sage production. Appl. Environ. Microbiol. 58, 884-890.

Gasparik-Reichardt, J., Sz. Tóth, L. Cocolin, E. H. Drosinos, M. Hadžiosmanović, F. Čaklovica, L. Turubatović, I. Petrohilou (2006): Safety of traditional fermented sausages: research on protective cultures and bacteriocins. Proceeding of 52nd ICoMST "Harnessing and exploiting global opportunities", Dublin, Ireland, 13.08.-18.08.2006, 335-336.

Hadžiosmanović, M. (1978): Influence of micrococci on lipolytic changes in dry fermented sausages.Dissertation.. Faculty of Veterinary Medicine, Zagreb.

Hadžiosmanović, M., J. Gasparik-Reichardt, M. Smajlović, S. Vesković-Moračanin, N. Zdolec (2005): Possible use of bacteriocins and starter cultures in upgrading of quality and safety of traditionally fermented sausages. Tehnologija mesa 46, 194-211.

Hammes, W. P. (1990): Bacterial starter cultures in food production. Food Biotechnology 4, 383-397.

Hugas, M., B. Neumeyer, F. Pages, M. Garriga, W. P. Hammes (1997): Comparison of bacteriocin-producing lactobacilli on *Listeria* growth in fermented sausages. Fleischwirtschaft International 5, 31-33.

Kozačinski, L., N. Zdolec, M. Hadžiosmanović, Ž. Cvrtila, I. Filipović, T. Majić (2006): Microbial flora of the Croatian traditionally fermented sausage. Archiv für Lebensmittelhyg. 57, 141-147.

Lahti, E., T. Johansson, T. Honkanen-Buzalski, P. Hill, E. Nurmi (2001): Survival and detection of *Escherichia coli* O157:H7 and *Listeria monocytogenes* during the manufacture of dry sausage using two different starter cultures. Food Microbiol. 18, 75-85.

Thévenot, D., M. L. Delignette-Muller, S. Christieans, C. Vernozy-Rozand (2005): Fate of *Listeria monocytogenes* in experimentally contaminated French sausages. Int. J. Food Microbiol. 101, 189-200.

Urso, R., L. Cocolin, G. Comi (2004): Cloning and sequencing of the sakP operon from *Lactobacillus sakei* isolated from naturally fermented sausages. In Proceedings Book of the 19th International ICFMH Symposium Foodmicro (pp. 157), 12-16 September 2004, Portoroz, Slovenia.

Urso, R., K. Rantsiou, C. Cantoni, G. Comi, L. Cocolin (2006): Technological characterization of a bacteriocin-producing *Lactobacillus sakei* and its use in fermented sausages production. Int. J. Food Microbiol. 110, 232-239.

Zdolec, N., L. Kozačinski, M. Hadžiosmanović, Ž. Cvrtila, I. Filipović (2005): Survival of *Listeria monocytogenes* during the ripening of dry sausages. Proceedings of lectures and posters Hygiena alimentorum XXVI, Safety and quality of meat and meat products in legislative conditions of the common market of the European Union. Strbske Pleso, Slovakia, 25.05.-27.05.2005., 230-233.

Zdolec, N. (2007a): Influence of protective cultures and bacteriocins on safety and quality of fermented sausages. Doctoral thesis. Veterinary Faculty, University of Zagreb.

Zdolec, N., M. Hadžiosmanović, L. Kozačinski, Ž. Cvrtila, I. Filipović, S. Marcinčák, Ž. Kuzmanović, K. Hussein (2007b): Protective effect of *Lactobacillus sakei* in fermented sausages. Archiv für Lebensmittelhyg. 58, 152-155.

Zdolec, N., L. Kozačinski, M. Hadžiosmanović, Ž. Cvrtila, I. Filipović (2007c): Inhibition of *Listeria monocytogenes* growth in dry fermented sausages. Veterinarski arhiv, 77, 507-514.

Zdolec, N., M. Hadžiosmanović, L. Kozačinski, Ž. Cvrtila, I. Filipović, M. Škrivanko, K. Leskovar (2008): Microbiological and physicochemical succession in fermented sausages produced with bacteriocinogenic culture of *Lactobacillus sakei* and semi-purified bacteriocin mesenterocin Y. Meat Sci. Article in Press.

