

---

## CONTROL AND HYGIENIC SAUSAGE PRODUCTION

---

GJINOVCI, V.\* , BIJO, B.\*\* , SULAJ, K.\* , MUSAJ, A.\*\*\* , TERPOLLARI, J.\*\*\*\*

\*Agjencia e Ushqimit dhe Veterinarisë, Prishtinë, Kosovë. email:valdetgjinovci@gmail.com;

\*\*Fakulteti i Mjekësisë Veterinare, Universiteti Bujqësor i Tiranës.

\*\*\*Universiteti i Prishtinës, FXM, Mitrovicë, Kosovë.

\*\*\*\*Instituti i Sigurisë Ushqimore dhe Veterinarisë, Tiranë, Shqipëri<sup>4</sup>

### SUMMARY

In Kosovo the sausage production took place many years ago and currently it is a very common meat processing production. This product already is known and desired in many other countries such as: Albania, Turkey, Macedonia, Bulgaria and many other Balkan countries. The sausage is prepared by the minced bovine meat, where according to the recipe are added flavors, nitrates, water and salt. This product is processed and thermally treated on the temperature of 65 - 72<sup>0</sup>C for 60 minutes. Afterwards it goes through the smoking process and is considered to be consumable within 60 days.

The inspections and analytical controls on food industry were always attentive and rigorous in order to prevent the abuse of this traditional product which is very preferable by the consumers. But with all the attention and carefulness still from time to time were reported cases of alimentary toxic-infections through the consumption of Kosovo sausage. This important fact served as a motive to apply even more detailed research in regard to analytical control of some microbiological indicators, such as; *Mesophilic aerobic bacteria* and *Salmonella spp.* pathogen.

We performed our research in one of the meat processing establishments in Kosovo. The samples of ready product were taken for analysis during the period of May – December 2008 and their total number reached to 56 samples. The microbiological analyses were done at the Institute of Food Safety and Veterinary in Tirana, Albania. The results of the research confirmed that at the 24 samples of sausage or (43%) of them were present *aerobic mesophile bacteria* that exceeds the determined limit on the national standard of Kosovo (1x10<sup>5</sup> cfu/gr). Whereas the microbiological spectrum proves the presence exceeding the norm of *aerobic mesophile bacteria*, meanwhile at the same samples was not identified the presence of *Salmonella spp.* pathogen.

**Key words:** *Microbiological control, sausage, Aerobic mesophile bacteria, Salmonella spp.*

### INTRODUCTION

Food in general provides for a human the necessary basic substances, such as: proteins, carbohydrates, fat, vitamins and minerals. Within conspicuous food that allows an optimal nutrition of consumer with necessary substances is processed meat, where it is included the sausage of Kosovo. But the sausage of Kosovo often served as a subject of food toxic-infections outbreaks due to its contamination with microbic causes above the allowed state standard norms. In most of the cases bacterial contaminants shows negative effects at the consumers. (Jay, 1982; Dao and Yen 2006).

In Kosovo, in general there is a wide consumption of meat products, but comparing with other products the sausage is being used more.

The meat processing establishments by insertion on use the new modern technologies, increased their production capacities aiming to

fulfill the consumer's needs along the year. Based on the demands the production of sausage takes place within the highest most important processed meat products.

The production technology of sausage necessarily requires the completion of smoking process that ensures higher organoleptic values and improves its taste. According to Kosovo state standards, the sausage can be stored up to 60 days, when the optimal conditions of humidity and temperature are complied. This product is used during the whole year, but mostly within the period of autumn and winter.

The microbiological control of sausage is of a great importance during the production phase as well as during the stored phase. Hygienic safety of this product is realized preventing and controlling the growth of pathogens and harmful microorganisms. Considerable number of researches on this field shows that only through this controlling method can be ensured the hygienic safety for

products with the meat base. ( *Bozkurt and Erkmén 2002; Aksu and Kay 2004; Kaban and Kaya 2006; Cola et al., 2007*).

Based on the above mentioned arguments we concluded that it would be very important to enable on our research the numerical estimation of indicators on bacterial contamination *Aerobic mesophile bacteria*, and the presence of *Salmonella spp.* pathogen. This estimation wasn't performed for the Kosovo sausage until the initiation of this research. We will stress that this spectrum of microbiological control for unprocessed meat is necessarily required, because it allows ensuring of optimal judgment on hygienic guarantee for this product.

