

Production of foal dry-cured sausages in Croatia

Njari¹, B., Ž. Cvrtila Fleck¹, L. Kozačinski¹

Conference paper

ABSTRACT

The paper describes technological process of production of foal dry-cured sausage which is traditionally produced in the Republic of Croatia, near Zagreb (Kloštar Ivanić). The meat of 22-24 month-old foals and firm pork fat tissue in the ratio 90% : 10% are used in the production. Traditional production manner in family farms has shown certain advantages in comparison to small-scale production facilities (meat processing trade).

Key words: foal dry-cured sausages, traditional production

INTRODUCTION

Many different kinds of autochthonous products are produced in the Republic of Croatia. One of them is foal dry-cured sausage which is produced near Zagreb (Kloštar Ivanić) in a traditional way for personal needs and butcheries sometimes produce it for the needs of public consumption. In the area where the sausages are produced horse breeding became customary. Cold-blooded breed of the Croatian Posavac horse is bred, which was a working animal at first but nowadays it is bred in the goal of breeding foals for sausage production. The geographical position has enabled young foals abundant pasture which gradually replaces milk, and the outdoor housing and feeding system for foals is represented all year long with optional supplemental feeding. The owners feed adult horses barley, corn and oats so foals begin to consume grains too. That is significant for the development of foals because after pasture (in late autumn) they are taken to barns where, except for the dry voluminous feed, grains are also given to them (corn, wheat, barley, oats). The housing and feeding system of foals, especially of those older ones (20-24 months), whose meat is used for the production of foal dry-cured sausage influence significantly the appearance of the carcass (content and appearance of adipose tissue; coverage) and meat quality (muscle tissue appearance; structure and color).

MATERIAL AND METHODS

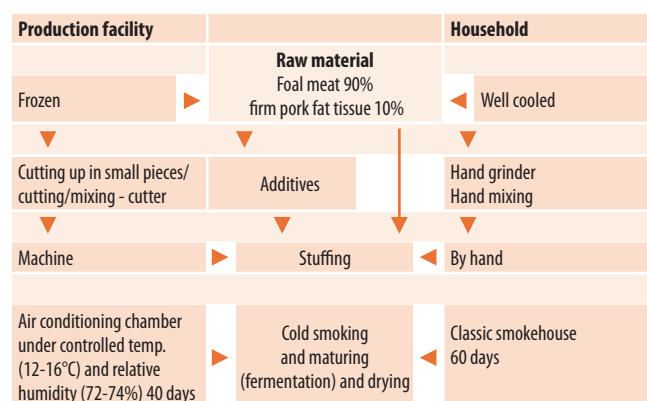
After slaughterhouse processing of a 20-24 month-old foal, in which process the yield was 60%, then after technological cooling but prior to meat processing, meat samples were taken for chemical analysis for the needs of sausage production. The meat samples were pooled and they represented the mean of required indicators (ham – first class, then shoulder blade, back, neck – second class). The analysis of meat and sausages included basic chemical composition (water, fat, protein, ash), fatty acid composition and determining aw. Water activity (aw) was determined using Testo 650. The mean value obtained by measurements was used in further data analysis. Water content was determined by gravimetric method ISO 1442. Protein content was determined by ISO 937 method. The ISO 1443 method was used for determining fat content. For determining ash there was used ISO 936 method. The fatty acid composition was determined by separation and quantification of fatty acids using gas chromatography method (Perkin Elmer Autosystem; FID detector, 300 °C). Enterobacteria were determined in microbiological research (HRN ISO 21528-2:2008), *Salmonella* spp (HRN EN ISO 6579:2003/Cor.1:2008), *S. aureus* (HRN EN ISO 6888-1:2004) and *Listeria monocytogenes* (HRN EN ISO 11290-1:1999/A1:2008).

¹ Bela Njari, PhD; full professor, Željka Cvrtila Fleck, PhD; assoc. professor, Lidija Kozačinski, PhD; assoc. professor, University of Zagreb, Faculty of Veterinary Medicine, Department of Hygiene, Technology and Food Safety, Heinzelova 55, Zagreb, Croatia.