Prispjelo / Received: 15.5.2008.
Prihvaćeno / Accepted: 24.5. 2008.

QUALITY OF SLAVONIAN HAMS ON THE THIRD NATIONAL HAM FESTIVAL

Senčić[1], Đ., Danijela Butko[1]

SUMMARY

Slavonian ham is a traditional Croatian cured meat product. There were 19 hams registered for evaluation, produced by different and mostly commercial producers. Except for organoleptic (sensory) characteristics, the pH-value of ham meat (M. semimembranosus) has been determined by the pH-meter Mettler Toledo, as well as meat color parameters ("L" and "a" value), which have been determined by the chromo meter Minolta CR-410. Evaluation results indicate the variability of quality of Slavonian ham. High and significant correlations have been determined among sensory characteristics of ham (appearance, cross-section appearance, consistency, smell, taste), both mutually and with average grade of

[1] **Đuro Senčić, DSc, full professor; Danijela Butko, assistant; Department of Animal Sciences, Faculty of Agriculture Osijek, Trg Sv.Trojstva 3, 31000 Osijek, Contact e-mail: dsencic@pfos.hr**

▼ **Figure 1.** Unsatisfying shape

ham. The average pH-value of ham meat of 5,84 and color parameters ("L"= 39,66 and "a"= 18,44) were both satisfying. There were some mistakes observed in quality of some hams (unsatisfying shape, occurrence of mould, inadequate color of meat and fat tissues, tyrosine depositions, soft consistency, rotting, etc.) and these reasons make it necessary to work on standardization of ham quality. Standardization of quality includes the following procedures: defining adequate pig genotype, i.e. creating a pig type for the purpose of producing Slavonian ham, developing technology for specified purpose of pig fattening, standardizing technology for pork ham processing, defining physico- chemical and organoleptic characteristics of Slavonian ham based on research, organizing a national association of ham producers that would start the procedure of registering Slavonian ham as an autochthonous Croatian product, legal protection of product name in Croatia and the EU (protected designation of origin and/or protected geographical designation).

Key words: *Slavonian ham, quality*

INTRODUCTION

Slavonian ham is a national Croatian dry- cured product. The quality of this product hasn't been standardized yet, i.e. it is quite variable in comparison with some other pork ham products (Istrian dry- cured ham, Drniš dry- cured ham). There are no information about Slavonian ham in professional literature. Vuković et all (2005) have pointed out some characteristics of Syrmian ham. Many factors affect the ham quality and they can be divided on factors of fresh ham quality (raw material) and factors of fresh ham processing technology (ham). Factors of fresh ham quality are pig genotype (breed, hybrids, sex, etc.), technology of pig fattening (breeding manner, feeding, weight, accommodation conditions, etc.) and treatment of pigs before slaughter. Factors of fresh ham processing technology (hams) are: technique of ham processing, texture of brine and techniques of pickling, techniques of smoking (drying), microclimatic conditions during processing, conditions of ham ripening, etc. It follows from above that ham production is a complex process which is far from being simple. For the purpose of quality improvement and promotion of Slavonian ham, a competitive manifestation takes place in Stari Mikanovci near Vinkovci and it is the national ham festival. Regarding the lack of information about Slavonian ham in professional literature, this review points out the results of analysis of Slavonian ham quality on this year's national ham festival.

METHOD OF EVALUATION

There were 19 hams registered for evaluation, produced by different, and mostly commercial producers from the Slavonian area (twelve producers from the County of Vukovar- Srijem, four producers from the County of Osijek-Baranya, two producers from the County of Slavonski Brod- Posavina, and one producer from the County of Požega- Slavonia). Professional commission of five

▼ **Figure 2.** Skinless ham

members carried out the ham evaluation. The following indicators of ham quality were being evaluated: appearance (1-7 points), cross- section appearance (1-8 points), smell (1-10 points), consistency (1-10 points) and taste (1-15 points). Ranking of hams was carried out according to the average total points score by five evaluators in the following classes: gold medal (46- 50 points), silver medal (41- 45 points) and bronze medal (35- 40 points). This method of ham evaluation is original and it was used for the first time on the second ham festival in Stari Mikanovci in 2006. Except for organoleptic (sensory) characteristics evaluated in the competitive manifestation, and for the purpose of defining some objective parameters of quality, pH- value of ham meat (M. *semimembranosus*) was determined by the pH- meter Mettler Toledo, as well as parameters of meat color ("L" and "a" value) by the chromo meter Minolta CR- 410.

