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MICROBIOLOGICAL QUALITY OF READY-TO-EAT FOODS PRODUCED IN SLOVAKIA

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ABSTRACT

The purpose of this study was to evaluate the microbiological quality of Ready-To-Eat (RTE) foods produced in Slovakia. A total amount of 144 samples of RTE food were tested during one-year period from January to December, 2014 and the microbiological quality of kebabs (n=30), gyros (n=10), hamburgers (n=54), cheeseburgers (n=5), hot-dogs (n=31), roasts (n=14) was analyzed. The samples were examined for the presence of: coliform bacteria, sulfite-reducing clostridia, yeast, microscopic filamentous fungi and coagulase positive staphylococci according to the ISO standards requirements. In kebab samples the counts of coliforms were from < 10 to $1.6x10^3$ cfu.g^{-1} and incompliance was found in 12/ 30 (40%) of samples. Maximum counts of coliforms and yeasts were exceeded in two and one sample of gyros and isolation range was from 10 to $1.5x10^3$ cfu.g^{-1} $3.2x10^2$ cfu.g^{-1} and from 10 to $1.4x10^2$ cfu.g^{-1}. Also 2/5 (40%) of samples of cheeseburger yielded unsatisfactory coliform counts and the isolation rates were from less than 10 to $1.5x10^3$ cfu.g^{-1}. In hot-dogs, counts of coliforms, yeasts and coagulase positive staphylococci ranged from less than 10 to $1.4x10^3$, < 10 to $2.1x10^3$ cfu.g^{-1} and <10 to $1.4x10^2$ cfu.g^{-1} and number of unsatisfactory samples were 3/31(10), 1/31(3) and 1/31 (3), respectively. In roast, the counts of coliforms, yeasts and microscopic filamentous fungi were from less than 10 to $2.1x10^2$ cfu.g^{-1}, less than 10 to $1.4x10^2$ cfu.g^{-1} and less than 10 to $3.2x10^2$ cfu.g^{-1}, respectively and the safety criteria were not met for 1/14 (7) samples for each of the bacteria group mentioned. Overall, the microbiological criteria set for RTE foods in Slovak Republic were violated in 36/ 144 (25) of samples tested. Results of the present study show that RTE foods might pose public health concerns in Slovakia and more attention on the hygienic practices should no paid.

Keywords: Microbiological quality, kebab, gyros, hamburgers, cheeseburgers, hot-dogs, roasts

INTRODUCTION

Controlling and improving of the quality and safety of chilled foods at all stages of the cold chain have always been among the main concerns in order to reduce food losses and eliminate public health hazards. Changes in microbial and physico-chemical quality of foods may occur during their shelf-life that is linked to storage temperature, as well as to the composition and properties of a product. Meat and processed meat products are ideal media for the growth of spoilage and pathogenic bacteria therefore the quality and safety of meat could change significantly during the shelf-life. Pork meat and Ready-To-Eat (RTE) pork meals are the main type of meat consumed in Europe **(Mataragas *et al.*, 2008; Verbeke *et al.*, 2010).**

RTE food is defined as food that can be consumed immediately at the point of sale without further preparation or treatment. It could be raw, partially or fully cooked, and hot, chilled or frozen **(FEHD, 2007; USFDA, 2009).** RTE food can be of animal and plant origin including fruits, vegetables and bakery products **(USFDA, 2009).** Since RTE foods are consumed without additional treatment, a risk of foodborne disease outbreaks linked to the consumption of RTE food are high if is the food was improperly handled. RTE foods were a source of bacterial foodborne outbreaks and various foodborne pathogens have been found in the RTE products in previous studies **(Castro-Rosas *et al.*, 2012; Seow *et al.*, 2012).** Methods of storage, processing, handling and distribution of RTE products can affect the numbers of microorganisms **(Christison *et al.*, 2008; Fang *et al.*, 2003).**