#### MATERIAL AND METHODS

Our research took place in one of the most important meat processing establishments in Kosovo. 56 samples were taken randomly for the period of May until December 2008. The samples were taken once a month after completion of technical process for sausage preparation, before its distribution on the market. The selected period matches with the time of our research initiation. The sausage samples were taken from the storage places, where the temperature conditions were in compliance with the required standard 4-7°C.

Taken samples for examination were placed on a sterile plastic bag and were transported by the cooling facilities with the storing temperature 4-8 °C. The transport was done within 10 hours. At the moment when samples reached the laboratory the examination started according to laboratory methods. The complete analytical control for microbiological estimation on samples was performed at ISUV, Department of Food Control.

The analytical control was performed according to ISO methods for:

Calculation of mesophile aerobic with the general method for calculation of *Mesophilic bacteria*, on food, calculation technique of cultures on 30°C (ISO 4833:2004-03-01, ISO 15214, 2002).

The control of *Salmonella spp.* pathogen presence on 25 gr of product (sausage), is realized according to horizontal discovery method of *Salmonella spp.* on food and feed ISO 6579:2002 (E).

#### RESULT AND DISCUSSION

From 56 sausage samples examined at the Department of Food Control on ISUV, 24 samples or (43 %) of them resulted with the presence of *Mesophilic bacteria* on the value higher than the Kosovo state standard limit ( $1 \times 10^5$  cfu/gr), ( see tab 1 and tab 2).

This indicator of bacterial contamination, shows clearly that a considerable part of samples have a high number of *aerobic mesophiles* reminding us that we are dealing with the contamination of product. Raw material, the meat which is used for production of sausage, always before entering in technological process is sent at the Kosovo National Institute of Public Health, on Prishtina for bacteriological analysis. Raw material is examined regarding the presence of pathogenic microorganisms which presents serious risk for the product. Interpretation on this situation allows us to estimate that the possibility of contamination exists on several levels concretely at the raw material which is used for sausage production, personnel hands, working environments, dishes which are being used for sausage preparation as well as storing facilities can serve as the source of sausage contamination by the microorganisms, used for research. There is a line of workouts performed on this field, which are pointing out the possibility of contamination ( *Kaban et al., 2006, Ferreira et al., 2007*).

Last years some producers preferred the thermal treatment of sausage, after the fermentation phase. The main objective on this technological modification was shortening the time of the process, more effective elimination of pathogens as well as lowering the cost of sausage production. We shouldn't forget that on economical loses always are reviewed and calculated carefully all the elements in regard to production of dangerous products for public health. Therefore day to day the objective is to improve and to reach the product according to standards and contemporary hygienic sanitary conditions. Some analytical reports of microbiological control of sausage, reported for food toxic-infections as a result of insufficient thermal treatment. Similar occurrence we investigated also on related researches on processed meat products, homogenous regarding the technology with the sausage of Kosovo. Through them is confirmed that the number increase of

*mesophile aerobics* occurs on the limits 12 – 34 % of examined samples (Shimoni *et al.*, 2000, Cheng-An Hëang *et al.*, 2009).

On our research the results showed that on 56 sausage samples is not identified the

*Salmonella spp.* pathogen. We estimate that a favorable influence on this case had the bactericid effect of pepper and other spicy substances which are found on the considerable amount on the sausage.

Table no. 1: Values of NPM of *Mesophile Aerobics* and *Salmonella spp.* pathogen taken from the sausage examinations performed on ISUV, during the period of May – July 2008.

