

MICROBIOLOGICAL SAFETY OF MINCED AND GRILL MEAT IN THE YEAR 2009

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ABSTRACT: The results of microbiological safety of minced and grill meat samples examined during the year 2009 are reported. 150 samples of meat were analyzed in this study: 75 samples of minced and 75 samples of grill meat.

Out of 75 analysed samples of minced meat, 20% were not safe due to presence of coagulasa positive staphylococcus and *Escherichia coli*, as well as due to increased number of total microorganisms within the range of 4×10^6 to 3×10^7 . Out of 75 analysed samples of grill meat, 48% were not safe due to presence of coagulasa positive staphylococcus and *Escherichia coli*, as well as due to increased number of total microorganisms, which was in the range from 32×10^5 to 35×10^7 .

During the production of grill meat more manipulative and manual labor is taking place than in the production of minced meat. Consequently, manual labor represents a risk and should be a critical control point in the production process.

Keywords: *microbiological safety, minced meat, grill meat*

INTRODUCTION

As the modern way of life influences eating habits of people, consumption of minced and grill meat increases daily. For that reason, knowledge about microbiological safety issues as well as possible critical control points in production of these products is of great importance.

Taking into account the fact that meat belongs to a group of easily perishable foods (Cardenas et al., 2008; Zehra et al., 2010), it is necessary to emphasize the importance of microbiological quality of meat and meat products monitoring.

Minced meat is uncured product obtained by milling or grinding of different types of meat, with addition of additives, spices, spice extracts, water, protein products, fibers and supplies. On the market, minced meat is present like: ground meat, minced meat prepared for shaping and shaped minced meat. Packaged products are stored at temperatures below +4 °C up to 48 h, and at a temperature of -18 °C up to 60 days. The date of meat grinding or milling is considered as date of production of minced meat (Pravilnik o kvalitetu i drugim zahtevima za proizvode od mesa, "Sl. list SCG", br.33/2004).

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Microbiological contamination of minced meat can be of primary or secondary origin. Primary contamination originates from microorganisms present in the tissues of animals before slaughter and secondary contamination occurs during production, storage and distribution (Malocki & Bruzewic, 2005).

Minced meat production is based on proper selection of raw materials, milling and grinding in a machine with rotating knives, packaging usually in foils (vacuum packaging) and distribution.

During meat milling or grinding, favourable conditions for microbial growth exist. In minced meat, meat surface is greatly increased as the fascia and aponeurosis (connective-tissue layers of muscle fibers), the biological barrier against the penetration of microorganisms in the depths of meat are deteriorated. Meat juice is released from damaged muscle fibers providing an increase of minced meat humidity. The initial microflora of meat increases with secondary contamination during preparation and addition of additives. All mentioned factors are responsible for rapid bacterial decomposition of minced meat (Bem & Adamič, 1991), (Škrinjar & Tešanović, 2007).

Bacteria in significant numbers can be found on the meat processing machines, such as meat grinders, meat mincing machines, filling machines, and others. Proposed control points during production are: selection of raw materials, temperature during cold storage, facility hygiene, hygiene of equipment for meat mincing and different areas in production facility (working area, equipment, wall and floor space, smear from workers hand) (Žakula, 1980).

Possible contamination sources of minced meat prepared for shaping are additives, supplements and special spices added during processing. Spices are daily used in the meat industry to achieve certain sensory properties of foods. They are added in small amounts, with the aim of improving taste and smell. Although they have antibacterial properties, spices are often highly contaminated with numerous microorganisms, which can lead to secondary contamination of the final product.

Monitoring of hygienic conditions and meat quality is important as well as the application of hygienic procedures on supplies and

equipment used in the meat industry. Control of production and distribution of minced meat is provided by establishing an organized system of supervision as well as by implementation of an integrated control system in the primary production chain. A good hygiene practice is also a precondition for safe food production.

MATERIAL AND METHODS

150 samples of meat were analyzed in this study. There were 75 samples of minced and 75 samples of grill meat. The analyses were conducted according to the current Regulation (Pravilnik o mikrobiološkoj ispravnosti namirnica u prometu, "Sl. list SRJ" br. 26/1993, 53/1995 i 46/2002) on the following microbiological parameters:

- ✓ *Salmonella* sp
- ✓ Coagulasa positive staphylococcus
- ✓ Sulphur reduction clostridium
- ✓ *Proteus* sp
- ✓ *Escherichia coli*
- ✓ Total count of microorganisms

Determination of mentioned parameters has been done according to the methods of isolation and determination under the applicable Regulations (Pravilnik o metodama vršenja mikrobioloških analiza i superanaliza, "Sl. list SFRJ", br. 25/1980).

RESULTS AND DISCUSSION

The results obtained in this study are shown in Tables 1 and 2 as total analyzed samples, number of correct and incorrect patterns. Total number of microorganisms was presented as an interval of obtained values.