HAM EVALUATION RESULTS AND DISCUSSION

Average values and dispersion measures of indicators of Slavonian ham quality are shown in Chart 1.

Values of the analyzed physico- chemical indicators (pH, "L" and "a" values) of ham meat were satisfying. It is normal for pH- values of hams, dry- cured hams and other smoked and cured meats to increase because of accumulation of alkaline proteolytic products. Chizzolini and associates (1996) determined that pH- value of *m. semitendinosus* in ripe Parma dry- cured ham was 5,83. Martin and associates (1999) specified that pH- value of *m. biceps femoris* of ripe Iberian dry- cured ham was 5,94. Average values of sensory characteristics of hams resulted in average grade of 32,80 points, which means that it hasn't reached lower limit for bronze medal (35 points). One gold, two silver and two bronze medals were awarded at the competitive manifestation. The highest variability (28,06%) was for the grade for appearance, and the lowest was for consistency (19,10%). Variability causes of ham quality are very different: uneven masses of hams and uneven quality of hams for processing, nonstandard technology of pork ham processing, and mistakes in processing technology (salting, smoking- drying, ripening). Uneven quality of hams for processing is a consequence of slaughtering pigs of different genotypes, at different times, i.e. with different weight, sex, feeding manners and kinds of food, treatment of pigs before slaughter, etc.

▼ **Figure 3.** Depositions of tyrosine crystals on the ham cross section

▼ **Table 1.** Mean values and measures of dispersion of quality indicators of Slavonian hams (n=19)

Characteristics	$\bar{x}$	s	vk
pH	5,84	0,23	3,96
„L"	39,66	2,98	7,54
„a"	18,44	1,96	10,63
Appearance (1-7)	4,40	1,23	28,06
Cross-section appearance (1-8)	5,11	1,28	22,06
Smell (1-10)	6,40	1,31	20,39
Consistency (1-10)	6,90	1,32	19,10
Taste (1-15)	9,98	2,18	21,79
Average value (max. 50)	32,80	6,68	20,37

The following mistakes in ham quality were recorded: unsatisfying shape, pale, brown or other unwanted color, rather fat layer of subcutaneous fat tissue, unpleasant smell, putrefaction, smelly ripening, sedimentation of tyrosine crystals, too soft consistency, insufficient or over saltiness, uncharacteristic taste, etc.

Appearance of hams wasn't homogenous. It was noticed that not all hams were symmetrically semi circularly shaped in a way that their lower edge is of about 6 cm away from the femur (picture 1). Hams sometimes have some cuts and larger accumulations of mould on their surface, or mould has been washed. Some hams were skinned (picture 2). A ham should be properly and primarily processed and properly shaped. It has to be without

▼ **Figure 4.** Ham with pronounced subcutaneous fat tissue

sacrum and hip bones and with the whole femur. Edges of ham should be properly trimmed, i.e. fresh ham should be semi circularly shaped so that the lower edge is approximately 6 cm away from head of the femur. Ham mustn't have any cuts or holes. It should be completely covered with skin from the outer side, and inside it is partly covered with skin and the other part are muscles, with completely visible head of the femur. Skin must be clean, dry, light to dark brown and of homogenous color, without any cuts, and without or with very little mould on it. Brown mould on hams is connected to lower air humidity during ripening, and good hams are accompanied by it, whereas white mould is a result of high air humidity (85-95%) in rooms for ripening of hams. There mustn't be any noticeable traces of cleaning and washing ham mould. Skin on ham mustn't be wrinkled or with hairs.

