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Original Scientific Paper

MICROBIOLOGICAL PROPERTY OF RAW MEAT IMPORTS IN THE YEAR 2017

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Abstract

International trade requires food safety guarantees based on specialized hygiene standards, transparency procedures, and programs. Meat, because of its high water content and nutrition, can be an ideal medium for microorganism growth and multiplication. *Salmonella*, as one of the most common pathogens that can be transmitted from animals to humans, causes major public health problems worldwide. Although mortality is low, the disease has important social and economic consequences. Based on governmental regulation, Serbia runs an active, official control of *Salmonella* in meat. From January to December 2017, 193 samples of imported pork, beef, lamb, kid, and poultry meat were analyzed for the presence of *Salmonella* spp. Only one (0.52%) of all analyzed samples was positive to *Salmonella* spp. The positive sample was frozen chicken drumsticks together with thighs originated from Poland, which makes 6.67% of the total examined poultry meat samples. Infected poultry is one of the most important reservoirs of *Salmonella* that are transmitted to humans through the food chain. The identity of the isolated strain was biochemically and serologically confirmed to be *Salmonella* Infantis. This pathogen is in the 4th place of most common *Salmonella* serovar among human isolates in Europe and the most common serovar isolated from poultry meat. In order to decrease the prevalence of *Salmonella* spp. it is necessary to maintain all the food safety standards through the whole food chain, from farm to fork.

Key words: international trade, *Salmonella* spp., major public health problems, raw meat

INTRODUCTION

People use the meat of different animals species in their diet. Most often, meat is obtained from domestic mammals and poultry reared for meat production. Due to its high water content and excellent nutritional value, meat is an ideal environment for the growth and multiplication of microorganisms. Namely, the meat is considered to be sterile during

slaughter. However, depending on the level of hygiene during slaughter, the cooling rate of the carcasses, and the meat keeping conditions, contamination of the meat with either pathogenic or spoilage microorganisms can occur (Mead, 2004).

Foodborne pathogens are bacteria that have the ability to cause foodborne diseases in humans, either alone or through their harmful products (Babić et al., 2018). These bacteria in meat are a hazard to consumers if the meat is not sufficiently heat-treated or if cross-contamination occurs with raw or insufficiently heat-treated food (Escartın et al., 2000). Meat and meat products can be important sources of human infection with *Salmonella* species, *Campylobacter jejuni/coli, Yersinia enterocolitica,* verotoxic *Escherichia coli (VTEC),* and *Listeria monocytogenes* (Nørrung and Buncic, 2008). Salmonella is the most common bacterial causative agent of foodborne illness in the United States (Dewey-Mattia et al., 2018), causing about 44% of confirmed bacterial foodborne infections. In Europe, it is just behind *Campylobacter* spp. (EFSA, 2018). It is estimated that 93.8 million people worldwide suffer from gastroenteritis caused by salmonella every year. Although only about 1% of infections require hospitalization, about 155 000 deaths are reported annually (Hoelzer et al., 2011).

Nowadays, food safety is a basic prerequisite for the free flow and trade of food. The integrated food safety system is based on producer responsibility, food traceability, the application of risk analysis systems, as well as the application of precautionary principles, when necessary. International trade requires food safety guarantees based on special hygiene standards, transparent procedures, and programs.

The basic act in the field of food safety in the Republic of Serbia is the Law on Food Safety (Regulation, 2009; Regulation, 2019). Other bylaws (regulations) prescribe the necessary common cross-sectoral approaches in the chain "from farm to fork", including preventive, on-time, and effective inspection activities (Vidaković et al., 2018), as well as requirements for microbiological criteria, temperature control, and cold chain maintenance, sampling, and analysis, guidelines for good practice and traceability.

The reason for the safety standards existence is food production without risk to human health. Nowadays, there are various microbiological criteria (based on the absence, presence, or number of microorganisms) that are used for the definition of the acceptability of a product, production batch, or production process. In the Republic of Serbia, in accordance with the Rulebook on General and Special Conditions for Hygiene of Food at any Phase of Production, Processing and Trade (Regulation, 2010; Regulation, 2018) according to the criteria for food safety, poultry meat is tested for the presence of *Salmonella* species according to point 1.4, while other types of meat are tested according to point 1.5. For the analysis of the microbiological safety of meat, it is necessary to take five units that make one sample of the product.

The aim of this paper is to present the microbiological safety of raw meat in the Republic of Serbia originating from imports in the period January-December 2017.