In Table 1 results of microbiological safety of minced meat according to the Regulation (Pravilnik o mikrobiološkoj ispravnosti namirnica u prometu, "Sl. list SRJ", br. 26/1993, 53/1995 i 46/2002) are shown. These products are microbiologically correct if pathogenic microorganisms: *Salmonella* species in 25 g of sample, coagulasa positive staphylococci in 0.1 g of sample, sulphur reduction clostridium in 0.01 g, *Proteus* species in 0.01 g and *Escherichia coli* in 0,001g are not identified in the samples. Total number of microorganisms must be less than 3×10^6 in 1 g of sample.

Table 1.

Microbiological safety of minced meat

Data on samples		Microbiological parameters	
Sample	Number	Interval the total number of microorganisms in 1g	The presence of pathogenic microorganisms
Total analyzed	75	$26 \times 10^3 - 3 \times 10^7$	6
Correct	60	$26 \times 10^3 - 2 \times 10^6$	- ^a
Incorrect	15	$4 \times 10^6 - 3 \times 10^7$	6

Legend: -^a Not found

Table 2.

Microbiological safety of grill meat

Data on samples		Microbiological parameters	
Sample	Number	Interval the total number of microorganisms in 1g	The presence of pathogenic microorganisms
Total analyzed	75	$1 \times 10^3 - 35 \times 10^7$	18
Correct	39	$1 \times 10^3 - 28 \times 10^5$	- ^a
Incorrect	36	$32 \times 10^5 - 35 \times 10^7$	18

Legend: -^a Not found

Based on the results shown in Table 1, out of 75 analyzed, 60 samples of minced meat were correct. Pathogenic microorganisms have not been isolated from these samples. Total bacterial count ranged from 26×10^3 to 2×10^6 organisms per 1 g sample.

Referring to the obtained results, 20% of the total analyzed samples were incorrect. In five samples, the reason was increased number of total microorganisms ranging from 4×10^6 to 3×10^7 per 1 g of sample. In two samples, the presence of coagulase-positive staphylococci was detected. The presence of *Escherichia coli* was detected in four samples, out of which one had increased total count of microorganisms. *Salmonella* species, sulphur reduction clostridium and *Proteus* species were not isolated from any of the investigated samples. Microorganisms may be present due to the poor standards of hygiene in the manufacturing process and inexpert manipulations of potential carriers of these microorganisms. Results of microbiological safety of grill meat are shown in Table 2. According to the Regulation on microbiological safety of food in trade (Pravilnik o mikrobiološkoj ispravnosti namirnica u prometu, "Sl. list SRJ", br. 26/1993, 53/1995 i 46/2002) these products are microbiologically correct if the samples do not contain following pathogenic microorganisms: *Salmonella* species in 25 g of sample, coagulasa positive staphylococci in 0.01 g of sample, sulphur reduction clostridium in 0.01 g, *Proteus* species in 0.01 g and

Escherichia coli in 0.001g. Total number of microorganisms must not be higher than 3×10^6 in 1 g of sample.

Based on the results shown in Table 2, out of total 75 analyzed samples of grill meat type of kebabs, burgers and barbecue sausages, 39 samples were correct. From these samples, pathogenic microorganisms were not isolated, and the total bacterial count ranged from 1×10^3 to 28×10^5 microorganisms in 1 g sample.

36 samples were contaminated, which is 48% of the total analyzed samples. The reason of contamination in 31 samples was increased number of microorganisms, ranging from 32×10^5 to 35×10^7 in 1 g sample. Pathogenic microorganisms were isolated from 18 samples, coagulasa positive staphylococci from 4 samples, and *Escherichia coli* from 14 samples. Out of 18 samples from which pathogenic microorganisms were isolated, total count of microorganisms was higher than allowed by the Regulations (Pravilnik o mikrobiološkoj ispravnosti namirnica u prometu, "Sl. list SRJ", br. 26/1993, 53/1995 i 46/2002) in 8 samples.

The reasons of these sample contaminations can be diverse. Since these products are produced with addition of spices and additives and different casings are used, level of microbiological contamination in final product is highly influenced by contamination of all these ingredients. Apart from meat for grill

which contains spices for which the maximum permitted total count of microorganisms is 5×10^6 per 1 g of sample, maximum permitted number of total microbiological count is the same for minced meat and meat for grill and is 3×10^6 microorganisms per 1 g sample, according to the Regulation on microbiological safety of food in trade (Pravilnik o mikrobiološkoj ispravnosti namirnica u prometu, "Sl. list SRJ", br. 26/1993, 53/1995 i 46/2002).

During the production of grill meat more manipulative and manual labor is taking place than in the production of minced meat. Consequently, manual labour represents a risk and should be a critical control point in the production process.

CONCLUSIONS

Study was conducted on 150 samples of minced and grill meat.

- Out of 75 analysed samples of minced meat, 20% were not safe due to presence of coagulasa positive staphylococcus and *Escherichia coli*, as well as due to increased number of total microorganism within the range of 4×10^6 to 3×10^7 .
- Out of 75 analysed samples of grill meat, 48% were not safe due to presence of coagulasa positive staphylococcus and *Escherichia coli*, as well as due to increased total number of microorganisms, which was in the range from 32×10^5 to 35×10^7 .
- Referring to the obtained results, it can be concluded that minced meat and meat for grill are substrate suitable for rapid multiplication of micro-

- organisms, and therefore every stage during production must be strictly controlled, especially when manual manipulation is taking place.

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