The catering business provides food and beverages to people and covers all sectors of society such as childcare, schools, hospitals, nursing homes, restaurants, bars, take-away and fast-food outlets **(Garayoa *et al.*, 2011).** This industry has expanded greatly and undergone profound changes in recent years. Many factors have contributed to this including changes in lifestyle, and business, travelling as well as increased purchasing power (**Garayoa *et al.*, 2011).** With globalization, the foodborne diseases (FBDs) have acquired a new dimension, as many food products are produced in one country to be imported and consumed in another **(Martins and Germano, 2008).** The increased international travel, as more affordable, has determined a FBDs globalization **(Käferstein *et al.*, 1997).** Many infectious diseases, including a variety of gastrointestinal disorders, are contracted by individuals while travelling outside their country of residence **(Evans 2006; Ravel *et al.*, 2011).** The World Tourism Organization (WTO), a specialized agency of the United Nations (UN), estimates world tourist arrivals at 940 million in 2010 **(UNWTO, 2011).** The World Health Organization (WHO) reports that up to 30% of individuals in developed countries suffer from food and water related diseases annually **(WHO, 2007).** The European Union (EU) Summary Report on foodborne outbreaks in 2009 indicated a total of 5550 foodborne outbreaks, with 48,964 human cases, 4356 hospitalizations and 46 deaths. The EU's annual report also showed that up to 63.6% of FBDs were associated with foodservice catering **(EFSA, 2011).**

In recent years, several studies **(Almualla *et al.*, 2010; Chapman *et al.*, 2010; Garayoa *et al.*, 2011; Gillespie *et al.*, 2000; Legnani *et al.*, 2004; Marzano and Balzaretti, 2011; Martinez-Tomè *et al.*, 2000; Rodríguez *et al.*, 2011 a, b; Santana *et al.*, 2009; Tessi *et al.*, 2002; Veiros *et al.*, 2009; Yoon *et al.*, 2008)** have been conducted aiming to evaluate the microbiological quality and safety of RTE foods prepared and served by catering business in many sectors of society - schools, hospitals, supermarkets, hotels, long term care facilities, canteens for workers, mass catering establishments, however, knowledge about the microbiological contamination of RTE foods in Slovakia is very limited, therefore the aim of the study was to evaluate the microbiological quality of selected ready-to-eat products. In our study we analyzed the microbiological quality of kebabs, gyros, hamburgers, cheeseburgers, hot - dogs and roasts by detection of coliform bacteria, sulfite-reducing clostridia, yeast, microscopic filamentous fungi and coagulase positive staphylococci.

MATERIAL AND METHODS

Sampling

Samples were obtained from the nearby fast food establishments in the Nitra region –shops, supermarkets and catering enterprises. After sampling, samples were delivered to the Regional Institute of Public Health of Regional Public Health Authority in Nitra accredited laboratory for microbiological testing.
A total amount of 144 samples of RTE food for the period of one year from January to December 2014 was investigated. The samples were kebabs (n=30), gyros (n=10), hamburgers (n=54), cheeseburgers (n=5), hot-dogs (n=31), roasts (n=14) were used in this study. The samples were examined for the presence of the following groups of microorganisms: coliform bacteria, sulfite-reducing clostridia, yeast, microscopic filamentous fungi and coagulase positive staphylococci.

