Economics of agriculture
SI – 2
UDK: 637.523 "UZICKA"

SPECIFICITIES OF "UZICKA" SAUSAGE PRODUCED IN TRADITIONAL WAY OF MANUFACTURE

Slavica Veskovic Moracanin[1], M. Raseta[1], Mirjana Djordjevic[1], L.Turubatovic[1], S. Stefanovic[1], Sasa Jankovic[1], Marija Skrinjar[2]

Summary

This paper investigates traditional way of production of "uzicka" sausage manufactured in household Kacer situated at Zlatibor Mountain. Investigated parameters were climatic (relative humidity, temperature and air circulation) during production process – smoking, drying and ripening (fermentation) of the sausage, as well as overall acceptability of the final product. The results have shown the direct influence of geographic location, altitude, temperature, wind direction and strength and epiphytic micro flora from the raw material, on the ripening process and quality of the final product. Specific weather conditions that can be measured during production process can vary significantly throughout the years, which is the main reason for non-standardized quality typical for traditionally manufactured products. At the end of the production, samples of "uzicka" sausage taken from all three fermentations were evaluated with high grades during sensory analysis. However, it is also concluded that sensory and quality parameters are largely dependent on microclimatic conditions during the production process.

Key words: *microclimatic conditions of ripening, traditional production, "uzicka" sausage*

1 Phd. Slavica Veskovic Moracanin, research fellow, Institute of meat hygiene and technology, Belgrade, Kacanskog 13, 011/2650722, slavica@inmesbgd.com; Mladen Raseta, research associate, Institute of meat hygiene and technology, Belgrade, Kacanskog 13, 011/2650722, mladen@inmesbgd.com; Mirjana Djordjevic, researcher, Institute of meat hygiene and technology, Belgrade, Kacanskog 13, 011/2650722, mirjana@inmesbgd.com; Lazar Turubatovic, principal research fellow, Institute of meat hygiene and technology, Belgrade, Kacanskog 13, 011/2650722, lazar@inmesbgd.com; Srdjan Stefanovic, research associate, Institute of meat hygiene and technology, Belgrade, Kacanskog 13, 011/2650722, ssrdjan@inmesbgd.com , Sasa Jankovic, research associate, Institute of meat hygiene and technology, Belgrade, Kacanskog 13, 011/2650722, sasa@inmesbgd.com

2 Phd. Marija Skrinjar, full professor, Faculty of technology, Novi Sad, Bulevar Cara Lazara

Introduction

Traditionally fermented meat products originating from specific areas are characterized by distinctive sensory properties and, in most cases, excellent quality. These attributes are largely influenced by climatic conditions of the production site, especially if microclimatic conditions are area-specific (*Radovanović et al*, 2005, *Rašeta et al,* 2010). Production of fermented sausages is one of meat-processing areas that occupy interests of scientists in the last several decades. Increase of competitiveness and liberalization of the global market resulted in focusing of meat and other food industries on higher productivity and profit increase (*Zlender*, 2004). From the other side, increased consumption of fermented meat products due to their recognizable and desirable sensory properties raised the issue of intensifying their production.

Research carried out in our country provided numerous data on optimal raw-material composition, used spices and food additives, possibilities of application of starter cultures and semi-purified bacteriocins, as well as novel technological procedures in manufacturing of traditionally fermented meat products (*Veskovic-Moracanin,* 2007). Microflora of fermented sausages has great importance for biochemical processes that take place in sausages during their fermentation. Since the lactic fermentation process during traditional production is spontaneous, uncontrolled and based on the activity of epiphytic microflora, the quality of such products is erratic and often the sensory properties are not characteristic for certain type of product. The outcome of these processes depends on the type of accidentally present microflora which means that fermentation can go in undesired direction leading to the spoilage of the product. The manufacture of relatively good products of standardized quality is possible providing that dominant microflora consists of hererofermentative species of lactic acid bacteria. If that is not the case, it is highly possible that such errors can lead to the manufacture of the product that is not fit for human consumption (Slavica Vesković Moračanin, 2010).

