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MICROBIOLOGICAL ANALYSIS OF DIFFERENT CONFECTIONERY PRODUCTS

Ľubomíra Juhaniaková[1], Jana Petrová[1], Lukáš Hleba[1], Simona Kunová[2], Alica Bobková[2], Miroslava Kačániová[*1]*

Address(es): prof. Ing. Miroslava Kačániová PhD.,
[1]Department of Microbiology, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, Slovak Republic.
[2]Department of Food Hygiene and Safety, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 949 76 Nitra, Slovakia.

*Corresponding author: Miroslava.Kacaniova@gmail.com

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ABSTRACT

The purpose of this work was to determine microbiological quality and water activity of confectionery products as coconut balls. In confectionery products microbiological parameters: total count of bacteria, coliforms bacteria, mesophilic aerobic bacteria, yeasts, microscopic filamentous fungi, counts of *Staphylococcus aureus* and *Salmonella* spp. were observed. For microbiological tests 10 samples of coconut balls were used. The total count of bacteria in coconut ball samples ranged from 3.00 to 3.74 log CFU.g^{-1}, the number of mesophilic aerobic bacteria ranged from 2.00 to 2.95 log CFU.g^{-1}, the number of coliforms bacteria ranged from 2.00 to 2.70 log CFU.g^{-1}, the number of microscopic filamentous fungi ranged from 2.00 to 2.60 log CFU.g^{-1}. From microscopic fungi was isolated genera *Penicillium*. Zero numbers of yeasts and staphylococci and the absence of cells *Salmonella* sp. were found in this samples. Not all samples of coconut ball samples from private production were accordance with Codex Alimentarius of the Slovak Republic. The Codex Alimentarius of Slovak republic just indicates number of coliforms bacteria (10^3) and microscopic fungi (10^2). Only three samples were accordance with CA, SR in number of microscopic filamentous fungi. The water activity in samples ranged from 0.821 to 0.885.

Keywords: microbiological quality, bacteria, microscopic filamentous fungi, coconut balls

INTRODUCTION

Due to the magnitude of the risk, it is critical to differentiate quality and safety. There are programs that help control each of them and microbiology is key to both. Quality control traditionally measures to certain parameters and rejects what is out of specification. Those parameters have a relationship to safety but are not the prime focus. Safety control is accomplished by identifying and controlling hazards so as not to introduce those hazards into food and thus a dangerous product into the food system. Traditional quality systems tend to be more reactive while modern safety programs are more proactive. Poor quality will eventually lead to reduced sales and then to business failure. However, poor safety procedures can lead to injured or dead consumers. Some manufacturers will compromise on quality in an effort to increase short-term profit, but compromising on safety can be deadly (**Galloway, 2010**). Spoilage problems are primarily of economic concern, since these organisms do not produce food poisoning (**Horská, 2012; Nagy et al., 2012**). Confectionery products are typically made of sugars (sucrose, glucose, fructose, etc.) and water. These components are combined with some interfering or texturing agents, such as cocoa, fat, milk solids, or syrups. Candy begins with water being supersaturated with solute, usually sucrose. The variations between different types of confectionery depend mainly upon the moisture content and sugar type (**Fontana, 2011**).
In sugar confectionery sugar prevents deterioration of microbiological parameters, which could be caused by bacteria, yeasts or molds. Reducing the amount of sugar in the product we should follow the validity of indicators. Traditionally, sugar confectionery products are considered as microbiologically stable and safe to use due to the inherent low water activity. Such sugar confectionery products as marmalades realization term limits the changes of the quality, which primarily due to changes in its structure, because it could be related to the crystallization of sugar and water activity changes and moisture loss during storage (**Kronberga et al., 2013**).
The production of cocoa powder, chocolate and part of the confectionery products is a dry operation which does not destroy *Salmonella* or other vegetative organisms. Therefore, the quality of the raw materials used during manufacturing is very important and will determine the quality of finished products. Simple visual checks at reception are useful tools to guarantee raw materials of good quality. Presence of condensation in containers or of spoiled packaging material represents a risk (**Cordier, 1994**).
The aspects of taste and health of foods, particularly desserts, are to be considered in an equal line, and should be improved and clarified for the consumers (**Cayot, 2007**). People are being more concerned about dessert consumption along with their consciousness on health and physical appearance, due to rapid change in popular life style and eating habits. The main problem observed during storage and exportation possibility of dessert is the microbiological deterioration due to the increase in water activity. The manufacturing process requires a concise understanding of a number of factors, including the knowledge of possible hazards, their occurrence and management in final product, control of water activity during prescribed shelf life, and possible applicability of edible coatings which display effective barrier properties (**Akpinar Bayizit et al., 2010**).
The purpose of this study was examining the microbiological quality and water activity of confectionary products sold at Slovakian private bakery a view to assessing their microbiological fitness for human consumption. In confectionery products microbiological parameters: total count of bacteria, coliforms bacteria, mesophilic aerobic bacteria, yeasts, microscopic filamentous fungi, count of *Staphylococcus aureus*, *Salmonella* spp. and water activity were observed.

