



SAFETY OF DELICACY PRODUCTS IN TRADE NETWORK

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ABSTRACT

The aim of this study was evaluation of microbiological quality of delicate products in Slovakia during years 2007 - 2011. In this study 14 834 samples were collected and 1223 (8.24 %) samples did not comply with microbiological criteria. Coliform bacteria were detected in 618 samples (4.17 %), *E. coli* was detected in 298 samples (2.01 %). Yeasts and filamentous microscopic fungi were detected in 397 samples (2.68 %). *Listeria monocytogenes* was detected in 41 samples (0.28 %), *Staphylococcus aureus* in 12 samples (0.08 %), *Bacillus cereus* in 13 samples (0.09 %), *Salmonella spp.* in 4 samples (0.03 %) and sulphidreduces clostridia were not detected in all samples. Coliform bacteria indicate poor operational hygiene.

Keywords: delicate products, coliform bacteria, *E. coli*, *Bacillus cereus*, *Salmonella spp.*

INTRODUCTION

Delicacy products are food products of different composition, designed for quick consumption and they are consisting of raw materials of plant and animal origin. They are mainly meat specialties, fish products, mayonnaise salads, vegetable salads, sandwiched bakery products, and confectionery products (**Decree no. 981/1996-100**). All cooked ingredients for the preparation of delicacy products must be cooled to +10 °C within 4 hours after cooking and a must be processed within 24 hours. Only heat-treated chicken eggs and egg mass can be used for the production of delicate products (**Decree no. 28167/2007**).

Coliforms bacteria (CB) are a large group of gram-negative, non-spore-forming, rod-shaped bacteria that all belong to a single taxonomic family *Enterobacteriaceae*. The CB group refers to bacteria that are capable of aerobic and facultative anaerobic growth, ferment lactose at 37 °C within 48 h, possess the enzyme *β-galactosidase* and are oxidase-negative. They can be isolated from polluted and non-polluted waters, soils and plants, as well as from the faeces of humans and warm-blooded animals (mammals and birds). Hence, CB represents not only the intestinal (faecal in origin) bacteria but also other free-living (non-faecal in origin) coliforms, and therefore could be understood in a simplified way to represent “environmental bacteria” (**Von Sperling, 2007**).

Durability of packaged foods depends on many factors, internal as pH, water activity, nutrient content, presence of antimicrobial agents, redox potential, the properties of biological structures, and external factors such as temperature, relative humidity, atmospheric composition (**Pavelková and Flimelová, 2012**).

Salmonellosis represents an important foodborne disease that continues to pose a major and unacceptable threat to human public health in both developed and developing countries. The dynamics of *Salmonella* infection is variable and may also be affected by human lifestyle and behavior, changes in industry, technology, commerce and travel (**Foley et al., 2008**). *Salmonella* serovars are widespread in nature and can be found in the intestinal tract of all animals species, both domestic and wild which result in a variety of *Salmonella* infection sources (**Allerberger et al., 2002**).

Microbial contamination affects most of foodstuffs consumed in the world. Although a residual bacterial charge is commonly accepted and even wished in some foods (for instance yoghurt) and a fungal presence is a characteristic pursued in some cases (as for some cheese varieties), an early and reliable detection of microbial contamination is a noteworthy not yet reached challenge. Indeed microbial contamination not only can alter taste and flavour, but

can also be harmful for customer's health whenever food pathogens (e.g. *Salmonella* or *Escherichia coli*) are present (Allwood et al., 2004).

Microbiological quality may be determined through reactions between indicators included within the package and metabolites which are produced during microbial growth. The using of those indicators to inside or outside of cover we can call smart or intelligent packaging. Smart packaging utilizes chemical sensor or biosensor to monitor the food quality and safety from the producers to the costumers (Pavelková, 2012).