no	Sample	Salmonella spp.	No. of Mesophile Aerobes cfu/gr	Month/Year
1	Sausage	Not found	2 x 10 <sup>3</sup> cfu/gr	
2	Sausage	Not found	9 x 10 <sup>4</sup> cfu /gr	
3	Sausage	Not found	7.6 x 10 <sup>3</sup> cfu /gr	
4	Sausage	Not found	5 x 10 <sup>7</sup> cfu /gr	
5	Sausage	Not found	1 x 10 <sup>4</sup> cfu/gr	May
6	Sausage	Not found	9 x 10 <sup>4</sup> cfu/gr	
7	Sausage	Not found	1,7 x 10 <sup>5</sup> cfu/gr	2008
8	Sausage	Not found	6 x 10 <sup>6</sup> cfu/gr	
9	Sausage	Not found	8 x 10 <sup>3</sup> cfu/gr	
10	Sausage	Not found	3 x 10 <sup>7</sup> cfu/gr	
11	Sausage	Not found	5 x 10 <sup>8</sup> cfu/gr	
12	Sausage	Not found	1x10 <sup>4</sup> cfu/gr	
13	Sausage	Not found	7 x 10 <sup>3</sup> cfu/gr	
14	Sausage	Not found	5 x 10 <sup>6</sup> cfu/gr	
15	Sausage	Not found	6 x 10 <sup>6</sup> cfu/gr	June
16	Sausage	Not found	7 x 10 <sup>5</sup> cfu/gr	
17	Sausage	Not found	3,5 x 10 <sup>5</sup> cfu/gr	2008
18	Sausage	Not found	4,7 x 10 <sup>4</sup> cfu/gr	
19	Sausage	Not found	1x10 <sup>5</sup> cfu/gr	
20	Sausage	Not found	9 x 10 <sup>3</sup> cfu/gr	
21	Sausage	Not found	7.3 x 10 <sup>4</sup> cfu/gr	
22	Sausage	Not found	3.5 x 10 <sup>6</sup> cfu/gr	July
23	Sausage	Not found	3.4 x 10 <sup>6</sup> cfu/gr	
24	Sausage	Not found	3.4 x 10 <sup>6</sup> cfu/gr	2008
25	Sausage	Not found	3.5 x 10 <sup>6</sup> cfu/gr	
26	Sausage	Not found	3.7 x 10 <sup>6</sup> cfu/gr	
27	Sausage	Not found	3.5 x 10 <sup>6</sup> cfu/gr	
28	Sausage	Not found	2. 4 x 10 <sup>7</sup> cfu/gr	
29	Sausage	Not found	3.4 x 10 <sup>5</sup> cfu/gr	
30	Sausage	Not found	3.4 x 10 <sup>5</sup> cfu/gr	
	Standard	0	100.000 cfu/gr	

The influence of spicy substances on the salmonella presence on salamis is identified also on other researches performed by foreign authors, where comparable researches proved the reduction of salmonellas for many times on spicy products (Bozkurt *et al.* 2002). On the other side we will mention that the sausage is a meat product discerned for retaining less

amount of free water than other similar meat products. This made it possible that the activity of bacterial *Salmonella spp.* cells to be lower not allowing their multiplication. Also the thermal treatment of product with the temperature of 65 - 72°C for 1 hour made it possible the absence of *Salmonella spp* pathogen. These temperatures are completely

suitable to cause the thermal stress on *Salmonella spp.* alignment blocking completely enzymatic activity of these cells.

On our research we noticed that heat treatment of the product after fermentation and drying reduces the number of microorganisms in general and *Salmonella spp.* pathogen in particular. The increased amount of *mesophile aerobic* according to

our judgment came as a massive contamination of raw material, that even with all the reduction effect of spicy substances on present microorganisms, as well as other inhibition elements such as high temperature, low humidity didn't make it possible to decrease their number under the standard required limit.

Table no. 2: Values of NPM of *Mesophile Aerobics* and *Salmonella spp.* pathogen taken from the sausage examinations performed on ISUV, during the period of August – December 2008.

no	Sample	Salmonella spp.	No. of Mesophile Aerobic cfu/gr	Month / Yeari
31	Sausage	Not found	$8 \times 10^5$ cfu/gr	August 2008
32	Sausage	Not found	$2,7 \times 10^4$ cfu/gr	
33	Sausage	Not found	$3.2 \times 10^3$ cfu/gr	
34	Sausage	Not found	$6 \times 10^6$ cfu/gr	
35	Sausage	Not found	$7 \times 10^6$ cfu/gr	
36	Sausage	Not found	$3.2 \times 10^4$ cfu/gr	
37	Sausage	Not found	$3 \times 10^3$ cfu/gr	
38	Sausage	Not found	$2 \times 10^7$ cfu/gr	
39	Sausage	Not found	$5 \times 10^5$ cfu/gr	October 2008
40	Sausage	Not found	$4 \times 10^3$ cfu/gr	
41	Sausage	Not found	$3 \times 10^3$ cfu/gr	
42	Sausage	Not found	$5 \times 10^3$ cfu/gr	
43	Sausage	Not found	$9 \times 10^4$ cfu/gr	
44	Sausage	Not found	$3 \times 10^2$ cfu/gr	
45	Sausage	Not found	$1 \times 10^4$ cfu/gr	
46	Sausage	Not found	$5.2 \times 10^2$ cfu/gr	
47	Sausage	Not found	$4.5 \times 10^3$ cfu/gr	November December
48	Sausage	Not found	$2 \times 10^4$ cfu/gr	
49	Sausage	Not found	$8.5 \times 10^4$ cfu/gr	
50	Sausage	Not found	$7 \times 10^3$ cfu/gr	
51	Sausage	Not found	$2 \times 10^4$ cfu/gr	2008
52	Sausage	Not found	$8.5 \times 10^4$ cfu/gr	
53	Sausage	Not found	$4 \times 10^6$ cfu/gr	
54	Sausage	Not found	$3 \times 10^4$ cfu/gr	
55	Sausage	Not found	$7,5 \times 10^3$ cfu/gr	
56	Sausage	Not found	$2 \times 10^4$ cfu/gr	
Standardi		0	100.000 cfu/gr	

