

ZUSAMMENFASSUNG**PFERDEFLEISCH UND HYPPHAGIA**

Pferdefleisch ist ein besonderes und wertvolles Nahrungsmittel animaler Herkunft. In der Welt ist ein größerer Trend der Pferdefleischherstellung bemerkbar. In den Mitgliederstaaten der EU beträgt der durchschnittliche Verbrauch von Pferdefleisch 0,4 kg jährlich pro Person. Wegen unzureichender eigenen Herstellung werden die Bedürfnisse des Binnenmarktes zu 66,7 % durch die Einfuhr gedeckt.

Ein größerer Teil von Wasser, Proteinen und Glicogen und ein kleinerer Teil von Fett im Pferdefleisch machen es günstiger von Rind- und Schweinefleisch für die Ernährung bei der anspruchsvolleren Kategorie der Menschen.

Unser Land hat sowohl gute Rassen- als auch geographische Bedingungen für die Herstellung von hochwertigem Fleisch der Huftiere.

Schlüsselwörter: *Pferdefleisch, Hypphagia*

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ADDITIONAL KNOWLEDGE ABOUT HORSEMEAT DRY SAUSAGE "PIKET" FROM THE PAKRAC AREA

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SUMMARY

Though the horsemeat is very suitable for human diet owing to its chemical composition, it does not come as a usual product in our country. Its special quality is a low amount of cholesterol, which makes it especially fit for selected diets. The production of horsemeat products persists as a traditional course in Croatia for more than

100 years. It was brought and preserved in the villages around Pakrac by the Italian minority from their fatherland. Horsemeat sausages are still produced in the households there as one of domestic products.

This study describes the production of sausages of horsemeat and presents the results of sensory, chemical and bacteriological analysis of traditionally produced sausages from 5 households.

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Key words: *sausage from horsemeat, sensory, chemical and bacteriological analysis*

INTRODUCTION

In Croatia horsemeat is very rarely used in human diet. However, the manufacture and processing of horsemeat, especially in the form of sausages, is well known in the Pakrac area. The Italian immigrants introduced the tradition of horsemeat production and processing into sausages. The region that they inhabited was mostly sylvan, and forestry workers used horses for hauling of timber. The immigrants used to buy old animals unfit for work, used their meat and sold the skin. Sale of horse skin covered the purchase cost and provided them with cheap and relatively qualitative food. Resistance of the native population towards the use of horsemeat gradually weakened. Currently, the horsemeat sausage is widely accepted and considered a valuable specialty in these areas.

Manufacturing process of horsemeat sausage ("piket") in households

In general, about 1500 horses have been annually slaughtered and processed in the Pakrac area. Lean horses are optimal for sausage production. Equine fat tissue is characterised by unpleasant odour and taste and it is prone to deterioration and should not be used as an ingredient of the horsemeat mixture for sausages. Consequently, well-nourished and fat horses are inadequate for sausage production, since their meat could contain a higher level of fat. Processing of horsemeat requires special care and takes more time for the preparation of sausage mixture, which increases both the duration and cost of manufacture.

- Meat processing and mixture preparation

Slaughter of animals and processing of carcasses are followed by boning and removal of thin blood vessels and fat tissue. Horsemeat of all categories can be used for the preparation of mixture. Meat is left to drip for 12 hours, then sliced and left to drip again for 12 hours. It is usually put in a suitable container with its one end raised to allow draining of liquid or on a floor grating. It is recommended to keep the meat at room temperature and cover with a wet cloth to avoid darkening of the meat surface. Then follows the preparation of the sausage mixture.

To each 100 kg of finely minced horsemeat the following ingredients are added:

Pork back bacon (coarsely cut or minced)	10-15 %
Common salt	2-2.2 %
Pepper black	200-250 g
Sweet pepper red	3-4 packs
Garlic (juice)	0.5 l
Onion (minced)	

Garlic should be added carefully, because an excessive quantity can lead to darkening of the mixture. Onion is

added directly to the mixture, which is then well mixed.

- Stuffing of casings (piket)

The sausage mixture is filled into casings (equine intestines). Equine intestines should be cleaned, washed and dried. The 1.5-2 m long intestines are inflated and dried in a warm place. The following day they are completely dry and then cut into about 30 to 40-cm long pieces. One end is manually or machine sewed. The mixture is stuffed tightly into casing. So stuffed casings are called "piket".