The aim of present study was to evaluate the microbiological quality of delicacy products during the years 2007 – 2011 in Slovak republic. The following microorganisms were evaluated: coliform bacteria, *Escherichia coli*, *Salmonella spp.*, yeasts and filamentous microscopic fungi, sulphid reduced clostridia, *Staphylococcus aureus*, *Bacillus cereus*, *Bacillus cereus* and *Listeria monocytogenes*.

MATERIAL AND METHODS

Selected microbial indicators were examined in 14 834 samples of delicacy products. Microbiological quality of delicacy products was evaluated during the five years in Slovakia. Official inspection was carried out by the each Regional Public Healthcare Office. Indicators, which evaluate microbiological quality of delicacy products are based on Slovak and European legislation. *Escherichia coli*, coliform bacteria, yeasts and filamentous microscopic fungi, sulphid reduced clostridia, coagulase-positive staphylococci, *Bacillus cereus* are intended as indicators of microbiological quality of delicate products in the production process according to Slovak legislation. *Salmonella sp.* is determined as a criterion of safety at sales of products (Decree no. 06267/2006). *Listeria spp.* is determined according to legislation of the European Union (Commission Regulation no. 2073/2005).

Determination of the number of coliform bacteria was performed on agar medium with crystal violet, neutral red, bile salts and lactose (VRBL) according to ISO 4832 (560085), determination of yeasts and filamentous microscopic fungi was performed on agar medium with yeast extract, glucose and chloramphenicol according to STN ISO 21527-1,2, determination of number of *Staphylococcus aureus* on Baird Parker agar pomocou according STN EN ISO 6888-1, determination of *Salmonella* at the selective reproduction in Rappaport - Vassiliadis and Müller – Kuuffman media according STN EN ISO 6579. Fraser liquid medium was used for the detection of *Listeria monocytogenes* according to STN EN ISO 11290-1. Determination of *Escherichia coli* was performed by an agar medium with tryptone, bile salts and glucuronide according to STN ISO 16649-1,2. Determination of *Bacillus*

cereus was performed according to **STN EN ISO 7932**. Sulphidreduced bacteria was performed by tryptose agar with metabisulfite and cycloserine without egg yolk according to **STN EN ISO 7937**.

RESULTS AND DISCUSSION

Microbiological quality of delicate products was evaluated during five years (2007, 2008, 2009, 2010, 2011) in Slovakia. In this study 14 834 samples were analyzed and 1 223 samples (8.24 %) were inadequate in terms of the number of microorganisms.