Cross- section appearance was sometimes inhomogeneous considering the structure and color. Appearance of pale, brown or any untypical meat color and white crystals of tyrosine amino acid were noticed (picture 3), as well as thicker subcutaneous fat tissue (picture 4), sometimes of yellow color. Cross- section appearance of ham should be homogeneous considering the structure and color. Ham mustn't have too many deposits of fat tissue, but it should have as much subcutaneous fat tissue as necessary to enable gradual ham drying and ripening. It is known that hams of male castrates are greasier than hams of female pigs, i.e. they have a fatter layer of subcutaneous fat tissue and a better marble- like appearance (Gou and associates, 1995). A light saturation of muscles with fat (marble- like appearance) is desirable because it positively affects the organoleptic characteristics of ham. This characteristic depends on pig genotype and feeding manner. Meat color can vary from light red to dark red (depending on genotype, oldness and feeding of pigs) and fat tissue color should be white. The color of muscular and fat tissue must be homogenous. The unwanted changes of ham meat color are: brown, green and untypical. Brown meat color in cross- section appearance of ham is connected to dehydration, when pigment myoglobin from muscular tissue becomes metmyoglobin. Low relative air humidity

▼ **Table 2.** Correlations between (r) physico-chemical and sensory indicators of quality of Slavonian hams (n=19)

Characteristics	X_1 pH	X_2 „L“	X_3 „a“	X_4 Appearance	X_5 Cross-section appearance	X_6 Smell	X_7 Consistency	X_8 Taste	X_9 Average value
X_1 pH	-	0,079	-0,113	-0,193	-0,166	-0,293	-0,387	-0,385	-0,313
X_2 „L“		-	0,410	0,213	0,120	-0,068	-0,145	-0,068	-0,015
X_3 „a“			-	0,484*	0,427	0,357	0,394	0,404	0,433
X_4 Appearance				-	0,759**	0,756**	0,721**	0,757**	0,840**
X_5 Cross-section appearance					-	0,932**	0,771**	0,834**	0,912**
X_6 Smell						-	0,894**	0,935**	0,969**
X_7 Consistency							-	0,950**	0,945**
X_8 Taste								-	0,974**

in rooms for ham ripening contributes to that appearance, but also too large amounts of added nitrites. Green meat color is caused by bacterial impact and high temperatures during the salting of fresh hams. It occurs during rotting and smelly ham ripening. Light color of meat is a consequence of insufficient smoking, or processing pale, soft or exudative meat (PSE). PSE- meat appears more often with some markedly bacon- type pigs (e.g. pietren) or it is a consequence of pigs' stress before slaughter. Pale meat color can also be a consequence of smaller quantity of myoglobin in pigs' muscles or poor oxidation of myoglobin to light red oximyoglobin.

Yellow color of fat tissue in hams, with the taste of rustiness, appears because of oxidation of fat acids in conditions of high temperature, high air humidity and exposure to light during ham ripening.

There are sometimes white sediments of crystals of tyrosine amino acid (precipitation), which is a consequence of more intensive proteolysis or of freezing fresh hams before processing. It appears more often with high- bred, markedly bacon- type pigs and with hams which have been longer in storage. The etiology of this appearance hasn't yet been completely scientifically explained. Some breeds, like Belgian landras and pietren, which are highly stress sensitive, often have the occurrence of PSW meat and tyrosine sediments in hams (Guerrero et all, 1996).

Figure 5. Ham putrefaction (deterioration)