- Drying and ripening

Sausages are hanged on highly placed bars beneath the ceiling of the ripening chamber. Rope length is 15-20 cm, and the distance between individual sausages must ensure that they will not touch one another.

During the first 24 hours after hanging, "pickets" are dried in the air and then under the stream of warm air. Fire-bin should be constructed to allow moving from one to another side of the smoking unit, if required. As excessive smoking is not advisable, and dry wood is usually used (best hornbeam). The fire is ignited every 5-6 days for 1 hour only. Of course, the entire process depends on weather conditions and sausage thickness. During sunny days, without air humidity, openings in the smoking unit are opened to allow drying of sausages in the air. These openings are closed and the fire ignited in case of unfavourable conditions (high air humidity and fog). Thermal drying lasts for about 1 month, i.e. when the dripping of sausages stops. Heating is discontinued but the sausages remain in the same unit for ripening and drying in the air during the winter months, until May respectively, when the weather becomes warm.

After completed drying, the sausages are wrapped in newspaper and put into boxes. So packed sausages are stored in cool and shadowy places without too high humidity. Shelf life of so stored sausages is minimum 1 year.

Chemical composition of horse meat differentiates from beef and pork by greater portion of proteins (21,7 % to 18-20 %, and 17-18 %), and smaller quantity of fat (2,7 % to 5-15 %, and 2-23 %) (Pag, 1992). Täufel and associates (1993) state that content of proteins and fat in meat depends on the degree of fattening of an animal. Horse meat has more solid consistency and sweetish taste because of high portion of glycogen, and horse meat contains more of it than the meat of other animals (Täufel and associates, 1993, Lawrie, 1998). (Täufel and associates, 1993).

In nutritional point of view, horse meat is easier to digest than beef, with very low cholesterol level in comparison to beef or pork, whereas the portion of polyunsaturated fatty acids is higher, so for that reason it is recommended in dietetic nutrition as well as in nutrition of children, sportsmen and diseased of anemia (Täufel, 1993; Paleari and associates, 2003).

But, since horse meat sausages are produced in households or small handicrafts, there are not enough data on their content and quality. Stamenković and Dević (1990) were researching the possibility of producing horse meat sausages cooked and smoked with warm smoke, and then dry-cured. They consider the sausages to be of acceptable organoleptic characteristics and capable of attracting wider range of consumers. In fermented horse meat products, pH-value is around 5,92, and a_w is 0,94 (Paleari et al., 2003), and such products contain less amount of saturated fatty acids than those produced of pork or beef (Täufel et al., 1993).

During ripening of horse meat sausages from handicraft production, Alagić and associates (2008) determined decreased number of pathogen (enterobacteria, *Escherichia coli*, *Staphylococcus aureus* and sulphate-reducing clostridium). *Salmonella* spp and *Listeria monocytogenes* weren't determined in any sample of sausages.

MATERIAL AND METHODS

The organoleptic traits and chemical composition of dry-cured horsemeat sausages have been identified in this research work. Bacteriological analysis was also carried out. Samples of sausages were collected from 5 rural household manufactures in the Pakrac area (5 samples

of each batch).

Sensory evaluation included the rating of the casing, structure and colour of stuffing at the sausage cross-section, consistency and smell. Sausage diameter was also measured.

Evaluation of chemical composition included the determination of content of water, fat, proteins and ashes in sausages by using standard methods of chemical analysis.

Bacteriological analyses of samples of horsemeat sausages included the following indicators: *Salmonella* spp. /25 g, *Staphylococcus aureus* /1 g, *Enterobacteriaceae* /1 g, Sulphite reducing clostridia /1 g, *Escherichia coli* /1g and *Listeria monocytogenes* /25 g. Isolation and determination of these species of microorganisms was made by means of HRN ISO methods.

RESULTS AND DISCUSSION

Results of analyses (organoleptic, chemical and bacteriological) of horsemeat sausages manufactured in rural households in the Pakrac area are presented in Tables 1., 2. and 3.