Corresponding author: zcvrtila@vef.hr

Sausage production

From one slaughterhouse processed foal aged about 22-24 months in our research, after cooling and maturing of meat, chosen parts of carcass (first and second class) were deboned and they were used for the production of six series of sausages. The sausages were produced in a small-scale production facility and on the family farm in the manner presented in Scheme 1.



Scheme 1. Comparison of technological production procedure of foal dry-cured sausage in a production facility and a household

According to the recipe, table salt (2-2.2%), pepper (20-25 dag), sweet red pepper are added per 100 kg of mixture, and in a household production some ground chili peppers and garlic juice too. Onion is added directly into the mixture. The mixture is mixed well. After maturing, i.e. the production of sausages, we performed a sensory analysis of the product. Sensory properties were evaluated according to the procedure by Cocolino et al. (2005) in grades from 1 to 10 (indicators: color, cross-section, coherence of mixture; odor (unpleasant, rancidity), fat quality, acidity, juiciness, softness; taste in general, after taste impression and general impression).

RESULTS AND DISCUSSION

Average share of different tissues in a carcass of a foal of 420

Table 1 Average share of different tissues in a carcass of a foal of 420 kg live weight (processed carcass 245 kg after technological cooling)

Sample	Meat weight, kg	Bone weight, kg
Ham, deboned	80,0	15,0
Shoulder blade, deboned	42,0	10,0
Back (loin roast), deboned	19,5	7,0
-trimmings	7,0	
-steak	3,0	
Neck, deboned	29,0	5,0
-trimmings	2,5	
Ribs, deboned	43,0	14,0
Total fat in carcass*	75,0	

* fatty foal meat

kg live weight (processed carcass 245 kg after technological cooling) is presented in Table 1.

In chemical analysis the following average chemical composition of foal meat was determined: water 76.8%, protein 21.5% and fat 2.5%. Water activity was 0.885 on average.

Unsaturated fatty acids amounted 60% on average in total and they were: linoleic (C18:2), linolenic (C18:3), palmitic (C16:=) and oleic fatty acid (C18:1), whereas the share of saturated fatty acids was around 40%. Pasture, i.e. the intake of fresh herbs in feeding is considered to have a large influence in such a ratio. The foals in our research were slaughterhouse processed in the period of a poor pasture and they did not manifest a large ratio between the unsaturated and saturated fatty acids.

The season and feeding type (pasture) influence the quality of foal meat which results in a higher content of fat in and on the carcass and the ratio of unsaturated fatty acids in comparison to the saturated fatty acids. The age (20-24 months) also influences the chemical composition of meat, especially the content of water in muscle tissue which is significant for the process of maturing and drying of meat, i.e. the stuffing of sausages (Dobranić et al., 2009).

The results of microbiological analysis have shown that foal meat does not contain *Salmonella spp.*, *S. aureus* and *L. monocytogenes*, and *S. aureus* and enterobacteria were determined in the count less than 100 cfu/g, which indicated to good hygiene practices in the production.

Foal meat looked very nice. The color is brighter, a bit greyish in places while mostly a nice, bright rose-red color prevailed. There was also an impression of a soft muscle tissue.

Sausages of chosen recipes had an almost identical production. The difference is in using devices (machines) that are used in butchery business considering those which are used in households that make this kind of sausage. The ratio of the mixture for both kinds of sausages was 90% foal meat and firm pork fat tissue 10%, and the mixture was stuffed into casings of 45 mm diameter (Scheme 1).