Microbiological analysis

An amount of 5 g of ready-to-eat food was homogenized with 45 mL of sterile peptone saline solution for 1 min in order to obtain the initial dilution. For quantitative detection of microorganisms the ten-fold dilution from 10^{-2} to 10^{-4} were made. After preparation of sample, for detection of the total coliforms the suspension was plated out on Violet Red Bile agar (Merck, Darmstadt, Germany) and incubated at 37 °C for 24 h **(STN EN ISO 4832)**. Detection of coagulase positive staphylococci was done on Baird-Parker egg yolk tellurite agar incubated at 37 °C for 24 h according to **STN ISO EN 6888-1.** For testing of *Clostridium perfringens* **(STN ISO EN 13401)**, suspension was plated onto Tryptose Sulphite Cycloserine agar incubated at 37 °C for 24-48 hour in anaerobically condition. Detection of yeast and microscopic filamentous fungi was undertaken on Dichloran Rose Bengal Chlortetracycline or Dichloran glycerol agar at 25 °C for 5 days **(STN ISO EN 21527 – 2)**. After incubation the bacterial colonies with typical morphology resembling the target microorganisms were selected from each Petri dish and all typical colonies were enumerated. Evaluating of the results have been doing by applicable Codex Alimentary of the Slovak Republic reflected in Table 1 **(CA SR, 2006).**

Table 1 Criteria of production process hygiene for ready-to-eat food

Microorganisms	n	c	m	M
Coliform bacteria	5	2	10^2	$5x10^2$
Sulfite-reducing clostridia	5	2	50	10^2
Yeasts	5	2	10^3	$2x10^4$
Microscopic filamentous fungi	5	2	$2x10^2$	10^3
Coagulase positive staphylococci	5	2	10^2	$5x10^2$

m = minumum number of microorganisms in the sample size „n“, M = maximum number of microorganisms in the specified amount of sample, which allows the maximum number of samples „c“., c = the number of samples from „n“ with values between “m” and “M” of the bacterial counts in other samples do not exceed “m”

RESULTS AND DISCUSSION

Homemade foods are taken as RTE for sale on the street or for the consumption, therefore, are one of the most susceptible to microbial growth in view of the longer length of time between preparation and consumption under improper temperature conditions, besides the unusual step of reheating the foods before consumption. In the case of streetmade foods, the raw materials are usually industrially processed and either prepared in advance or on demand. Environmental conditions faced by the street vendors are an important risk factor to the safety of the food sold. Nevertheless, no difference was found between the microbial counts of home- and street-made samples in **Hanashiro *et al.* (2005)** study. It is presumable that the sanitary and structure conditions are not better at the handlers’ home and neighborhood added to the fact that food handling practices are the same no matter the place **(Hanashiro *et al.*, 2005).**

Table 2 Microbiological quality of kebab samples (n=30)

Microorganisms	Results	No. of unsatisfactory samples /No. of samples (%)
Coliform bacteria	< 10 – $1.6x10^3$ cfu.g^{-1}	12/ 30 (40)
Sulfite-reducing clostridia	< 10 cfu.g^{-1}	0/ 0 (0)
Yeasts	< 10 – $5.0x10^2$ cfu.g^{-1}	0/ 0 (0)
Microscopic filamentous fungi	< 10 – $1.8x10^2$ cfu.g^{-1}	0/ 0 (0)
Coagulase positive staphylococci	< 10 cfu.g^{-1}	0/ 0 (0)