MATERIALS AND METHODS

In the period from January 1st, 2017 to December 31st, 2017, a total of 193 samples of raw (frozen or fresh) meat (table 1.) were tested for the presence of *Salmonella* spp. Out of the total number of samples, 171 samples were from pork, 15 from chicken, 5 from lamb, 1 from goat, and 1 from veal meat.

All samples were sampled on the demand of the border or republic veterinary inspection of the Republic of Serbia, as part of the import control. Sampling was performed according to the prescribed sampling conditions, while transport was performed within the prescribed time and temperature range to the laboratory of the Scientific Veterinary Institute "Novi Sad" in Novi Sad.

Of the total number of samples, 15 were tested for the presence of *Salmonella* spp. according to item 1.4, while the remaining samples were tested according to item 1.5 of the Regulation (2010; 2018).

For the isolation of *Salmonella* spp., method SRPS EN ISO 6579-1:2017 (ISS, 2017), prescribed by the Rulebook on General and Special Conditions for Hygiene of Food at any Phase of Production, Processing and Trade (Regulation, 2010; Regulation, 2018) was used. Identification of isolated strains was performed by serological rapid agglutination test on a plate (Grimont and Weill, 2007).

RESULTS AND DISCUSION

The type, origin, and number of tested samples during the year 2017 are presented in table 1. Of the 193 samples tested for the presence of *Salmonella* species, only one was positive (0.52%). Namely, *Salmonella* was isolated from one sample of frozen chicken drumsticks together with thighs originating from Poland, which makes 6.67% of the total number of tested samples of imported chicken meat. According to the White-Kauffmann scheme (Grimont and Weill, 2007), *Salmonella* Infantis was isolated.

Table 1. The type, origin, and number of tested meat samples from imports

Type of samples	Origin	Number of tested samples
Frozen pork shoulder	Germany	40
	Spain	21
	Netherlands	10
	Denmark	3
	Austria	1
	Croatia	1
Frozen pork legs	Spain	29

	Hungary	7
	Belgium	1
	Germany	1
	Croatia	1
Frozen pork loin chain off	Spain	16
	Croatia	1
	Germany	1
	Poland	1
Frozen pork collar straight cut	Spain	13
	Germany	3
	Austria	1
	Netherlands	1
	Hungary	1
Frozen pork	Hungary	1
	Germany	1
	Spain	1
Frozen pork head meat	Germany	3
Frozen pork trimmings 90/10	Spain	1
Frozen pork trimmings 80/20	Spain	2
	Italy	1
Frozen pork trimmings 70/30	Netherlands	7
Frozen young pork	Spain	1
Frozen veal	Netherlands	1
Lamb carcass	North Macedonia	5
Kid carcass	North Macedonia	1
Frozen chicken drumsticks together with thighs	Poland	12
	Germany	1
	Bosnia and Herzegovina	1
Frozen chicken heart and liver	Bosnia and Herzegovina	1

In recent years, *Salmonella* Infantis has been ranked fourth as the cause of salmonellosis in humans, while since the year 2013, *Salmonella* Infantis is the most common serotype isolated from chicken meat (EFSA, 2016). This is confirmed by various studies, including a study conducted in Republic of Srpska where *Salmonella* Infantis is the most commonly isolated serotype from chicken drumsticks together with thighs and chicken wings (Kalaba et al., 2017). Then there is the research conducted in Hungary with 100% *Salmonella* Infantis positive samples of carcasses and retail chicken meat (Nógrády et al., 2008). The emergence of this serotype has also been reported in other European countries, including the Netherlands (Van Duijkeren et al., 2002), Germany, Austria, Poland, Italy, and the United Kingdom (Nógrády et al., 2012).

The increase in cases associated with *Salmonella* Infantis serotype is related to the ability to spread clones resistant to many antibiotics (Antunes et al., 2016; Kalaba et al., 2017).

The appearance of *Salmonella* Infantis in chicken meat may be the result of poor application of good manufacturing and good hygiene practices in slaughterhouses. Namely, once contaminated slaughter or production line cross-contaminates chicken carcasses or their parts with each subsequent contact. Contamination can occur during plucking, evisceration, cooling, cutting, and/or packaging (Olsen et al., 2003). The prevalence of *Salmonella* in raw meat is directly related to the findings of *Salmonella* in primary production (Karabasil et al., 2012), whether it is the production of chicken, pork, or some other meat.

However, since 2004, there has been a decline in salmonellosis in EU countries, as a consequence of control programs for specific serotypes in primary production (ECDC, 2018).

CONCLUSION

Based on the obtained results and literature review, it can be concluded that, in order to ensure healthy products, it is necessary to build a network of good communication between risk assessment and legislative institutions, as well as food safety agencies at the global level.