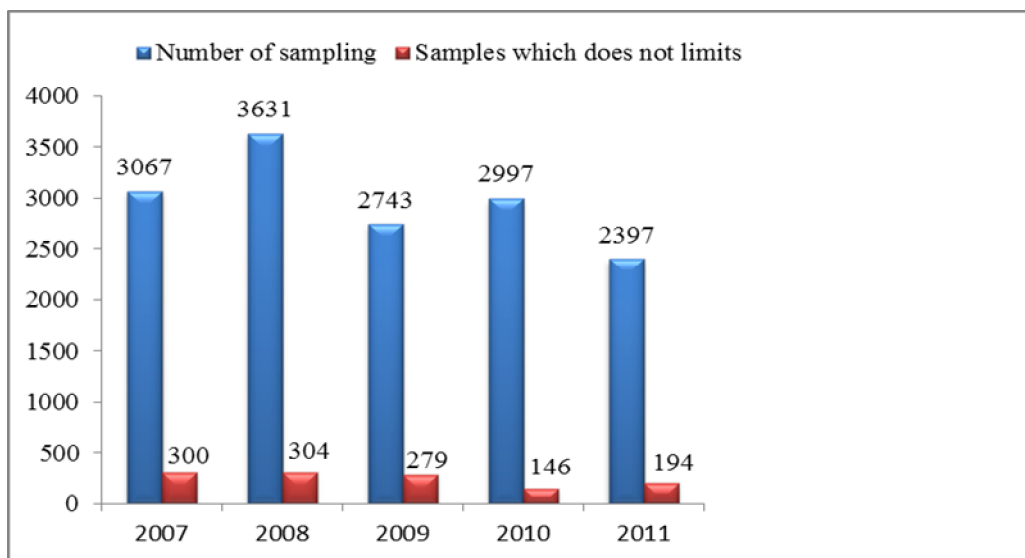


Figure 1 Number of sampling during the period 2007 – 2011 in Slovak republic

Fig. 1 shows number of taken samples and samples, which doesn't meet the microbiological limits of delicate products during 2007 – 2011 in Slovak republic. Increased amount of sampling in 2008 was because of publicity listeriosis in the Czech Republic and also because of new legislation.

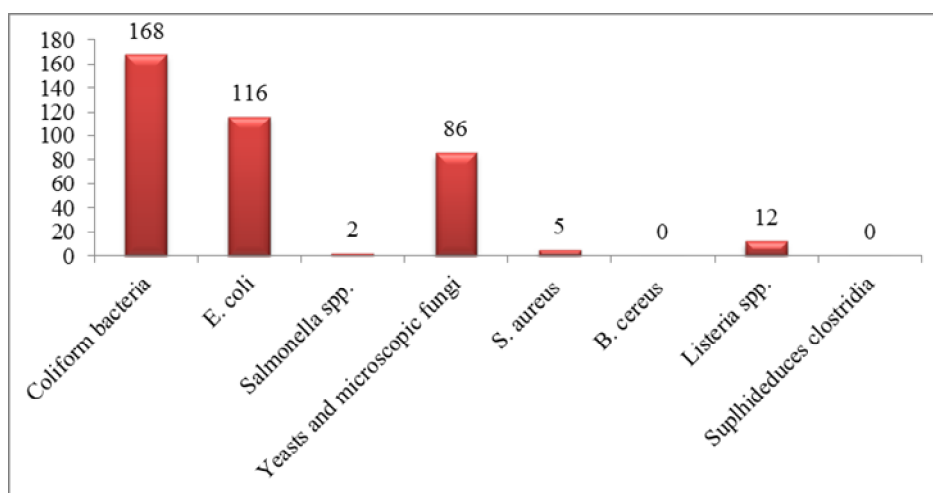


Figure 2 Number of samples which doesn't meet the microbiological limits during year 2007 in Slovak republic

The presence of *L. monocytogenes* in 10 % of ready-to-eat (RTE) product is considered very important, as unlike other foods, chilled RTE are not further processed. This situation may increase the risk of listeriosis posed by consumption of RTE. On the other hand *L. monocytogenes* is able to growth in refrigerated products from less than 100 cells /gram, which is considered to be highest accepted dose for healthy people (Buchanan et al., 2000; Huss et al., 2000) to more than 10^5 cells/gram, in less than a week (Miettinen et al., 1999).

Chilled RTE foodstuffs such as oloveyh salad are stored at refrigeration temperature for about 2 weeks and are consumed without further heat treatment. This raises more concern on risk of eating RTE foods and also highlights the necessity of consumer protection rules against this pathogen (Messens, 2005).

In year 2007 were examined 3 067 samples and 300 samples (9.78 %) did not comply with microbiological criteria. Coliform bacteria were present in 168 samples (5.48 %), *E. coli* was present in 116 samples (3.78 %), yeasts and filamentous microscopic fungi were present in 86 samples (2.80 %), *Listeria monocytogenes* was detected in 12 samples (0.39 %), *Staphylococcus aureus* was in 5 samples (0.16 %) and *Salmonella* spp. was detected in 2 samples (0.07 %).

