	2.2 ±0.7^{a}	1.2 ±0.4^{b}	1.0 ±0.1^{b}	***	Ns
	plum woodchips	1.0 ±0.0^{c}	1.1 ±0.3^{c}	1.0 ±0.0^{c}	1.4 ±0.6^{b}	2.8 ±1.0^{a}	***	*
Off odour (1-7)		1.1 ±0.2^{b}	1.1 ±0.3^{b}	1.0 ±0.1^{b}	1.1 ±0.2^{b}	1.6 ±1.0^{a}	**	Ns
Saltiness (1-4-7)		4.4 ±0.3^{ab}	4.4 ±0.3^{b}	4.4 ±0.4^{b}	4.3 ±0.2^{b}	4.6 ±0.4^{a}	*	Ns
Aroma intensity (1-4-7)		5.0 ±0.8^{a}	5.0 ±0.8^{a}	4.2 ±0.6^{b}	4.1 ±0.7^{b}	5.0 ±0.4^{a}	***	***
Aroma harmony (1-7)		5.3 ±0.6^{a}	5.3 ±0.8^{a}	5.1 ±0.6^{a}	5.2 ±0.9^{a}	4.2 ±1.0^{b}	***	Ns
Aroma of smoke from (1-7)	beech woodchips	2.3 ±1.7^{a}	1.5 ±1.1^{b}	1.1 ±0.4^{b}	1.0 ±0.0^{b}	1.0 ±0.0^{b}	***	***
	birch woodchips	1.7 ±1.2^{b}	2.1 ±1.1^{a}	1.0 ±0.0^{c}	1.0 ±0.0^{c}	1.0 ±0.0^{c}	**	***
	apple woodchips	1.2 ±0.4^{ab}	1.1 ±0.3^{c}	1.1 ±0.3^{c}	1.4 ±0.7^{a}	1.0 ±0.0^{c}	*	*
	cherry woodchips	1.0 ±0.0^{c}	1.0 ±0.1b^{c}	2.1 ±0.8^{a}	1.3 ±0.5^{b}	1.0 ±0.1^{bc}	***	Ns
	plum woodchips	1.0 ±0.0^{c}	1.1 ±0.3^{c}	1.0 ±0.0^{c}	1.5 ±1.0^{b}	2.7 ±1.1^{a}	***	Ns
Off aroma (1-7)		1.2 ±0.3^{b}	1.3 ±0.3^{b}	1.3 ±0.3^{b}	1.2 ±0.3^{b}	1.6 ±0.7^{a}	*	Ns

*Significance: ***P ≤ 0.001 very high statisticaly significant, **P ≤ 0.01 high statistically significant, *P ≤ 0.05 statistically significant, Ns – P > 0.05 statistically not significant; P_S – statistical probability of smoke type effect; P_R – statistical probability of production repetition effect; means with different superscript letters ($^{a, b, c}$) within row differ significantly (P ≤ 0.05; significance of differences between smoke types).*

Colour intensity of the surface of frankfurters smoked with beech woodchips (control group) was estimated with 5.1 points and did not differ significantly compared to birch woodchips (4.8 points), but they were considerably darker compared to frankfurters smoked with cherry (4.1 points), apple (4.3 points) and plum (3.8 points) woodchips (Table 3). Differences in colour intensity on the cross-section of frankfurters were smaller but significant. Thus, the slices of frankfurters smoked with beech, birch, cherry and apple woodchips had almost optimal colour intensity; only frankfurters smoked with plum woodchips were brighter and less intensive. Different types of smoke affected rigidity of casings during chewing; the most rigid frankfurters were those smoked with birch and apple woodchips (5.3 points). One the other side, rigidity of casings determined tactile shown no statistical differences between smoke types.