Smell of hams was sometimes smoky, or even unpleasant, because of rotting process (picture 5). The smell of ham must be specific and pleasant. It is affected by factors of processing, but also enzymatic meat composition (endoproteasis and exoproteasis, lipasis and esterasis) which is affected by a pig genotype. Therefore, for example, the meat of hybrids with Belgian landras breed has a low level of exopeptidasis and it is not prone to creating precursors of characteristic smell and taste (Armero et all, 1999a, 1999b, 1999c). Proteolytic and lipolytic activity in fresh hams, which finally affects the smell of hams, also depends on weight of pigs (Toldrá, 1998). Fresh hams of heavy pigs have a higher level of peptidasis than proteinasis activity, a higher activity of lipases and pyroglutamic aminopeptidases. Fresh hams of light pigs, on the other hand, contain more water, more cathepsin B and cathepsin B+L, and a lower activity of peptidases. A high activity of cathepsin B, with low concentrations of added salt, increases proteolysis, and a consequence can be over softness and occurrence of tyrosine crystals on hams' cut surface (Sarraga et all, 1993). Hams mustn't have too intensive smell of smoke, ammonia, rustiness, fish, urine (sex), etc. A specific smell of urine appears when processing fresh hams of boars and a smell of fish appears because of feeding pigs with fish flour in the final stage of fattening. Meat can also absorb smells of other substances during feeding of pigs with different by- products. Ham rotting appears because microorganisms break through in the meat during animal's life (disease) through blood, during slaughterhouse- processing and fresh ham processing (dirty knives and wiping cloths, and generally, bad hygiene). Bacteria disintegrate proteins, so different compounds of unpleasant smell arise. If disintegration of organic substance happens anaerobic, rotting happens slower and a really smelly rotting appears (Rahelić et all, 1980). Smelly ripening, on the other hand, appears because of accelerated enzymatic decomposition of proteins, during which appear the products (ammonia, sulfurhydrogen and other) which give the meat an unpleasant smell. Meat has gray- green to dark green shade on cross section, while its consistency is softly elastic to dough- like. Meat reaction is extremely sour. Smelly ripening appears because of unfavorable ham ripening conditions under the activity of its own enzymes. Meat is a suitable environment for development of groups and types of microorganisms. Bacteria (*Pseudomonas spp., Micrococcus spp., Proteus spp.,* and other) dissolve proteins and transform meat amino acids, so ammonia, sulfur hydrogen, amines, diamines, indole, skatole, cresol, phenol, mercaptans and other compounds of unpleasant smell appear. Some types of bacteria (*Salmonella spp., Staphylococcus pyogenes, Clostridium botulinum*) can cause poisoning of people because they produce toxins. Among biogenic poisonous amine, which appear by decomposition of proteins,

generally known are: muscarine, histamine, sepsin, and neurine. *Clostridium botulinum* generates the strongest poison of biological origin, botulinum which is a neurotoxin by its characteristics.

A smell of carbol appears during smoking with moist wood of conifers, and smell of mould appears if hams are stored in humid rooms, which is favorable to appearing green mould.

Consistency of meat was too soft in some hams, and in some others it was even solid in certain spots. Consistency of muscular and fat tissue in hams must be homogenous and solid. It mustn't be too soft or too solid. Because of precipitated ham drying, callow becomes dried up, which prevents drying of its inner part, distribution of water in a ham is unequal, outer layers of a ham are dry and solid (crust), and the center is moist. During proper drying, water from the inside of a ham gradually and permanently moves toward the surface, so that muscles and sinew are connected to a solid, compact mass. Soft consistency of hams is connected to denaturizing of proteins (high activity of cathepsin B), and to a lesser degree, it is a consequence of a smaller amount of salt in hams. During smelly ripening, meat consistency is softly elastic to dough- like (Oluški, 1973). Too solid consistency with the lack of juiciness occurs with too salty hams.

Taste of hams was sometimes very salty or insufficiently salty, a bit sour or bitter. Taste of hams should be pleasant. Hams mustn't be too salty or insufficiently salty. Concentration of salt in a ripe ham should be within boundaries from four to six per cent (Živković and Hadžiosmanović, 1996). A taste of hams mustn't be bitter or sour. Changes which occur during ham ripening crucially affect their taste. Taste of rustiness appears because of longer storing of hams in inappropriate rooms with high temperature and high air humidity, with insufficient circulation of air, and under the influence of light. Taste of hams is connected to other indicators of ham quality, and it is valued the most during the evaluation of whole ham quality.

A connection between the analyzed physico- chemical characteristics and sensory characteristics of hams (Chart 2), was mostly weak and insignificant (P> 0,05). However, connection of grades for sensory characteristics was high and highly significant (P< 0,01). An average ham grade was in the highest connection with taste (r = 0,974**), and the lowest connection was with the appearance of hams (r = 0,840**).