In kebabs, the number of coliform bacteria were in the range from <10 to $1.6x10^3$ cfu.g^{-1} (Table 2) and 12 (40%) samples of kebab did not corresponding with **CA SR 2006**. Numbers of sulfite-reducing clostridia, coagulase positive staphylococci did not exceed 10 cfu.g$^{-1,}$ while the isolation range of yeasts and microscopic and filamentous fungi was from <10 to $5.0x10^2$ cfu.g^{-1} and $1.8x10^2$ cfu.g^{-1}, respectively. These microbiological quality indicators of the samples were with the requirements of Codex Alimentarius of SR **(CA SR, 2006).**
Our results indicate the microbiological quality of the tested samples was better than in previously conducted studies. In 30 samples of kebab in **Agbodaze *et al.*, 2005** research, the mean total plate count (TPC) at Osu was 5.02, Accra Central 4.08 and those from Nima 4.80 $\log_{10}$ CFU/g. The samples from Accra Central shared the highest mean coliform count - 5.12, while the samples from Osu and Nima - 4.41 and 3.70 $\log_{10}$ cfu.g^{-1}, respectively. Accra Central samples again recorded the highest fecal coliforms (4.4 $\log_{10}$ cfu.g^{-1}) as compared to 3.98 and 3.80 log10 cfu.g^{-1} for samples bought from Osu and Nima, respectively. Kebab samples from sites were contaminated with *E. coli*, other Gram-negative bacteria and *Staphylococcus* species, whose virulence factors are yet to be determined.
In study of *Ziino et al. (2013)* the microbiological quality of kebabs retailed in Palermo and Messina was evaluated and 20 raw and 22 cooked kebabs were analysed to determine the aerobic mesophilic bacteria (AMB), *Enterobacteriaceae*, *Escherichia coli*, sulphite reducing anaerobes, coagulase positive staphylococci, micrococci, *Bacillus cereus* and the presence of *Salmonella* spp. and *Listeria monocytogenes*. In raw kebabs, AMB ranged from 4.00 to 7.34 log cfu.g^{-1} and *Enterobacteriaceae* from 1.00 to 7.59 log cfu.g^{-1}. *Escherichia coli* and sulphite reducing anaerobe counts were from <1.00 to 6.18 and 4 log cfu.g^{-1}, respectively. Coagulase positive staphylococci ranged from <1.00 to 3.48 log cfu.g^{-1} and micrococci from <1.00 to 6.00 log cfu.g^{-1}. *Listeria* spp. was found in three raw kebab samples. In cooked kebabs, the AMB values ranged from 1.78 to 6.30 log cfu.g^{-1}, *Enterobacteriaceae* from 1.00 to 4.00 log cfu.g^{-1} and micrococci from <1.00 to 5.30 log cfu.g^{-1}. Three samples were positive for *Escherichia coli* (from 1 to 1.30 log cfu.g^{-1}) and one for sulphite reducing anaerobes (2.00 log cfu.g^{-1}). Coagulase positive staphylococci were found in two samples with loads of 2.30 and 2.78 cfu.g^{-1}, respectively.
Kebab is product, which is frequently to find to be contaminated and also the results of our study in 40% was non satisfactory and the microbiological quality of kebab should be monitored.
In gyros samples the numbers of coliform bacteria was from less to 10 to $1.5x10^3$ cfu.g^{-1}, but the numbers of yeasts was from less than 10 to $1.4x10^2$ cfu.g^{-1} and of fungi from less than 10 to $2x10^2$ cfu.g^{-1}. Counts of yeasts and coagulase positive staphylococci did not exceed 10 cfu.g^{-1} (Table 3).

Table 3 Microbiological quality of gyros samples (n=10)

Microorganisms	Results	No. of unsatisfactory samples /No. of samples (%)
Coliform bacteria	< 10 – $1.5x10^3$ cfu.g^{-1}	2/ 10 (20)
Sulfite-reducing clostridia	< 10 cfu.g^{-1}	0/ 0 (0)
Yeasts	< 10 – $1.4x10^2$ cfu.g^{-1}	1/ 10 (10)
Microscopic filamentous fungi	< 10 – $1.2x10^2$ cfu.g^{-1}	0/ 0 (0)
Coagulase positive staphylococci	< 10 cfu.g^{-1}	0/ 0 (0)

In gyros samples, we found that two samples (2/10/20) did not meet the acceptable value for coliforms bacteria and one samples of gyros (1/10/10) did not corresponding of acceptable value of yeast.
Number of unsatisfactory samples in case of gyros was higher than in case of kebab. The gyros usually is manufactured from the poultry meat and the poultry meat was found to be contaminated with high numbers of bacteria. Bacterial counts (aerobes, *Salmonella* spp., *E. coli*, *C. jejuni*, and *C. coli*) are higher on the breast area of broiler carcasses than on the thigh and drum areas. In addition, some microorganisms particularly *Salmonella* spp. attaches to the poultry skin and is difficult to remove **(Kotula and Davis, 1999)**. A great risk may be occurred by these pathogens, when chicken skin is added to chicken doner kebabs. Thus, some manufactures recommend that the skin using in doner kebabs can be heated to increase chemical and microbiological quality of chicken doner kebabs. Doner kebab as well as gyros are a traditional products. If it is produced properly, there have no any microbiologically serious risk. In general, the microbiological quality of gyros could be improved through implementation of the hazard analysis critical control point (HACCP) concept for the chicken doner kebab and gyros because the incompliance in case of gyros we identified more frequently than in case of kebab.

