

MICROBIOLOGICAL QUALITY OF CAKES AND PASTRIES SOLD IN SKOPJE, MACEDONIA

Angelovski Ljupco, Sekulovski Pavle, Jankuloski Dean,
Ratkova Marija, Kostova Sandra, Prodanov Mirko

*Institute for food safety, Faculty of veterinary medicine,
University of "Ss. Cyril and Methodius",
str. Lazar Pop Trajkov 5, Skopje 1000, Macedonia
e-mail: angelovski@fvm.ukim.edu.mk*

ABSTRACT

*This study investigated the microbiological quality of cakes and pastries sold directly to the consumers in Skopje, Macedonia. Sampling took place in 16 sampling points (bakeries, confectioneries) with total number of 70 samples being investigated. All the samples were tested for *S. aureus*, *Enterobacteriaceae*, aerobic colony count, *E.coli*, *Salmonella* spp. and *Listeria monocytogenes*.*

The samples were tested in the Food microbiology laboratory at the Faculty of veterinary medicine in Skopje using standard methods accredited by the Macedonian Institute for Accreditation.

Results were interpreted according to the Guidelines for the Interpretation of Results of Microbiological Analysis of Some Ready-To-Eat Foods Placed on the Market (HPA, UK).

After the analysis of the results the following data was obtained:

S.aureus: 68.57% (n= 48) of the samples were satisfactory, 31.42% (n=22) were acceptable and 0.0% (n=0) were unsatisfactory;

Enterobacteriaceae: 60.0% (n= 42) of the samples were satisfactory, 40.0% (n=28) were acceptable and 0.0% (n=0) were unsatisfactory;

Aerobic colony count: 51.42% (n= 36) of the samples were satisfactory, 45.71 (n=32) were acceptable and 2.85% (n= 2) were unsatisfactory;

Salmonella spp., Listeria monocytogenes and E.coli: None of these microorganisms were detected in the samples taken.

High levels of ACC, Enterobacteriaceae and S. aureus reflect unsatisfactory hygienic practice during processing of food from source to table. This often indicate contaminated raw materials or unsatisfactory processing and unsuitable time/temperature control during storage. The established level of acceptable and unsatisfactory results highlight the need for targeted inspection and education program in order to address the potential food safety risk from hygienic practice issues.

Key words: pastries, food safety, *S. aureus*, *Enterobacteriaceae*, ACC

INTRODUCTION

“Ready-to-eat food” – food intended by the producer or the manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level microorganisms of concern (1).

RTE foods can support the growth of pathogenic bacteria and therefore high level of hygiene must be maintained through the production process, the raw materials used must be free of microbial hazards and certain temperatures must be kept to minimize the growth of any pathogens that may be present in the food or to prevent the formation of toxins in the food. There is a wide variety of ready-to-eat foods. In this study the microbiological quality of some types of ready-to-eat foods was evaluated. This research was concentrated on cakes, desserts and pastries with fillings and toppings sold directly to the consumers from specialized shops. For the microbiological evaluation of this foodstuffs the “Guidelines for the Interpretation of Results of Microbiological Analysis of Some Ready-To-Eat Foods Placed on the Market” from the UK Health Protection Agency (2) was used.

In this study the following tests on ready-to-eat foods were performed:

- Aerobic colony count, also known as a standard plate count is used as a general indication of the microbiological quality of a food and the result does not differentiate between the natural microflora of a food, spoilage microorganisms, organisms added to fermented foods or pathogenic microorganism. Therefore it can not be used to predict the safety of the product. Depending on the product, a high standard plate count may indicate that the product may have been prepared unhygienically or stored inappropriately.
- Indicator organisms. In this group the tests consisted of detection and enumeration of Enterobacteriaceae and *E. coli*. They are commonly used as an indicator of faecal and cross-contamination. Process failure, poor hygiene and sanitation or post process contamination by equipment, personnel or raw materials are possible causes for the presence of this two indicator organisms.