CONCLUSION

Evaluation results point to variability of quality of Slavonian ham. High and significant connection of sensory characteristics of ham (appearance, cross- section appearance, consistency, smell, taste) has been determined mutually, as well as with the average grade of hams. The average pH- value of ham meat (5,84) and color parameters ("L" = 39,66 and "a" = 18,44) were satisfying. Mistakes in quality of some hams (unsatisfying shape, occurrence of mould, inadequate color of meat and fat tissue, tyrosine sediments, soft consistency, rotting, etc.) have been noticed, which is the reason that makes it necessary to work on standardization of ham quality.

Standardization of quality assumes the following procedures:

- defining an adequate pig genotype, i.e. creating a pig type for the purpose of producing Slavonian ham,
- developing technology for specified purpose of pig fattening,
- standardizing technology for pork ham processing,
- defining physico- chemical and organoleptic characteristics of Slavonian ham, based on research,
- organizing a national association of Slavonian ham producers that would start the procedure of registering Slavonian ham as an autochthonous Croatian product,
- legal protection of product name on the levels of Republic of Croatia and the European Union (protected designation of origin and/or protected geographical designation).

ZUSSAMENFASSUNG

QUALITÄT DES SLAWONISCHEN SCHINKENS AUF DER 3. NATIONALEN SCHINKENRIADE

Der slawonische Schinken ist ein traditionelles kroatisches Raucherzeugniss. Zur Bewertung wurden 19 Schinken verschiedener, hauptsächlich kaufmännischer Hersteller angemeldet. Außer organoleptischen (sensorischen) Eigenschaften wurde auch der pH Wert des Schinkenfleisches (M. semimembranosus) festgestellt, dies mit Hilfe von pH-Meter Mettler Toledo, sowie die Parameter der Fleischfarbe („L" und „a" Werte), mit Hilfe von Chromometer Minolta CR-410. Die Bewertungsresultate weisen auf die Variabilität der Qualität des slawonischen Schinkens hin. Es wurde ein hoher und bedeutender Zusammenhang unter den sensorischen Eigenschaften des Schinkens (äußeres Aussehen, Aussehen des Durchschnittes, Konsistenz, Geruch, Geschmack) und der durchschnittlichen Bewertung des Schinkens festgestellt. Der durchschnittliche pH-Wert des Schinkenfleisches 5,84 und Farbenparameter („L"=39,66 und „a"=18,44) waren zufriedenstellend. Es wurden Mängel bei der Qualität einiger Schinken festgestellt (mangelhafte Form, Schimmel, unentsprechende Fleisch- und Fettfarbe, Thyrosinschichten, weiche Konsistenz, Fäulnis u.a.), was auf eine weitere notwendige Arbeit hinsichtlich Standardisation der Qualität hinweist. Die Standardisation der Qualität beinhaltet folgende Leistungen: Definierung des entsprechenden Genotypus der Schweine, d.h. die Aufzucht einer zielgerichteten Schweinesorte für die Herstellung des slawonis-

chen Schinkens, Entwicklung einer Technologie für die Zuwendungsschweine, Standardisation einer Technologie für die Bearbeitung von Schweineschinken, Definierung – auf Grund der Forschung – der physikalisch-chemischen und organoleptischen Eigenschaften des slawonischen Schinkens, Organisation eines nationalen Herstellungverbandes für slawonische Schinkensorten, der das Verfahren für die Registration des slawonischen Schinkens als ursprünglich kroatisches Erzeugnisses in Wege leiten würde, gesetzlichen Schutz für den Artikelnamen auf der RH und EU Ebene (Schutz der Ursprünglichkeit und/oder des geographischen Ursprungs).

Schlüsselwörter: *slawonischer Schinken, Qualität*

REFERENCES

Armero, E., J. A. Barbosa, F. Toldrá, M. Baselga, M. Pla (1999a): Effects of the terminal sire and sex on pork muscle catepsin (B, B+L and H), cysteine proteinase inhibitors and lipolytic enzyme activities. Meat Science 51, 185-189.