Sensory evaluated odour and aroma characteristics differed significantly with smoke types; some properties were also affected by production repetition. According to odour, the highest intensity was observed at beech woodchips, followed by plum and birch woodchips. Smoke intensity of beech was recognized also at frankfurters smoked with birch woodchips. Off odour and off aroma were detected only in frankfurters smoked with plum woodchips (1.6 points). In study of Malarut and Vangnai (2018) different smoke types did not affect aroma of frankfurters, main differences were observed in colour, where brighter colour was estimated with lower scores. Overal aroma intensity was optimal for all types of smoke and was slightly more pronounced at beech (control group), birch and plum woodchips compared to cheery and apple woodchips. Different types of smoke had significant effect on the aroma harmony, but there were no differences between groups, exception was smoke from plum woodchips, which was assessed with 4.2 points and was at the limit of acceptability.

CONCLUSION

Different smoke types effects on sensory profile of smoked products, especially on colour and aroma characteristics. Consumers from Central Europe are most accustomed to smoke from beech woodchips, for this reason it was used as a control in our study. Results of sensory evaluation shown that most similar to control group was smoke from birch woodchips. Frankfurters smoked with cheery and apple woodchips had recognizable and pleasant aroma, while smoke from plum woodchips was determined as less suitable, expecially for its significant brighter colour on the surface of frankfurters, with intensive and less harmonious aroma.

**This article is a part of MSc. thesis named Effect of different type of smoke on sensory profile of frankfurters, issued by Ana Kuhar.*

REFERENCES

Ayo, J., J. Carballo, M.T. Solas, F. Jimenez-Colmenero (2008): Physicochemical and sensory properties of healthier frankfurters as affected by walnut and fat content. Food Chemistry, 107: 1547-1552.

Gašperlin, L., M. Skvarča, B. Žlender, M. Lušnic, T. Polak (2014): Quality assessment of Slovenian Krvavica, a traditional blood sausage: sensory evaluation. Journal of Food Processing and Preservations, 38: 97-105.

Golob, T., M. Jamnik, J. Bertoncelj, U. Doberšek (2005): Sensory analysis: methods and assessors. Acta Agriculturae Slovenica, 85: 55-66.

Gomes, A., C. Santos, J. Almeida, M. Elias, L.C. Roseiro (2013): Effect of fat content, casing type and smoking procedures on PAHs contents of Portuguese traditional dry fermented sausages. Food and Chemical Toxicology, 58: 369-374.

Hitzel, A., M. Pöhlmann, F. Schwägele, K. Speer, W. Jira (2013): Polycyclic aromatic hydrocarbons (PAH) and phenolic substances in meat products smoked with different types of wood and smoking spices. Food Chemistry, 139, 1-4: 955-962.

Ledesma, E., M. Rendueles, M. Diaz (2016): Contamination of meat products during smoking by polycyclic aromatic hydrocarbons: Processes and prevention. Food Control, 60: 64-87.

Malarut, J., K. Vangnai (2018): Influence of wood types on quality and carcinogenic polycyclic aromatic hydrocarbons (PAHs) of smoked sausages. Food Control, 85: 98-106.

P□hlmann, M., A. Hitzel, F. Schwägele, K. Speer, W. Jira (2012): Contents of polycyclic aromatic hydrocarbons (PAH) and phenolic substances in Frankfurter-type sausages depending on smoking conditions using grow smoke. Meat Science, 90,1: 176-184.

Roseiro, L, A. Gomes, C. Santos (2011): Influence of processing in the prevalence of polycyclic aromatic hydrocarbons in a Portuguese tratitional meat product. Food and Chemical Toxicology, 49: 1340-1345.

Škaljac, S., L. Petrović, T. Tasić, A. Tjapkin, B. Škrbić (2014): Influence of smoking in traditional and industrial conditions on polycyclic aromatic hydrocarbons content in dry fermented sausages (Petrovská klobása) from Serbia. Food Control, 40: 12-18.

Delivered: 10.11.2017. **Accepted: 29.11.2017.**

Učinak različitih vrsta dima na senzorni profil hrenovki

SAŽETAK

Cilj ovog istraživanja bio je odrediti senzorni profil hrenovki dimljenih s pet različitih vrsta drvenog iverja: bukvom (kontrola), brezom, trešnjom, jabukom i šljivom. Tekstualni parametri određeni su aparatom za analizu teksture Texture Analyser TA.XT Plus, a instrumentalno mjerenje boje izvršeno je na površini i u presjeku hrenovki. Boja na površini i u presjeku hrenovki značajno se promijenila ovisno o vrsti drvenog iverja. Utvrđivanje senzornog profila hrenovki pokazalo je da različite vrste dima posebno utječu na značajke mirisa i arome. Najsličnije kontrolnoj skupini (drveno iverje bukve) bile su hrenovke dimljene iverjem breze, dok je manje harmoničnim ocijenjen dim iverja šljive.