- Pathogen microorganisms. In this group the tests consisted of detection and enumeration of *S. aureus* and *Listeria monocytogenes* and detection of *Salmonella* spp. Their presence in ready-to-eat foods may be a result of undercooking, poor handling practices and cross contamination. *S. aureus* is commonly associated with the skin, nose and throat of healthy individuals. Under suitable conditions and possible temperature abuse this organism can multiple to dangerous levels. *Listeria monocytogenes* is an important food-borne pathogen which has common occurrence in a variety of foods and the exclusive resistance of the microorganism to low temperatures, low pH and high concentrations of sodium chloride is responsible for its long-time survival in foodstuffs. *Salmonella* species are enteric bacteria and can be found in the intestinal tract of animals but are a major pathogen with a well known history of food poisonings.

MATERIALS AND METHODS

Sampling took place during August, September and October of 2009. A total of 70 samples of cakes, desserts and pastries from 16 sampling points in Skopje, Macedonia were collected for examination. The samples were collected in sterile plastic bags and transported to the laboratory in boxes containing ice. All the samples were processed for microbiological analysis within 6 h of collection. The samples were tested in the Food Microbiology Laboratory at the Faculty of veterinary medicine in Skopje using standard accredited methods. Samples were tested for the presence of *S. aureus*, *Enterobacteriaceae*, aerobic colony count, *E.coli*, *Salmonella* spp. and *Listeria monocytogenes* (3,4,5,6,7,8,9).

RESULTS

Obtained results were interpreted according to the Guidelines for the Interpretation of Results of Microbiological Analysis of Some Ready-To-Eat Foods Placed on the Market (HPA, UK).

After the analysis of the results the following data was obtained:

- *S.aureus*: 68.57% (n= 48) of the samples were satisfactory, 31.42% (n=22) were acceptable and 0.0% (n=0) were unsatisfactory;

- *Enterobacteriaceae*: 60.0% (n= 42) of the samples were satisfactory, 40.0% (n=28) were acceptable and 0.0% (n=0) were unsatisfactory;
- Aerobic colony count: 51.42% (n= 36) of the samples were satisfactory, 45.71 (n=32) were acceptable and 2.85% (n= 2) were unsatisfactory;
- *Salmonella spp.*, *Listeria monocytogenes* and *E.coli*: None of these microorganisms were detected in the samples taken.

suggest non-hygienic handling, poor storage, inadequate general hygiene during processing and/or poor quality raw materials.

Regarding the borderline (acceptable) results obtained for *Enterobacteriaceae* (28 samples - 48.0%) and *S.aureus* (22 samples - 31.42%) it must be pointed that they demand further attention in the future because any deterioration or incident in the production process will allow the transition in the area of unsatisfactory results.

Foods prepared in these shops are at higher risk

Table 1. Categorised results of the analysis and their interpretation

No.	ANALYSED PARAMETER	SATISFACTORY	BORDERLINE	UNSATISFACTORY
1	Aerobic colony count	< 10 ⁵	10 ⁵ - 10 ⁷	> 10 ⁷
		36 samples (51.42%)	32 samples (45.71%)	2 samples (2.85%)
2	<i>Enterobacteriaceae</i>	< 10 ²	10 ² - 10 ⁴	> 10 ⁴
		42 samples (60.0%)	28 samples (48.0%)	0 samples (0.0%)
3	<i>Escherichia coli</i>	< 20 cfu / gr	20 - 10 ²	> 10 ²
		70 samples (100%)	0 samples (0.0%)	0 samples (0.0%)
4	<i>Staphylococcus aureus</i>	< 20 cfu / gr	20 - 10 ⁴	> 10 ⁴
		48 samples (68.57%)	22 samples (31.42%)	0 samples (0.0%)
5	<i>Listeria monocytogenes</i>	< 10 cfu / gr	10 - 10 ²	> 10 ²
		70 samples (100%)	0 samples (0.0%)	0 samples (0.0%)
6	<i>Salmonella spp.</i>	Not detected in 25 gr.	N/A	Detected in 25 gr.
		70 samples (100%)		0 samples (0.0%)

DISCUSSION

This is first time that this kind of survey is undertaken in Republic of Macedonia. The author's idea was to acquire data and to disseminate it correctly, primarily to the food microbiologists, food examiners, public health organizations and local authority enforcement officers.