Armero, E., M. Baselga, M. C. Aristoy, F. Toldrá (1999b): Effects of sire type and sex on pork muscle exopeptidase activity, natural dipeptides and free amino acids. Journal of the Science of Food and Agriculture 79, 1280-1284.

Armero, E., Monica Flores, F. Toldrá, J. A. Barbosa, J. Olivet, M. Pla, M. Baselga (1999c): Effects of pig sire type and sex on carcass traits, meat quality and sensory quality of dry–cured ham. Journal of the Science of Food and Agriculture 79, 1147-1154.

Chizzolini, R., Novelli, E., Campanini, G., Dazzi, G., Madarena, G., Zanardi, E., Pacchioli, M.T., Rossi, A. (1996): "Lean color of green and maturated Parma hams: comparative evaluation and technological relevance of sensory and objective dana". Meat Science, 44, 3, 159-172.

Gou, P., L. Guerrero, J. Arnau (1995): Sex and crossbreed effects on the characteristics of dry-cured ham. Meat Science 40, 21-31.

Guerrero, L., P. Gou, P. Alonso, J. Arnau (1996): Study of the physicochemical and sensorial characteristics of dry–cured hams in three pig genetic types. Journal of the Science of Food and Agriculture 70, 526-530.

Martin, L., Córdoba, J. J., Ventanas, J., Antequera, T. (1999): "Changes in intramuscular lipids during ripening of Iberian dry-cured ham". Meat Science, 51, 129-134.

Oluški, V. (1973): Prerada mesa. Institut za tehnologiju mesa. Beograd.

Rahelić, S., Joksimović, J., Bučar, F. (1980): Tehnologija prerade mesa. Tehnološki fakultet u Novom Sadu. Novi Sad.

Sárraga, C., M. Gil, J.A. Garcia- Regueiro (1993): Comparison of calpain and cathepsin (B,L and D) activities during dry-cured ham processing from heavy and light large white pigs. Journal of the Science of Food and Agriculture 62, 71-75.

Toldrá, F. (1998): Proteolysis and lipolysis in flavor development of dry-cured meat products. Meat Science 49, 1, 101-110.

Vuković, I., Vasilav, D., Saičić, Snežana., Tubić, M., Kričković, D. (2005): Važnije osobine sremske šunke proizvedene optimiziranjem tradicionalnog postupka proizvodnje.Tehnologija mesa, vol.46, 3-4, 110-114.

Živković, J., Hadžiosmanović, M. (1996): Suhomesnati proizvodi. Veterinarski priručnik, peto izdanje. Medicinska naklada. Zagreb.

* **Pravilnik o proizvodima od mesa** (NN 01/07)

Prispjelo / Received: 27.2.2008.
Prihvaćeno / Accepted: 15.5.2008.

IDENTIFICATION OF HISTAMINE CONTENT IN FISH SAMPLES

Smajlović[1], A., A. Baković[1], I. Mujezinović[1], M. Muminović[1], M. Smajlović[2], O. Kapetanović[3], S. Hadžijusufović[3]

SUMMARY

Histamine is biogenic amine, which is developed in food rich in proteins as a result of histidine decomposition. The decomposition is caused by growth of certain types of bacteria.

Samples of imported fish from B&H market were analysed for the presence and quantity of histamine by ELISA (RIDASCREEN® Histamine). The results should repre-

[1] Ahmed Smajlović, MSc, senior assistant; Asima Baković, DVM, expert assistant; Indira Mujezinović, assistant professor; Mehmed Muminović, DSc, full professor; Department for Pharmacology and Toxicology, Veterinary faculty, University of Sarajevo, Zmaja od Bosne 90, 71000 Sarajevo
[2] Muhamed Smajlović, DSc, assistant professor, Department of Food Hygiene and Technology, Veterinary faculty, University of Sarajevo, Zmaja od Bosne 90, 71000 Sarajevo
[3] Osman Kapetanović, DM; Senada Hadžijusufović, DM; Sanitary Inspection, Ministry of health, canton Sarajevo, Bulevar Meše Selimovića 12, 71000 Sarajevo