Table 4 Microbiological quality of hamburger samples (n=54)

Microorganisms	Results	No. of unsatisfactory samples /No. of samples (%)
Coliform bacteria	< 10 – 2.2x10³ cfu.g^{-1}	10/ 54 (19)
Sulfite-reducing clostridia	< 10 cfu.g^{-1}	0/ 0 (0)
Yeasts	< 10 – 8.2x10² cfu.g^{-1}	1/ 54 (2)
Microscopic filamentous fungi	< 10 – 2.0x10² cfu.g^{-1}	0/ 0 (0)
Coagulase positive staphylococci	< 10 cfu.g^{-1}	0/ 0 (0)

In **Min *et al.* (2013)** study an amount of 20 RTE hamburgers sold in Canterbury region were tested for *Listeria monocytogenes*, *Staphylococcus aureus*, coliforms and *Escherichia coli*. Among samples were13 chicken and 7 beef burgers, respectively, which were purchased from five fish and chip shops located in the different areas over period of 4 weeks. Overall, 16 (80%) and 4 (20%) samples were found to be of satisfactory and marginal microbiological quality, respectively. None of the samples tested was in the category of unsatisfactory or potentially hazardous levels of microbial counts. Among the 4 burger samples with marginal microbiological quality two chicken burgers were contaminated with coliforms ($1.50x10^2$ and $2.25x10^2$cfu.g^{-1}), but one chicken and one beef burgers with *S. aureus* ($1.05x10^2$ and $2.30x10^2$cfu.g^{-1}). *E. coli* and *L. monocytogenes* were not detected in any samples. Results indicate that the microbiological quality of burgers sold in different shops in Canterbury was satisfactory

In study of **Dinucci Bezerra *et al.*, 2010** an amount of 105 hamburgers were evaluated for facultative aerobic and/or anaerobic mesophilic bacteria, coliform counts, *Staphylococcus*, *Bacillus cereus*, sulfite-reducing clostridia and *Salmonella* spp. The hamburgers were unsuitable for human consumption in 31.4% of cases because the positive samples for coliforms and *Staphylococcus* were contaminated at unacceptably high levels set by Brazilian standards.

In cheeseburgers, sulfite-reducing clostridia and coagulase positive staphylococci were less than < 10 cfu.g^{-1} but the highest counts were detected for coliforms which were isolated from samples in up to 1.5x10³ cfu.g^{-1} high counts (Table 5).

Table 5 Microbiological quality of cheeseburger samples (n=5)

Microorganisms	Results	No. of unsatisfactory samples /No. of samples (%)
Coliform bacteria	< 10 – 1.5x10³ cfu.g^{-1}	2/5 (40)
Sulfite-reducing clostridia	< 10 cfu.g^{-1}	0/0 (0)
Yeasts	< 10 – 5.0x10² cfu.g^{-1}	0/0 (0)
Microscopic filamentous fungi	< 10 – 1.6x10² cfu.g^{-1}	0/0 (0)
Coagulase positive staphylococci	< 10 cfu.g^{-1}	0/0 (0)