This study showed that the majority (97.15%) of ready-to-eat foods sampled at specialized shops in Skopje municipality were of satisfactory or acceptable microbiological quality. Only 2 samples (2.85%) were of unsatisfactory quality because of high aerobic colony count. A high aerobic colony count alone does not make food unsafe but it does

of contamination and the factors that can lead to contamination are that this products are:

- handled following cooking, i.e. to ice or fill products;
- made of ingredients that allow growth of bacteria, such as cream, toppings and custard;
- filled using single use piping bags that are re-used;
- often left unrefrigerated for long periods of time;
- manufactured in premises where *Salmonella* contaminated eggs are not properly separated from ready-to-eat products;
- use of non-purpose built premises.

CONCLUSIONS

High levels of aerobic colony count, *Enterobacteriaceae* and *S. aureus* reflect unsatisfactory hygienic practice during processing of food from source to table. This often indicate contaminated raw materials or unsatisfactory processing and unsuitable time/temperature control during storage.

The established level of acceptable and unsatisfactory results highlight the need for targeted inspection and education program in order to address the potential food safety risk from hygienic practice issues.

Also, the surveillance data collected through research papers and targeted analysis can provide information about the food items carrying a high risk of transmitting food-borne pathogens. With this information, education can be carried out through published recommendations and specialized trainings. Furthermore, the accent must be made on the industrial hygiene, the optimal preparation of food items, elimination of the pathogen microorganisms from food and more frequent screening for the microbes.

REFERENCES:

1. European Commission. Regulation (EC) No. 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs. Official Journal of the European Union 2005; L338: 1-26. Available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32005R2073:EN:NOT>
2. Guidelines for the Interpretation of Results of Microbiological Analysis of Some Ready-To-Eat Foods Placed on the Market. Health Protection Agency, United Kingdom (2009)
3. ISO 16649-1:2001 Microbiology of food and animal feeding stuffs -- Horizontal method for the enumeration of beta-glucuronidase-positive *Escherichia coli* -- Part 1: Colony-count technique

at 44 degrees C using membranes and 5-bromo-4-chloro-3-indolyl beta-D-glucuronide.

4. ISO 11290-1:1996 Microbiology of food and animal feeding stuffs -- Horizontal method for the detection and enumeration of *Listeria monocytogenes* -- Part 1: Detection method.
5. ISO 11290-2:1998 Microbiology of food and animal feeding stuffs -- Horizontal method for the detection and enumeration of *Listeria monocytogenes* -- Part 1: Enumeration method.
6. ISO 6888-1:1999 Microbiology of food and animal feeding stuffs -- Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) -- Part 1: Technique using Baird-Parker agar medium.
7. ISO 6579:2002 Microbiology of food and animal feeding stuffs -- Horizontal method for the detection of *Salmonella* spp.
8. ISO 21528-2:2004 Microbiology of food and animal feeding stuffs -- Horizontal methods for the detection and enumeration of *Enterobacteriaceae* -- Part 2: Colony-count method.
9. ISO 4833:2003 Microbiology of food and animal feeding stuffs -- Horizontal method for the enumeration of microorganisms -- Colony-count technique at 30 degrees C.
10. Sweet Baked Goods, A survey of the microbiological quality of sweet baked goods. Department of Health, Government of South Australia (2007).
11. Microbiological quality of unrefrigerated desserts. ACT Health protection service. Report prepared by Geoff Millard (1999).
12. Survey of Restaurant Desserts. Scottish Food Enforcement Liaison Group. Report of the Food Quality Sub Committee (2003).