Ključne riječi: *dimljenje, različite vrste dima, drveno iverje, hrenovke, senzorni profil*

Die Wirkung verschiedener raucharten auf das sensorische profil von Bockwürsten

ZUSAMMENFASSUNG

Das Ziel dieser Untersuchung war es, das sensorische Profil von Bockwürsten festzulegen, die mit fünf verschiedenen Arten von Holzspänen geräuchert wurden: Buche (Kontrolle), Birke, Kirsche, Apfel und Pflaume. Die Texturparameter wurden mithilfe des Apparats für die Analyse der Textur, dem Texture Analyser TA.XT Plus festgelegt, und die instrumentelle Messung der Farbe erfolgte an der Oberfläche und an der Schnittfläche der Bockwurst. Die Farbe an der Oberfläche und an der Schnittfläche der Bockwurst hat sich erheblich verändert, abhängig von der Art der Holzspäne. Die Festlegung des sensorischen Profils der Bockwurst hat gezeigt, dass die verschiedenen Raucharten besonders die Geruchs- und Aromaeigenschaften beeinflussen. Die der Kontrollgruppe (Holzspäne der Buche) ähnlichsten Bockwürste waren die, die mit der Holzspäne der Birke geräuchert wurden, während als weniger harmonisch der Rauch der Pflaumenspäne beurteilt wurde.

Schlüsselwörter: *räuchern, verschiedene Raucharten, Holzspäne, Brühwurst, sensorisches Profil*

El efecto de diferentes tipos de humo sobre el perfil sensorial de salchichas

RESUMEN

El fin de está investigación fue determinar el perfil sensorial de salchichas ahumadas con cinco diferentes tipos de astillas de madera: haya común (control), betula, cerezo, manzano y ciruelo. Los parámetros textuales fueron determinados con el aparato Texture Analyser TA.XT Plus, y la medida instrumental del color fue hecha sobre la superficie y en la sección transversal de salchichas. El color en la superficie y en la sección transversal de salchichas fue modificada significativamente con respecto al tipo de astilla de madera usado. La determinación del perfil sensorial de salchichas mostró que diferentes tipos de humos efectan particularmente las características del olor y aroma. Las salchichas ahumadas con la astilla de madera de betula fueron las que más se parecieron al grupo de control (astilla de madera de haya), mientras el humo de astilla de madera de ciruelo fue menos agradable.

Palabras claves: *ahumado, diferentes tipos de humo, astilla de madera, salchichas, perfil sensorial*

Effetto dei diversi tipi di fumo sul profilo sensoriale dei würstel

SUNTO

L'obiettivo di questa ricerca consisteva nello stabilire il profilo sensoriale dei würstel affumicati col fumo di cinque tipi di truciolato di legno: faggio (gruppo di controllo), betulla, ciliegio, melo e prugno. I parametri di texture sono stati definiti con l'apparecchio per l'analisi della texture Texture Analyser TA.XT Plus, mentre la misurazione strumentale del colore del würstel è stata effettuata sulla superficie e in sezione. È stato riscontrato che il colore del würstel sulla superficie e in sezione cambia significativamente a seconda del tipo di truciolato di legno. L'analisi del profilo sensoriale dei würstel ha mostrato che i diversi tipi di fumo incidono, in particolare, sulle caratteristiche olfattive e aromatiche. I würstel affumicati con truciolato di betulla sono stati giudicati più simili al gruppo di controllo (affumicato con truciolato di faggio), mentre i würstel affumicati con truciolato di prugno sono stati giudicati i meno armonici.

Parole chiave: *affumicatura, diversi tipi di fumo, truciolato di legno, würstel, profilo sensoriale*