The production of safe product of standard quality is imperative in agenda of every serious food producing business. Adopting these principles results in continous production and, from the other side, confidence of consumers and regulatory and official food control authorities.

Materials and methods

Traditional «uzicka» sausage was produced in the household of Nikola Brkovic in the Kacer village situated on the slopes of Zlatibor mountain. The sausage was made from beef and pork, firm fatty tissue, nitrite and common salt and S77 (Alimenta) within the three-months period (November 2008 – January 2009). The stuffing was filled into beef small intestine. Fermentation process lasted for 21 days. Basic properties, ingredients and ripening procedure of «uzicka» sausage are shown in table 1. Sausages were manufactured according to the traditional recipe, three batches (fermentations) being made during the entire experiment.

Table 1. Properties, ingredients and ripening procedure of «uzicka» sausage.

Type of fermented sausage	Sausage dimensions and weight	Casing	Ingredients	Quantity (100 kg)	Ripening process
Uzicka sausage	40 mm ø 41 cm in lenght 700 g	*Natural (beef small intestine*	Beef Pork Beef small intestine Nitrite salt Common salt Spice S77 Alimenta	70 kg 20 kg 10 kg 2.5 kg 300 g 850 g	Ripening - 21 days at 2 - 13°C, 64% - 88% rel. hum.

After the filling, sausages were hanged on rods and left in the production facility at + 10 °C for a few hours (draining). After the draining they were transferred to the traditional smokehouses for smoking, ripening and drying in traditional manner. Smoking was carried out using cold procedure; smoke being obtained by burning beech on the open burner. Temperature and relative humidity was recorded hourly using electronic data acquisition system (175-H2, Testo, Germany). Air circulation was measured three times a day (morning, midday, evening) every day by digital anemometer (405-V1, Testo, Germany).

At the end of the ripening process, 5 expert panelists using quantitative-descriptive test carried out sensory evaluation. Overall acceptability was graded on the scale ranging from 1 to 10. Highest grade stood for best overall sensory properties typical for this product.

Statistical analysis of obtained data included determination of mean (), standard deviation (Sd), standard error (Se), interval of variation (IV) and coefficient of variation (CV). Statistical calculations were carried out using Statistica v7.00 software.

Results and discussion

Table 2 shows the values of relative humidity measured during traditional production of “uzicka” sausage in individual household. The results were expressed as average value calculated from 24 measurings during one day.

Table 2. Relative humidity during the production of "uzicka" sausage %

	1st day	7th day	14th day	21st day
I fermentation				
	72,67 p, z, q, Q	75,16 q, Q	69,35 z, Q	80,34 o, Q
Se	1,20	0,62	1,01	0,46
Sd	5,90	3,02	4,95	2,24
Range	22,40	13,90	19,00	8,20
Min.	58,20	66,50	59,70	76,30
Max.	80,60	80,40	78,70	84,50
Cv	8,12	4,02	7,14	2,79
II fermentation				
	72,64 q, Q	77,13 z, Q	80,65 z, Z	73,45 q, Z, X
Se	1,33	0,61	0,52	0,67
Sd	6,53	3,00	2,54	3,27
Range	26,10	12,20	8,00	10,20
Min.	62,20	71,20	77,90	69,10
Max.	88,30	83,40	85,90	79,30
Cv	8,99	3,89	3,15	4,45
III fermentation				
	82,23 q, Z	88,92 z, Z	70,06 p, P	70,11 p, Z, Y
Se	0,90	0,30	1,10	0,56
Sd	4,39	1,45	5,40	2,74
Range	12,00	4,80	21,40	10,60
Min.	76,50	85,80	55,60	65,90
Max.	88,50	90,60	77,00	76,50
Cv	5,34	1,63	7,71	3,91

We observed significant statistical differences during drying and ripening of "uzicka" sausage. Values were in the range from 69.35% (14th day) to 80.34% (end of ripening) in the first fermentation. Differences between values measured in the first 14 days and the end of the production process were statistically significant ($p < 0,001$), while between the 1st and the 14th day of production, no significant differences were ($p > 0,05$). In the second fermentation, values for relative humidity increased during the first 14 days (from 72,64% to 80,65 %), the last value decreasing in the last week of production to 73.45% which is significantly less compared to the 14th day ($p < 0,001$).