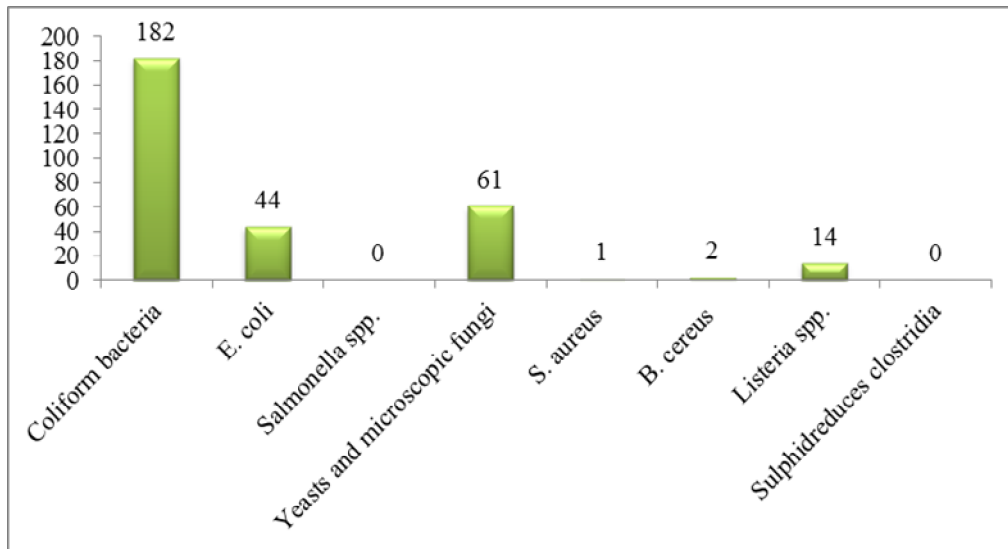


Figure 3 The number of samples which doesn't meet the microbiological limits during year 2008 in Slovak republic

In year 2008 were collected 3 631 samples and 304 samples (8.37 %) did not comply with microbiological criteria. Coliform bacteria were in 182 samples (5.01 %), *E. coli* was detected in 44 samples (1.21 %), yeasts and filamentous microscopic fungi in 61 samples (1.68 %), *Listeria monocytogenes* in 14 samples (0.39 % - occurrence of *Listeria monocytogenes* was the highest during the monitored period 2007 - 2011), *Staphylococcus aureus* in 1 sample (0.03 %) and *B. cereus* in 2 samples (0.06 %).

In relation to pork sausages, a study in France revealed a single positive strain Of *E. coli* out of the 250 meat samples tested (Thornton et al., 2009). In another study in Argentina, 4.8 % of the 83 fresh sausages tested and 3.3% of the 30 dry sausages tested were positive for *E. coli* O157 (Chinen et al., 2001).

Studies concerning hamburgers were reported from Colombia, where 8.7 % of the tested samples were contaminated with *E. coli* O157 (Mattar and Vásquez, 1998), and from Brazil, where no *E. coli* O157 strain was isolated from 886 hamburger samples examined (Silveira et al., 1999).