Generally, the addition of pork fat tissue in the stuffing of foal dry-cured sausages after a 49-day maturing period in the sense of autoxidation influences the formation of volatile substances (Lorenzo et al., 2012). The authors also emphasize the influence of added pork fat tissue on color and texture of the sausages at the end of the production process whereby the sausages with a higher content of pork fat tissue (20% in the stuffing) show a shine at the cross-section and the consistency is less tough. Even though a smaller amo-

unt of fat tissue (10%) was used, the sausages made in the household had high grades for the cross-section appearance in sensory analysis (Table 2). The greatest changes in chemical composition of sausages in the household and the production facility were recorded in water content. The end product from the production facility contained 30-35% water and sausages from the household contained 40-41% water. Water content in sausages from the household depended on the season, i.e. on the climatic conditions in that period of the year, which is in accordance with the results by Alagić (2010) in the research on the production of foal sausages. The author also determined a lower content of water in end product (around 20%), whereas Aw was 0.896 after 36 days of maturing. From the initial 0.925 in our sausages, Aw on the last day of maturing was 0.897.

A special attention was paid to the time of year which relates to the processes of cold smoking, maturing and drying of sausages in a chamber and a classic (brick) smokehouse. Despite of the controlled climate, i.e. temperature and humidity in the maturing chamber, spoilage of sausages appeared, which goes in favor of the assertion that quality and health safety of fermented meat products is dependent primarily on the initial quality of raw material but also on the environmental conditions which direct the process of maturing and the development of microflora (Toldra, 2004).

After a longer period of maturing and drying in a classic smokehouse (60 days), end products produced in the household had better sensory properties (Table 2) above all expectations in comparison to sausages

produced in the production facility in controlled conditions of the air conditioning chamber. It should be emphasized that the results of the microbiological analysis of the sausages (there weren't determined Salmonella spp., S. aureus and L. monocytogenes and enterobacteria were determined in the count less than 100 cfu/g) indicate to good production and hygiene practices in both production sites, especially in the household.

In sensory evaluation of sausages from the household there were determined better grades in all the indicators. So in the research of quality of horse sausages by Alagić (2010), the highest grades were given to properties of stuffing consistency, fat quality and the property of acidity, and the lowest grades to properties of color, cross-section appearance, softness and juiciness. As opposed to foal sausages, horse sausages are darker at the cross-section appearance.

In the end there is an open question of whether a foal dry-cured sausage can be successfully produced every time in a production facility or it is a sort of rarity of the area where it should survive as such in the future and be produced in family farms.

Acknowledgment

This paper resulted from the research within the project Production of Kloštar Foal Sausage, financed by the Ministry of Agriculture of the Republic of Croatia, 2007-2009. This paper was presented at International Conference Hygiene Alimentorum XXXV. Štrbské Pleso, 21. – 23. 5. 2014.

Table 2 The results of sensory evaluation of foal dry-cured sausages

Indicator	Sausage	
	Production facility	Household
Color	6,50	6,95
Cross-section	6,80	7,10
Coherence of stuffing	8,30	8,40
Unpleasant smell Yes/No	Ne	Ne
Odor	7,80	8,20
Rancidity	7,90	8,10
Fat quality	8,50	8,60
Acidity	8,80	8,90
Juiciness	7,30	7,80
Softness	7,60	7,90
Taste in general	7,50	7,80
After taste impression	8,20	8,50
Total impression	7,90	8,20

REFERENCES

- Alagić, D (2010):** Čimbenici fermentacije u nadjevu trajnih kobasica. Doktorska disertacija. Veterinarski fakultet, Zagreb, 2010, str. 77
- Cocolin, L., R. Urso, K. Rantsiou, G. Comi (2005):** Identification, sequencing and characterization of lactic acid bacteria genes responsible for bacteriocin production. Tehnologija mesa 46, 162-172.
- Dobranić, V., B. Njari, B. Mioković, Ž. Cvrtila Fleck, M. Kadivc (2009):** Kemijski sastav konjskog mesa, Meso. XI, 32-36.
- Lorenzo J.M., R. Montes, L. Purriños, D. Franco (2012):** Effect of pork fat addition on the volatile compounds of foal dry-cured sausage. Meat Sci. 91,506-512.
- Toldrá, F. (2004):** Fermented meats. U: Y.H Hui, J.S. Smith (ur.), Food processing: Principles and applications. Blackwell Publishing.

Received: 20.1.2015.

Accepted: 26.2.2015.