(Aksu et al 2004). Based on this situation currently identified by sample microbiological examination we are able to evaluate that predisposed elements for the increase of *mesophile aerobics* could be the incompliance of hygienic rules for the staff and environment, which were not separately researched by us.

## CONCLUSION

At the end of our research on Kosovo sausage samples to evaluate the presence of *Mesophilic bacteria dhe Salmonella spp.* we can generate some concrete conclusions.

On the samples of sausage product is not identified the presence of *Salmonella spp.*

pathogen that came as a consequence of bactericide effect of spicy substances, low humidity that this product possess as well as thermal treatment on relatively high temperatures.

43 % of sausage samples resulted with the increased level of *Mesophilic bacteria*, above the norm that Kosovo standards require.

Based on results, where 43% of samples has the increased number of *Mesophilic bacteria*, even though the processing technology is respected, we estimate that one of the possible causes for this situation is incompliance by the personnel with the hygienic-sanitary conditions on working environment (the research of which was not the objective of our research)

To pay the particular attention for the disinfection (hygienic treatment) of working facilities, working environment as well as selection of raw material intended for the production of sausage.

#### REFERENCES

AKSU, M.I. AND M. KAYA (2004) Effect of usage of *Urtica dioica* L. On microbiological properties of sucuk, a Turkish dry-fermented sausage. *Food Control*, 15:591-595. DOI:10.1016/j.foodcont.2003.09.006.

BOZKURT, H. AND OO ERKMEN, (2002) Effects of starter cultures and additives on the quality of Turkish style sausage (sucuk). *Meat Sci.*, 61:149-156. DOI:10.1016/S0309-1740(00176-0).

BORCH E, NERBRINK E, SVENSSON P. Identification of Major Contamination Sources during Processing of Emulsion Sausage. *Inter J Food Microbiol* 1988;7:317-330.

CHENG-AN HËANG, ANNA C.S. PORTO-FETT, VIJAY K. JUNEJA, STEVEN C. INGHAM, BARBARA H. INGHAM AND JOHN B. LUCHANSKY. Modeling the survival of *Escherichia coli* O157:H7, *Listeria monocytogenes*, and *Salmonella* Typhimurium

during fermentation, drying, and storage of soudjouk-style fermented sausage. *International Journal of Food Microbiology*, Volume 129, Issue 3, 28 February 2009, Pages 244-252.

DAO, H.T. AND P.T. yen, (2006) Study of *Salmonella*, *Campylobacter* and *Escheria coli* Contamination in Raë Food Available in Factories, Schools and Hospital Canteens in Hanoi, Vietnam Annual N.Y. Academic Sci., 1081:262-265.

EYAL SHIMONI AND THEODORE P. LABUZA. Modeling pathogen growth in meat products: future challenges. *Trends in Food Science & Technology*. Volume 11, Issue 11, November 2000, Pages 394-40

KABAN, G. AND M. KAYA (2006) Effect of starter culture on growth of *staphylococcus aureus* in sucuk. *Food Control*, 17:797-801. DOI: 10.1016/j.foodcont.2005.05.003.

L.A. SHELEF AND V. POTLURI. Behaviour of foodborne pathogens in cooked liver sausage containing lactates. *Food Microbiology*, Volume 12, February 1995, Pages 221-22

NEL S, LUES JFR, BUYS EM, VENTER P, The personal and General Hygiene practices in the Deboning Room of a High Throughput Red Meat Abattoir. *Food Control* 2004; 15:571-578.

TEMELLI S. DOKUZLU C, SEN MKC. Determination of Microbiological Contamination Sources during Frozen Snail Meat Processing Stages. *Food Control* 2006; 17:22-29.

VÂNIA FERREIRA, JOANA BARBOSA, JOANA SILVA, MARIA TERESA FELÍCIO, CRISTINA MENA, TIM HOGG, PAUL GIBBS AND PAULA TEIXEIRA. Characterisation of *alheiras*, traditional sausages produced in the North of Portugal, with respect to their microbiological safety. *Food Control*, Volume 18, Issue 5, May 2007, Pages 436-440.