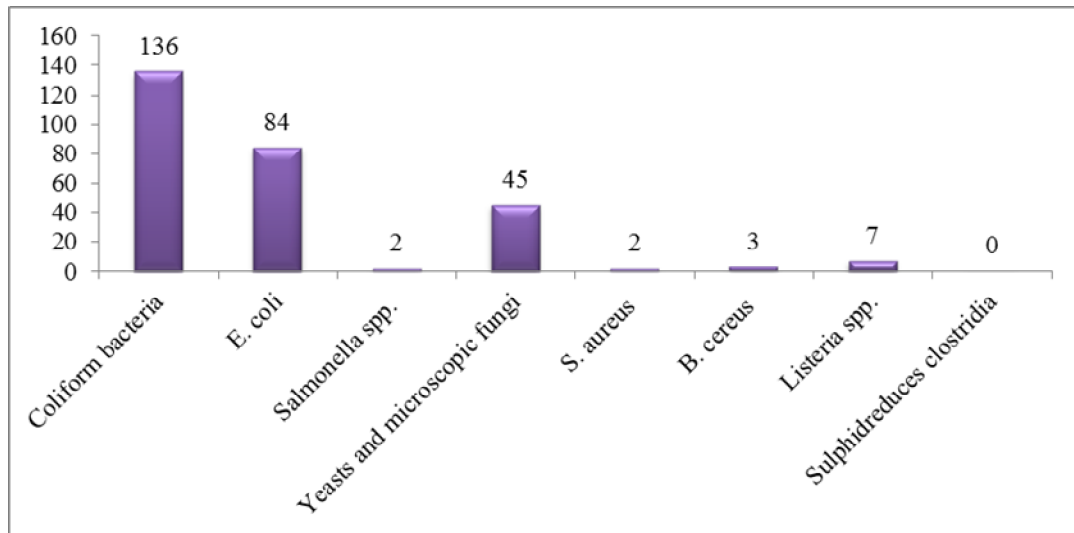


Figure 4 Number of samples which doesn't meet the microbiological limits during year 2009 in Slovak republic

In this study 2 742 samples were collected and examined in year 2009 and 279 samples (10.18 %) did not comply with microbiological criteria. Coliform bacteria were 136 samples (4.96 %), *E. coli* was present in 84 samples (3.06 %), yeasts and filamentous microscopic fungi were in 45 samples (1.64 %), *Listeria monocytogenes* in 7 samples (0.26 %), *Staphylococcus aureus* in 2 samples (0.07 %), *Salmonella* spp. in 2 samples (0.07 %) and *B. cereus* was detected in 3 samples (0.11 %).

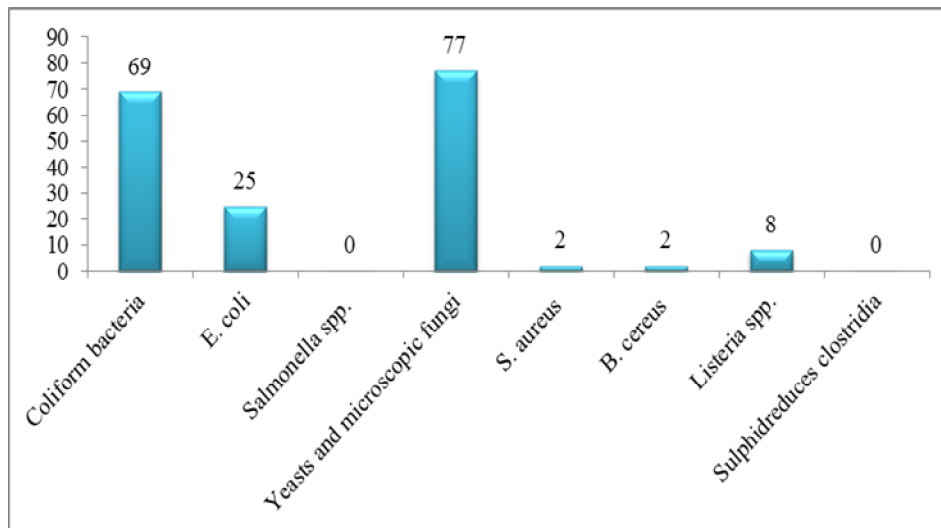


Figure 5 Number of samples which doesn't meet the microbiological limits during year 2010 in Slovak republic

In this study 2 997 samples were collected in year 2010 and 146 samples (4.87 %) did not comply with microbiological criteria because of the increased number of yeast most

often (77 unsuitable samples - 2.57 %), coliform bacteria were in 69 samples (2.30 %) and *E. coli* was in 25 samples (0.83 %), *Listeria monocytogenes* was detected in 8 samples (0.27 %), *Staphylococcus aureus* in 2 samples (0.07 %) and *Bacillus cereus* in 2 samples (0.07 %).

Delicate products from Slovakia had the best microbiological quality in year 2010. Microbial contamination of delicate products from Czech republic was higher in compare with previous year.