At the same time, we observed significant differences ($p < 0,001$) in relative humidity measured in the last days of investigation between I, II and III fermentation. These differences are the result of uncontrolled conditions during drying and ripening of "uzicka" sausage in traditional way of production. Table 3 shows temperature values during drying and ripening of "uzicka" sausage (means with measures of variation).

Table 3. Average temperatures during the production of "uzicka sausage, °C

	1st day	7th day	14th day	21st day
I fermentation				
	8,94 ^{q}	13,70 $^{z, Q}$	9,11 $^{q, Q}$	6,05 $^{o, A}$
Se	0,30	0,33	0,37	0,07
Sd	1,49	1,63	1,81	0,36
Range	4,80	5,90	6,80	1,40
Min.	7,00	10,20	6,20	5,40
Max.	11,80	16,10	13,00	6,80
Cv	16,67	11,89	19,87	5,95
II fermentation				
	7,06	7,59 ^{Z}	8,58 ^{Q}	8,56 ^{B}
Se	0,31	0,86	0,36	0,45
Sd	1,53	4,19	1,74	2,22
Range	5,20	14,30	6,20	7,70
Min.	4,60	-1,20	4,70	4,70
Max.	9,80	13,10	10,90	12,40
Cv	21,67	55,20	20,28	25,93
III fermentation				
	8,89 $^{q, a}$	6,53 $^{q, b, Z}$	16,00 $^{z, Z}$	6,25 $^{q, b, A}$
Se	0,46	0,30	0,41	0,58
Sd	2,24	1,45	2,02	2,86
Range	5,30	4,70	8,50	9,20
Min.	6,10	4,00	12,10	1,90
Max.	11,40	8,70	20,60	11,10
Cv	25,19	22,21	12,63	49,76

Temperatures taken during the production were characteristic for the period of the year, however, certain variations were observed. Temperatures during the first fermentation ranged from 6,05 to 13,70°C and were significantly different ($p < 0,001$). In the second fermentation, the temperature was constant throughout the entire process with no significant differences observed ($p > 0,05$). During the third fermentation, the highest temperature was measured on the 14th (16°C), while average temperatures of other days were lower (8,89, 6,53 and 6,25°C). Significant differences determined within this experiment were the result of the influence of different periods of the year and different weather (November 2008 – January 2009).

Table 4 shows values of air circulation. The differences in this parameter were not significant ($p >0,05$) and were 0,17, 0,17 and 0,16 m/s.

Table 4. Average air circulation during the production of "uzicka" sausage, m/s

	I fermentation	**II fermentation**	**III fermentation**
	0,17	0,17	0,16
Se	0,01	0,01	0,01
Sd	0,04	0,06	0,05
Range	0,14	0,31	0,15
Min.	0,12	0,09	0,09
Max.	0,26	0,40	0,24
Cv	23,53	35,29	31,25

Table 5 shows the results of sensory evaluation and overall acceptability of "uzicka" sausage with high grades given to various sensory (8,80 – first fermentation, 7,50 – second fermentation and 8,90 – third fermentation).