MATERIAL AND METHODS

Collection of confectionery samples

The samples of confectionery products were collected from Slovak private production. For microbiological tests together 10 samples of confectionery products were used before expiration date.

Determination of CFU counts

For microbiological analysis the confectionary samples were processed immediately after collection. The total count of bacteria (TCB), mesophilic aerobic bacteria (MAB), coliforms bacteria (CB), yeasts (Y), microscopic filamentous fungi (MF), *Staphylococcus aureus* (SA) and *Salmonella* spp. (SS) were observed. Plate diluting method was applied for quantitative CFU (Colony Forming Units) counts determination of respective groups of microorganisms in 1 g of confectionery products. Petri dishes of gelatinous nutritive substrate were inoculated with 1 mL of confectionery samples (TCB, MAB, CB, Y, MF, SA, SS) in three replications. Homogenized samples of confectionery components were prepared in advance by sequential diluting based on decimal dilution system application. For microorganism cultivation six types of cultivating mediums were used, to segregate individual microorganism groups. Plate count agar was used for CFU segregation of TCB (incubation 48-72 h at 30 °C, aerobic cultivation method). Meat peptone agar was used for CFU segregation of MAB (incubation 48-72 h at 25 °C, aerobic cultivation method). Violet red bile agar was used for CFU segregation of CB (incubation 24 h at 37 °C, aerobic cultivation method). Chloramfenicol yeast glucose agar was used for CFU segregation of Y and MF (incubation 5-7 days at 25 °C, aerobic cultivation method). XLD agar was used for CFU segregation of SS (incubation 18-24 hour at 37 °C, aerobic cultivation method) and Baird Parker agar was used for *Staphylococcus aureus* segregation of SA (incubation 45-48 hour at 35-37 °C, aerobic cultivation method). Cultivating medium composition corresponded to producer introductions (Biomark™, Pune, India). Basic dilution (10^{-1}) was prepared as follows: 5 g of confectionery components was added to the bank containing 45 mL of distilled water. The cells were separated from substrate in shaking machine (30 minutes). Prepared basic substance was diluted to reduce the content of microorganisms below 300 CFU level.