Kačániová and Juhaniaková (2011) examined microbiological quality of confectionery products. They examined coliforms bacteria, microscopic filamentous fungi and yeasts, *Salmonella* sp. and staphylococci in confectionery products. For microbiological tests 18 samples of confectionery products were used. Numbers of coliforms bacteria in confectionery products ranged from $<1 \times 10^1$ to 4×10^2 cfu.g⁻¹, the number of microscopic fungi ranged from 0 to $<1 \times 10^1$ cfu.g⁻¹, the number of yeasts from $<1 \times 10^1$ to 5.5×10^2 cfu.g⁻¹, cells of *Salmonella* sp. were not detected and the number of staphylococci was from 0 to $<1 \times 10^1$ cfu.g⁻¹. All investigated samples of confectionery products were in accordance with the Codex Alimentarius of the Slovak Republic.

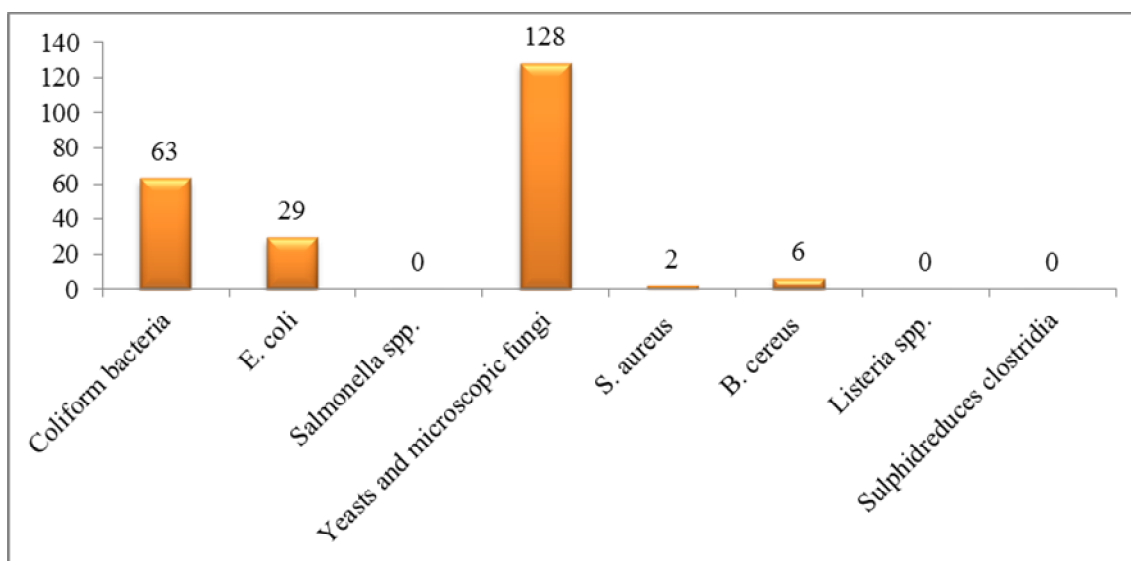


Figure 6 Number of samples which doesn't meet the microbiological limits in year 2011 in Slovak republic

There were examined 2 397 samples in year 2011 and 194 samples (8.09 %) did not comply with microbiological criteria. Number of yeasts and filamentous microscopic fungi were increased in 128 samples (5.34 %). Coliform bacteria were present in 63 samples (2.63

%), *E. coli* in 29 samples (1.21 %). *Bacillus cereus* was detected in 6 samples (0.25 %) and *Staphylococcus aureus* in 2 samples (0.08 %).