Evaluating the microbiological quality of cheeseburgers, two samples (40%) were not accordance with the requirements of **CA SR 2006.** Cheesburgers and other sandwiches were found to be contaminated in previous studies and studies on the microbiological quality of sandwiches sold on the streets of São Paulo and Rio Grande do Sul showed high levels of contamination by fecal Coliforms **(Lopes, 2005).** These results probably reflect the inappropriate conditions during the preparation of food -dirtiness of the water used for hand washing by the sandwich makers, insufficient hand washing, insufficiently-heated food, and unsuitable conditions of ingredients storage. Therefore, the likelihood of contamination by fecal coliforms in the sandwiches sold on Brazilian roadsides is similar to that which occurs in other countries in Latin America **(Garin*et al.*, 2002).** Results of the present study show that the contamination of cheeseburger samples could be an actual problem for food retailed in Slovakia.

In hot-dogs, the lowest isolation rates were obtained for coliform sulfite-reducing clostridia and microscopic filamentous fungi – less than 10 cfu.g^{-1} and less than 10 to 2.4x10² cfu.g^{-1}, respectively. The highest counts were obtained for coliform bacteria, yeasts and coagulase positive staphylococci (Table 6).

Table 6 Microbiological quality of hot-dog samples (n=31)

Microorganisms	Results	No. of unsatisfactory samples /No. of samples (%)
Coliform bacteria	< 10 – 1.4x10³ cfu.g^{-1}	3/31 (10)
Sulfite-reducing clostridia	< 10 cfu.g^{-1}	0/0 (0)
Yeasts	< 10 – 2.1x10³ cfu.g^{-1}	1/31 (3)
Microscopic filamentous fungi	< 10 – 2.4x10² cfu.g^{-1}	0/0 (0)
Coagulase positive staphylococci	< 10 – 1.4x10² cfu.g^{-1}	1/31 (3)

Among the hot-dog samples three (3/ 31/ 10) shared the counts of coliform bacteria which were not in accordance with the limit set by **CA SR 2006** and the testing results ranged from less than 10 to 1.4x10³ cfu.g^{-1}. Yeasts counts ranged from less tan 10 to 2.1.10³ cfu.g^{-1} and one sample (1/ 31/ 3)had unsatisfactory results. Coagulase positive staphylococci values were from less than 10 to 1.4x10² cfu.g^{-1} and one sample had unsatisfactory results.

Hot-dogs are frequently are found to be contaminated with coliforms and staphylococci and this corresponds to our results **(Kothe *et al.*, 2016).** In **Kothe *et al.*, 2016)** study, 75% of the hot-dogs were contaminated with total coliforms, 30% of them presented fecal coliforms while 25% coagulase-positive staphylococci levels above the maximum limit permitted by Brazilian regulations. Reason for this could ne not adequate hygienic and sanitary conditions of hot-dog vendors in Southern Brazil and this results were based on questionnaire completed for evaluation of sanitary conditions of vendors. Unconformities related to storage of defrosted sausages at environmental temperature or inadequate cooling, absence of thermometer in vendors, usage of non-potable water were described. The lack of cross contamination preventive measures, lack of time and temperature controls and the use of ingredients with unknown origins were also the important factors which could influence the microbiological safety of hot-dogs in Southern Brazil (**Kothe *et al.*, 2016**).

In roasts, counts of sulfite-reducing clostridia and coagulase positive staphylococci were less than 10 cfu.g^{-1}, but coliforms, yeasts and microscopic filamentous fungi ranged from less than 10 to 2.1x10² cfu.g^{-1} , less than 10 to 3.6.x10³ cfu.g^{-1} and less than 10 to 3.2x10² cfu.g$^{-1,}$ respectively (Table 7).