RESULTS AND DISCUSSION

The total count of bacteria (fig. 1) in coconut ball samples ranged from 3.00 to 3.74 log CFU.g^{-1}. The number of mesophilic aerobic bacteria (fig. 2) in coconut ball samples ranged from 2.00 to 2.95 log CFU.g^{-1}. The number of coliforms bacteria (fig. 3) in coconut ball samples ranged from 2.00 to 2.70 log CFU.g^{-1}. The number of microscopic filamentous fungi (fig. 4) in coconut ball samples ranged from 2.00 to 2.60 log CFU.g^{-1}. Zero numbers of yeasts and staphylococci and the absence of cells *Salmonella* sp. were found in this samples. Not all coconut ball samples from private production were in accordance with Codex Alimentarius of the Slovak Republic **(CA SR, 2009)**. The Codex Alimentarius of Slovak republic just indicates number of coliforms bacteria (10^3) and microscopic fungi (10^2). Only three samples were in accordance with CA, SR in number of microscopic filamentous fungi.
The confectionery products in the study **Juhaniakova et al. (2013)** were evaluated: Kremeš and Venček cake. For microbiological tests 20 samples of confectionery products were used. The numbers of total count of bacteria ranged from 3.00 to 3.84 log CFU.g^{-1}, the number of mesophilic aerobic bacteria ranged from 1.86 to 2.85 log CFU.g^{-1}, coliforms bacteria in confectionery products ranged from 0 to 2.06 CFU.g^{-1} and the number of microscopic fungi ranged from 1.13 to 1.96 CFU.g^{-1}. The samples of cake from private production showed better microbiological quality as samples from market production. All investigated samples of confectionery products were in accordance with the Codex Alimentarius of the Slovak Republic. The control of raw materials, processing and environment are critical factors in the prevention of microbial contamination in confectionery. Salmonella has been found to be the major hazard in confectionery. Testing for this organism at specific control points provides the best means of quality control. Constant surveillance and good manufacturing practice are the best methods for prevention of contamination (**Kačániová and Juhaniaková, 2011**).

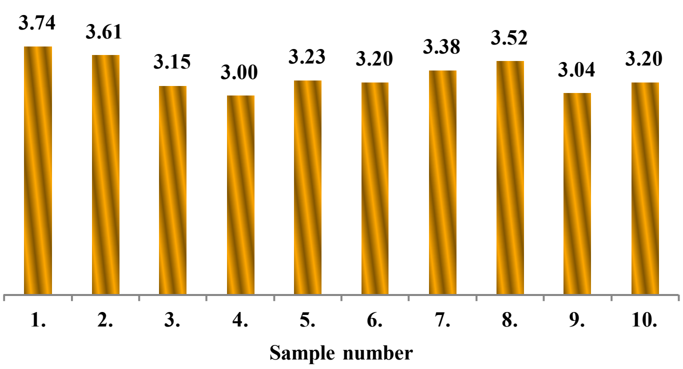

Figure 1 Total count of bacteria in coconut ball samples (log CFU.g^{-1})

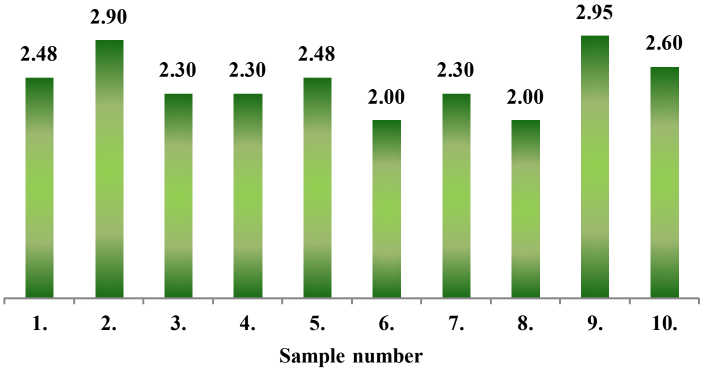

Figure 2 Number of mesophilic aerobic bacteria in coconut ball samples (log CFU.g^{-1})

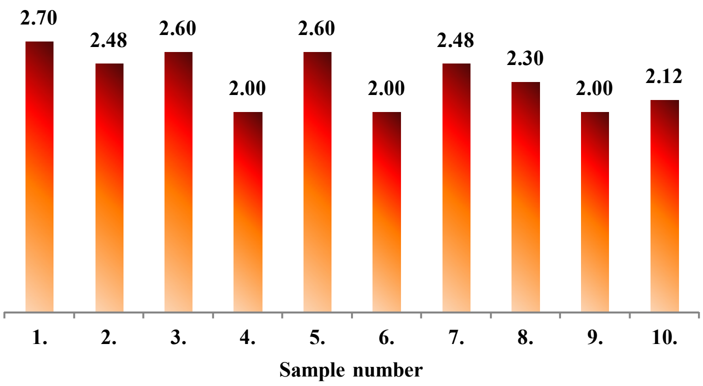

Figure 3 Number of coliforms bacteria in coconut ball samples (log CFU.g^{-1})