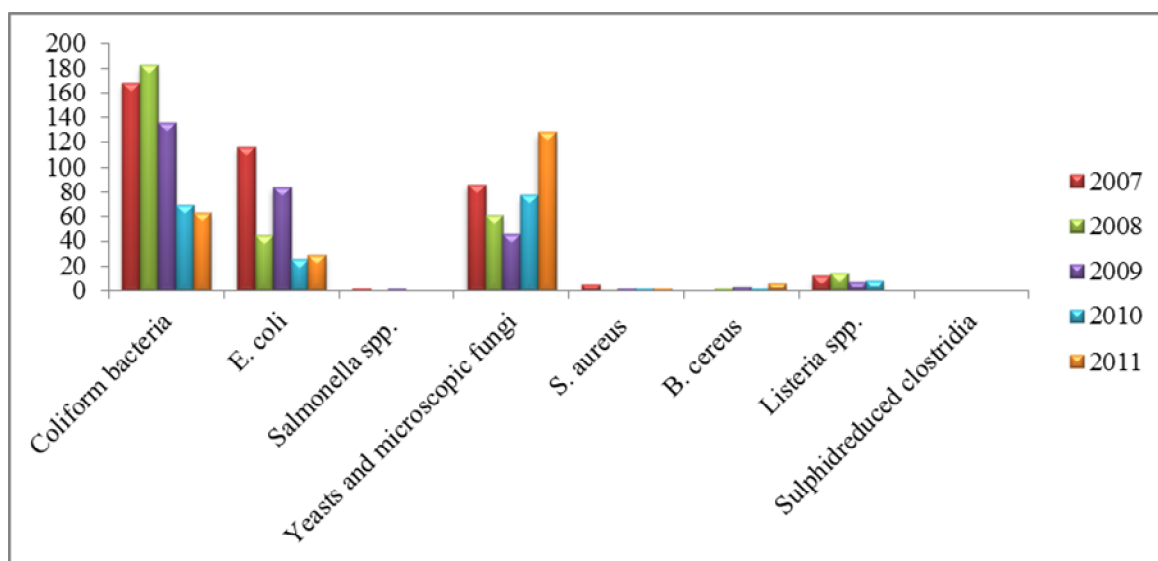


Figure 7 Number of samples which doesn't meet the microbiological limits during years 2007 – 2011

Controlling microbial contamination events when ready-to-eat (RTE) foods are exposed for processing and packaging is a potentially critical factor in managing the public health risks associated with *Listeria monocytogenes*. Because *L. monocytogenes* is inactivated by cooking or pasteurization, contamination of RTE foods after they are prepared is the normal mode of transmission. Because *L. monocytogenes* can grow at refrigeration temperatures, RTE foods that support the growth of pathogenic *L. monocytogenes* during the shelf life of the product are of particular concern. For such foods, both the frequency and the duration of contamination events may be important public health risk determinants (**Powell, 2006**).

Coliform bacteria were the the most establishment of indicators during years 2007 – 2011. The most non-compliant samples were identified in 2008 (168 samples) and at least non-compliant samples were in 2011 (63 samples). *E. coli* was the second significant indicator. The most samples with *E. Coli* were in year 2007 (116 samples) and the best results were in year 2010 (25 contaminated samples). Yeasts and filamentous microscopic fungi were the most detected in year 2011 (128 samples) and least in year 2009 (45 samples). *Listeria monocytogenes* was the most detected in year 2008 (14 samples) and negative result in 2011. *Salmonella* spp., was detected onlz in year 2007 (2 samples) and in 2009 (2 samples). *Bacillus*

cereus was detected in year 2011 (6 samples). *Staphylococcus aureus* was the most detected in year 2007 (5 samples) and at least in year 2008 (1 sample). Sulphidreduces clostridia was detected only in pasteurized products. Only one positive sample was detected in Slovak republic during years 2007 až 2011.

CONCLUSION

Microbiological quality of delicacy products was evaluated during years 2007 - 2011. In this study 14 834 samples were collected and these results were obtained and 13 611 samples (91.75 %) complied with microbiological requirements. The collection of samples was performed in Slovak republic during all seasons of year. The most problematic organisms are coliforms, which indicate poor operational hygiene, and *E. coli*, which indicate poor personal hygiene.

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