Organoleptic characteristics of sausages provide an average illustration of sausages from each household. Within a single household there were no significant dif-

▼ **Table 1.** Organoleptic traits of horsemeat sausages

Sample*	CHARACTERISTICS				
	Casing	Stuffing structure and colour	Consistency	Smell and taste	Diameter
1	Dry, moderately wrinkled	Pieces of meat of brown colour and fat tissue of grey colour, a dark brown, 5-mm wide rim is visible under the casing, a	Firm	Pleasant and characteristic	46 mm
2	Wrinkled, greasy, covered with white and black dotted mould, easily detached from the stuffing	hollow space in the middle of stuffing (1 sausage)	Firm, elastic	Pleasant and characteristic	38 mm
3	Wrinkled, greasy, partially covered with white mould, easily detached from the stuffing	Homogeneous meat mixture of dark red colour and with orange coloured fat tissue, under the casing a brown-red rim, 2-3 mm wide	Firm, elastic	Pleasant and characteristic	37 mm
4	Moderately wrinkled, clean	Pieces of finely cut meat of dark red colour and white fat tissue, a dark brown, 3-4 mm wide rim is visible under the casing	Firm, elastic	Pleasant and characteristic	30 mm
5	Moderately wrinkled, covered with white mould	Finely cut meat of brown colour with pieces of white fat tissue, a slightly visible dark brown rim, 2-3 mm, under the casing	Firm	Pleasant and characteristic	39 mm

*Households 1-5, 5 samples from each

ferences in the appearance of the stuffing, taste, smell and diameter of sausages. Appearance of the sausage stuffing differed only between the households in which they had been manufactured. Individual ingredients of the stuffing were differently cut up in small pieces, adipose tissue ranged from white to orange colour (depending on the quantity of added red pepper), while the meat was of red or brown colour. Casing of sausages manufactured in the households 2 and 3 were wrinkled and easily detached from the stuffing, covered with mould, fatness protruding respectively. At the section of sausage samples, except in case of sample from the household 5, dark coloured rim under the casing could be seen, while in one sample from the household 1 there was a hollow space in the middle of the stuffing.

The above-mentioned defects are probably due to incorrect manufacturing technological procedure. Wrinkled casing is a result of rapid drying process, and detaching of casing from stuffing is a consequence of high relative air humidity in the ripening chamber. High smoking temperature causes fatness of casing, or it can be a result of addition of greater quantity of fat tissue in the sausage stuffing. Darker rim of the stuffing is caused by low relative humidity and high air temperature in the drying chamber, i.e. excessive smoking temperature. Such products are less valuable (Živković, 1986).

Results of chemical analysis of horsemeat sausages are presented in Table 4.

Chemical analysis of horsemeat sausages manufactured in individual households showed the average water content between 20.2 % and 29.2 %, fat content 24.83 % - 36.33 %, protein content 20.3 % - 36.60 %, respectively. Content of mineral substances ranged between 4.8 % and 5.8 %.

Presumably, a longer shelf life and decreased possibility of deterioration could be attributed to lower water content in the horsemeat sausages (they are kept in households even up to one year). Fat content varies depending on the individual manufacturing household. The recorded

▼ **Table 2.** Results of chemical analysis of horsemeat sausages (average values; x)

Sample*	Water, %	Proteins, %	Fat, %	Ash, %
1	28,3	20,30	36,33	5,8
2	23,2	23,36	32,54	5,6
3	27,1	34,52	31,58	4,8
4	29,2	36,60	28,30	5,6
5	20,2	35,07	24,83	5,2

*Households 1-5, 5 samples from each

▼ **Table 3.** Results of bacteriological analysis of horsemeat sausages

Domaćinstvo/ uzorak	Pokazatelji					
	1	2	3	4	5	6
1/1	+	180	-	>10	-	-
1/2	-	100	-	-	-	-
1/3	-	-	-	-	-	-
1/4	-	-	-	-	-	-
1/5	-	-	-	-	-	-
2/1	-	180	-	-	-	-
2/2	-	-	-	>10	+	-
2/3	-	-	200	-	-	-
2/4	-	-	150	-	-	-
2/5	-	200	300	-	-	-
3/1	-	-	-	>10	-	-
3/2	-	-	150	-	-	-
3/3	-	-	200	-	-	-
3/4	-	-	350	-	-	-
3/5	-	-	100	-	+	-
4/1	-	100	-	>10	+	-
4/2	-	-	-	-	-	-
4/3	-	-	50	-	-	-
4/4	-	100	-	-	-	-
4/5	-	-	-	-	-	-
5/1	-	-	-	-	-	-
5/2	-	-	-	-	-	-
5/3	-	-	-	-	-	-
5/4	-	-	-	-	-	-
5/5	-	-	-	-	-	-