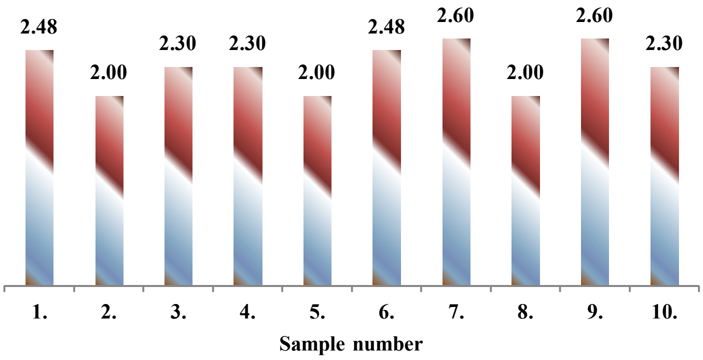

Figure 4 Number of microscopic filamentous fungi in coconut ball samples (log CFU.g^{-1})

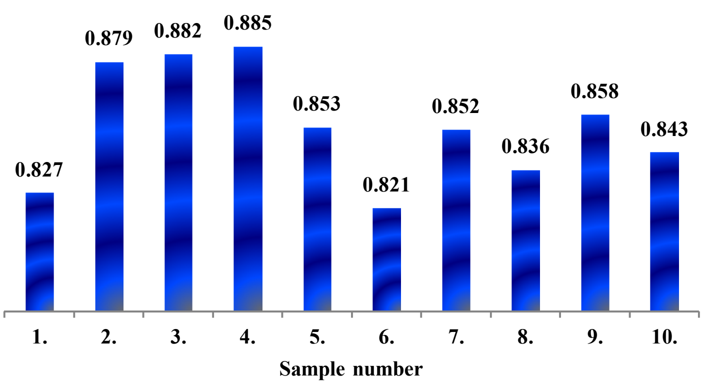

Figure 5 Water activity in coconut ball samples

The water activity (fig. 5) in samples ranged from 0.821 to 0.885. Water is important during the manufacturing of confections, is an important factor in governing texture and is often the limiting parameter during storage that controls shelf life. Thus, an understanding of water relations in confections is critical to controlling quality. Water content, which is controlled during candy manufacturing through an understanding of boiling point elevation, is one of the most important parameters that governs the texture of candies. For example, the texture of caramel progresses from soft and runny to hard and brittle as the moisture content decreases. However, knowledge of water content by itself is insufficient to controlling stability and shelf life. Understanding water activity or the ratio of vapor pressures, is necessary to control shelf life. A difference in water activity, either between candy and air or between two domains within the candy, is the driving force for moisture migration in confections. When the difference in water activity is large, moisture migration is rapid, although the rate of moisture migration depends on the nature of resistances to water diffusion. Barrier packaging films protect the candy from air whereas edible films inhibit moisture migration between different moisture domains within a confection. More recently, the concept of glass transition or the polymer science approach, has supplemented water activity as a critical parameter related to candy stability. Confections with low moisture content, such as hard candy, cotton candy and some caramels and toffees, may contain sugars in the amorphous or glassy state. As long as these products remain below their glass transition temperature, they remain stable for very long times. However, certain glassy sugars tend to be hygroscopic, rapidly picking up moisture from the air, which causes significant changes that lead to the end of shelf life. These products need to be protected from moisture uptake during storage (**Ergun et al., 2010**).

CONCLUSION

Water is one of the most important ingredients in confectionary product making. We usually take water for granted and do not completely understand its function in confectionery products. We commonly know the quantity of water in a product, but we need to better understand its form and location to really grasp its function. To better understand the function of water in confectionary products we can use water activity as an analytical tool. This tool can help us control microbiological quality texture, appearance, flavor and keeping quality in our finished products. As the title indicates, this paper will focus on the importance of water activity in confectionary products making in private production.

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