Table 5. Sensory evaluation of overall acceptability of "uzicka" sausage

	I fermentation		**II fermentation**		**III fermentation**	
	X	SD	X	SD	X	SD
"Uzicka" sausage	4,00	0,00	5,20	0,45	6,20	0,45

The quality and specificity of fermented sausages depends on applied technological procedure (traditional in this case), which is different in various parts of the world (*Gasparik-Reichardt et al.* 2005). It should be stated that sensory properties of traditionally manufactured meat products result from direct influences of many factors, firstly of the quality of raw material, spices, effects of epiphytic microflora and the conditions in which ripening, smoking and drying take place. (Turubatović L., Tadić R., 2005). *Radetic* (1997) suggests that the ambient temperature in smoking houses should not be higher than 20 °C, while optimal relative humidity should be 75–80 %. Surface of raw sausages that are partly dried, can be (according to this author) eliminated by short smoking at 85% of relative humidity. *Vukovic* (2006) states that fermented sausages should be cold-smoked at the beginning of the ripening process at the temperatures from 12 to 25 °C, and the drying should be carried out gradually regardless of ripening speed.

Conclusion

Undoubtedly, national food products represent one part of the cultural and historical heritage of people living on certain area. Ever-growing demand for traditional products and basic market requirements led to the need for defining the conditions for

controlled production of highly regarded "uzicka" sausage (standardized relative humidity, temperature and air circulation), as well as creating the possibilities of utilization of national starter cultures based on selected epiphytic microflora. The final result would be internationally recognized and, at the same time, safe product of high quality.

Acknowledgement

The results presented in this paper are the part of the scientific project funded by the Ministry of Science and technological development of Serbia No 20127 – «Technological and protective properties of the autochtonous strains of lactic acid bacteria isolated from tarditionally fermented sausages and posiibilities of their application in meat industry»

References

1. Gasparik–Reichardt J., Toth Sz., Cocolin L., Comi G., Drosinos E., Cvirtla Z., Kozačinki L., Smajović A., Saičić S., Borović B., 2005b. Properties of traditional fermented sausages in Mediterranean and central European countries. Proceedings workshop for dissemination of the project results ,,Safety of traditional fermented sausages; Research on protective cultures and bacteriocins''. University of Sarajevo, Faculty of Veterinary medicine, 10–23.

2. Radetić P., 1997. Sirove kobasice, autor, Beograd.

3. Radovanović R., Tomić N., Tomašević I., Rajković A., 2005. Prinos muskulature namenjene proizvodnji ,,Goveđe užičke pršute'', Tehnologija mesa 5–6, 46, 250–260.

4. Turubatović L., Tadić R., 2005. Standard operating procedure (SOP) for the production of traditionally fermented sausages. Proceedings workshop for dissmeniation of the project results ,,Safety of traditional fermented sausages: Research on protective cultures and becteriocins'', University of Sarajevo, Faculty of Veterinary Medicine.

5. Vesković-Moračanin S., 2007. Uticaj *Lactobacillus sakei* I 151, bakteriocina *Leuconostoc mesenteroides E 131* i MAP na održivost ,,Sremske'' kobasice. Doktorska disertacija, Poljoprvredni fakultet, Univerzitet u Beogradu.

6. Vuković I., 2006. Osnove tehnologije mesa. Treće izmenjeno i dopunjeno izdanje, Veterinarska komora Srbije, Beograd 2006.

7. Žlender B., Gašperin L., 2004. Tradicionalni postupci u preradi mesa i mogućnost njihove primene u savremenim industrijskim tehnologijama, Tehnologija mesa 45, 3–4, 81–88.

8. Vesković Moračanin S., 2010. Bakteriocini bakterija mlečne kiseline (BMK) - mogućnosti primene u industriji mesa. Tehnologija mesa, Vol. 51, br. 1, 83-94.

9. Rašeta M.. Vesković Moračanin S., Borović Branka, Karan Dragica, Vranić Danijela, Trbović Dejana, Slobodan Lilić, 2010. Mikroklimatski uslovi tokom zrenja kobasica proizvedenih na tradicionalan način. Tehnologija mesa, Vol. 51, br.1, 45-51. ISSN 0494-9846,