Table 7 Microbiological quality of in roasts (n=14)

Microorganisms	Results	No. of unsatisfactory samples /No. of samples (%)
Coliform bacteria	< 10 – 2.1x10² cfu.g^{-1}	1/14 (7)
Sulfite-reducing clostridia	< 10 cfu.g^{-1}	0/0 (0)
Yeasts	< 10 – 3.6x10³ cfu.g^{-1}	1/14 (7)
Microscopic filamentous fungi	< 10 – 3.2x10² cfu.g^{-1}	1/14 (7)
Coagulase positive staphylococci	< 10 cfu.g^{-1}	0/0 (0)

Regarding conformity with microbiological quality criteria, in roasts in one sample 1/ 14 (7) the counts of coliforms did not meet the critera were set. The counts of yearsts and of microscopic filamentous fungi were unsatisfactory in 1/14 (7) and 1/14 (7) of samples, respectively. The safety of foods is affected by several common factors including the quality of the raw materials, food handling and storage practices. In RTE street vendors the hygiene is mostly affected, that could led to contamination of foods. In most cases, running water is not continuously supplied for hand and dishwashing, cooking or drinking, leading the street vendors to store water under vulnerable conditions subject to contamination. Street foods are exposed to aggravating environmental conditions, such as the presence of insects, rodents, other animals and air pollution studies **(Lucca and Torres, 2002; Sobel *et al.*, 1998).** Furthermore, most food vendors ignore good food handling practices, exposing foods to dangerous conditions such as cross-contamination, unsafe storage and poor time-temperature conditions **(Ekanem, 1998).**

The presence of fecal coliforms (30%) in the samples in the previous study indicates a high risk that other pathogenic organisms have also contaminated the food. *E. coli* was present in 22.5% of the samples, probably from raw vegetables and due to the lack of good hygienic practices. and 70% of tuna and 40% of chicken sandwiches were unsuitable according to the sanitary standards for fecal coliforms in study completed in the northen region of Brazil **(Damsceno and Cardonha, 1999).**

In general, the microbiological criteria set for RTE foods in Slovak Republic were violated in 36/ 144 (25). Mostly, unconformity with the microbiological criteria were observed for kebabs and cheeseburgers – 40% for each, respectively. The lowest amount of unsatisfactory samples were observed among

the hot-dogs were tested – 9.67%. Distribution of unsatisfactory samples of RTE food products produced in Slovak Republic is shown in Figure 1.

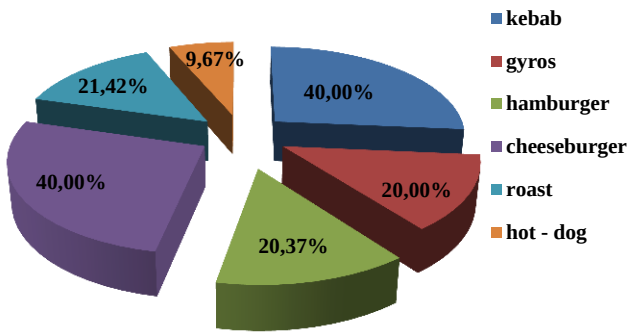

Figure 1 Distribution of unsatisfactory samples (n=36) according to the microbiological criteria set by SR CA, 2006

The results of the present study show that unconformity with the microbiological criteria was faced in 25% of all samples tested, therefore RTE foods produced in Slovakia should considered to pose a possible risk to consumers. The efficient use of HACCP can improved the microbiological safety and quality of these products **(Vazgecer *et al.*, 2004).**

CONCLUSION

Finally, we hope that the systematic microbiological testing of the RTE foods as conducted at the present study could help to assess a risk which poses each RTE product and to define better the control measures needed in order to prevent foodborne infections related to the consumption of RTE foods. This research shows that eating of RTE foods might pose public health concerns even though as there have not been any report of outbreaks related to consumption of RTE foods in Slovakia. However, to ensure the safety and health of their customers, fast-food restaurants should inculcate good hygienic practices and habits in their staff and food processing. The critical control points to preventing food borne illness such as preventing cross – contamination from the raw products to RTE foods, using adequate time and temperatures for cooking, avoiding recontamination after cooking, by surfaces previously contaminated with the raw meat, and properly chilling and storing meat after mincing should be emphasized. Food handlers should also be trained on hygienic food handling practices and safety.

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