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REFERENCES

Antunes P., Mourão J., Campos J., Peixe L. (2016): Salmonellosis: the role of poultry meat. Clinical Microbiology and Infection, *22*(2):110-121.

Babić J., Vidaković S., Bošković M., Nikolić A., Knežević S., Pelić M., Ljubojević Pelić, D. (2018): Uticaj klimatskih promena na bezbednost hrane u lancu od njive do trpeze. Ecologica, 25(90):337-340.

Dewey-Mattia D., Manikonda K., Hall A. J., Wise M. E., Crowe S. J. (2018): Surveillance for foodborne disease outbreaks-United States, 2009–2015. MMWR Surveillance Summaries, 67(10):1.

ECDC. (2018). Salmonellosis. In Annual epidemiological report for 2015. European Centre for Disease Prevention and Control.

EFSA. (2016): The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2015. European Food Safety Authority, EFSA Journal, 14(12):e04634.

EFSA. (2018). The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2017. European Food Safety Authority and European Centre for Disease Prevention and Control, EFSA Journal, 16(12):e05500.

Escartín E. F., Lozano J. S., García O. R. (2000): Quantitative survival of native Salmonella serovars during storage of frozen raw pork. International journal of food microbiology, 54(1-2):19-25.

Grimont P. A., Weill F. X. (2007): Antigenic formulae of the Salmonella serovars. World Health Organisation, WHO collaborating centre for reference and research on Salmonella, 9:1-166.

Hoelzer K., Switt A. I. M., Wiedmann M. (2011): Animal contact as a source of human non-typhoidal salmonellosis. Vet Res., 42:34.

ISS. (2017): Microbiology of the food chain — Horizontal method for the detection, enumeration and serotyping of Salmonella — Part 1: Detection of Salmonella spp. Institute for standardisation of Serbia, SRPS EN ISO 6579-1.

Kalaba V., Golić B., Sladojević Ž., Kalaba D. (2017): Incidence of Salmonella Infantis in poultry meat and products and the resistance of isolates to antimicrobials. In IOP Conference Series: Earth and Environmental Science, 85(1):012082.

Karabasil N., Pavlicevic N., Galic N., Dimitrijevic M., Loncina J., Ivanovic J., Baltic M. (2012): Nalaz salmonela na trupovima svinja u toku klanja i obrade. Veterinarski glasnik, 66(5-6):377-86.

Mead G. C. (2004): Microbiological quality of poultry meat: a review. Revista Brasileira de Ciência Avícola, 6(3):135-142.

Nógrády N., Kardos G., Bistyak A., Turcsányi I., Mészáros J., Galántai Z., Juhász Á., Samu P., Kaszanyitzky J.É., Pászti J., Kiss I. (2008): Prevalence and characterization of Salmonella infantis isolates originating from different points of the broiler chicken–human food chain in Hungary. International journal of food microbiology, 127(1-2):162-167.

Nógrády N., Király M., Davies R., Nagy B. (2012): Multidrug resistant clones of Salmonella Infantis of broiler origin in Europe. International journal of food microbiology, 157(1):108-112.

Nørrung B., Buncic S. (2008): Microbial safety of meat in the European Union. Meat Science, 78(1-2):14-24.

Olsen J. E., Brown D. J., Madsen M., Bisgaard M. (2003): Cross-contamination on a broiler slaughterhouse line demonstrated by use of epidemiological markers. Journal of Applied Microbiology, 94:826-835.

Regulation. (2009): Law on Food Safety. Official Gazette of Republic of Serbia, 41/2009.

Regulation. (2019): Law on Food Safety. Official Gazette of Republic of Serbia, 17/2019.

Rulebook. (2010): General and Special Conditions for Hygiene of Food at any Phase of Production, Processing and Trade. Official Gazette of Republic of Serbia, 72/2010.

Rulebook. (2018): General and Special Conditions for Hygiene of Food at any Phase of Production, Processing and Trade. Official Gazette of Republic of Serbia, 62/2018.

Van Duijkeren E., Wannet W. J. B., Houwers D. J., van Pelt W. (2002): Serotype and phage type distribution of Salmonella strains isolated from humans, cattle, pigs, and chickens in the Netherlands from 1984 to 2001. Journal of Clinical Microbiology, 40:3980-3985.

Vidaković S., Babić J., Glišić M., Pelić M., Knežević S., Pajić M., Ljubojević Pelić, D. (2018): Stop salmonelozi u vrtićima poreklom iz hrane. Ecologica, 25(90):355-358.

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