1= *Salmonella* spp. /25g, 2 = *S. aureus* /1g; 3 = *Enterobacteriaceae* /1g; 4 = Sulphite-reducing clostridia /1g; 5 = *E. coli* / 1g; 6 = *L. monocytogenes* /25 g

results suggest possible errors in some phases of production, because the fat content in the final product depends on the quantity of added fat tissue in the sausage mixture, but also on the correct drying procedure. Thus, the reasons could be non-adherence to a defined recipe (or different recipes) for the manufacture of horsemeat sausages. This could include the quantity of added fat tissue (too little or too much than required to obtain satisfactory

organoleptic characteristics of consistency and juiciness) or an error in the manufacturing process in the sense of excessive drying, which leads to increased fat content in the final product.

Results of bacteriological analysis of horsemeat sausages are presented in Table 5.

Bacteria of the genus *Salmonella* were found in one sample taken from the household 1. The isolation of *S. aureus* and sulphite-reducing clostridia is a disturbing finding. Enterobacteria count ranged from 50 to 350/g, and they were found in sausage samples collected from the households 2, 3 and 4. *E. coli* was isolated from 3 sausages. *L. monocytogenes* was not found. All the sausages manufactured in the household 5 were of impeccable microbiological quality.

Finding of individual bacteria species in sausages is the reflection of not only hygienic quality of the raw material used, but also point out the level of hygienic conditions of manufacture of horsemeat sausages in rural households.

Both the improvement and strict observance of the technological process of sausage production, and in particular the upgrading of the level of hygienic conditions, would certainly result in satisfactory market and hygienic quality of horsemeat sausages. Only such approach to the traditional manufacture of horsemeat sausages in rural households could provide the consumers with high-quality foods.

CONCLUSIONS

Based on the results of organoleptic, chemical and bacteriological analyses it can be concluded as follows:

1) Organoleptic examination of sausages did not show significant differences in the taste and smell of sausages. However, differences were found in the appearance of stuffing at the sausage section depending on the household in which they were produced (different size of cut up pieces of meat and fat tissue, meat of red to dark brown colour, fat tissue of white to orange colour, darker rim under the casing, and a hollow space in the middle of stuffing).

2) In sausages sampled from individual households the water content ranged from 20.2 % to 29.2 %, fat content from 24.83 % to 36.33 %, protein content 20.3 % - 36.60 %, and ash content 4.8 % - 5.8 %.

3) The following bacteria were isolated from sausages: *Salmonellae*, *S. aureus*, sulphite-reducing clostridia, enterobacteria and *E. coli*. *L. monocytogenes* was not found in any of the analysed samples. All the sausages manufactured in the household 5 were of impeccable microbiological quality.

4) The recorded results suggest the necessity of standardisation of manufacture of sausages made of horsemeat, in order to avoid errors manifested by diversity in

sensory traits and non-uniformity of chemical composition of sausages. Furthermore, the level of manufacturing hygienic conditions should be raised.

ZUSAMMENFASSUNG BEITRAG ZUM KENNEN DER DAUERWÜRSTE AUS PFERDEFLEISCH

Der Gebrauch von Pferdefleisch ist in unserem Land keine Gewohnheit, obwohl das Pferdefleisch nach seiner chemischen Zusammensetzung sehr günstig für die Ernährung ist. Besonders tut sich der niedrige Cholesterolspiegel hervor, was für die Diätenernährung sehr günstig ist. In Kroatien besteht eine 100-jährige Tradition der Herstellung von Erzeugnissen aus Pferdefleisch. In den Dörfern um Pakrac hat die italienische nationale Minderheit diese Tradition aus ihrer Urheimat mit sich gebracht und aufbewahrt. Sie herstellen in der heimischen Produktion eine Dauerwurst, die Wurst aus Pferdefleisch.

In dieser Arbeit ist der Prozess der Herstellung von Wurst aus Pferdefleisch in dörflichen Haushalten beschrieben. Es sind Resultate der organoleptischen, chemischen und bakteriologischen Untersuchungen dargestellt, u.zw. von Würsten, die aus 5 Haushalten stammen, die diese Wurst traditionell herstellen.

Schlüsselwörter: Wurst aus Pferdefleisch, organoleptische, chemische und bakteriologische Untersuchung

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