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EVALUATION OF BACTERIAL AND FUNGAL CONTAMITATION OF COMMERICALLY PRODUCED CAKE IN URMIA, NORTHWEST OF IRAN

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ABSTRACT: Disease caused by consumption of contaminated food always has been a problem around the world and annual expenses spent on improving these conditions. Cake because of ingredients has great potential to be contaminated with many types of microbes. The purpose of this study is to determine microbial contamination of the cake is produced in Urmia. 200 cakes were prepared randomization from commercial cake factories in Urmia city and according to national standards survey was performed rate and type of bacterial and fungal infection. The study revealed 100% of samples were contaminated with mold and yeast but the infection was allowed and standard. Fortunately, 100% samples abut bacteria, Entrobacteria, Staphylococcus aureus, positive coagulase, Escherichia coli and salmonella were negative. Training and supervision on the process of health production and better maintenance and package commercial cake is essential for health community.

Keywords: Cake, Bacterial and fungal infection, Food poisoning, Urmia, Iran.

INTRODUCTION:

Cakes are important bakery products. Their worldwide market currently grows with about 1.5% a year. Challenges in the cake market include cost reduction, increased shelf life and quality control (ISIRI, 2014).

Sweetened products are said that the original compositions are flour (wheat, rice, or a mixture of them), oil and sugar. And may they are supplied as sweets or semi-arid and dry sweets (ISIRI, 2014).

Sweet or confectionary products comprise a major part of Iran's productive country food that will supply the industrial and trade production. Due to the high consumption of these products is necessary for control of microbial health and industry applied in terms raise both quality and keeping the shelf products (ISIRI, 2014). According to differences in composition, production conditions and maintenance, these products can be divided in two groups, sweets and confectionary products. Microbial contamination of sweets and confectionary depend on products ingredients, production methods, environmental and preservation conditions. Sweets that applied heat in process contained few heat resistant spores. Some of confectionary products because of more water in their composition than other types are exposed microbial contamination particularly fungi. These products can be spoiled by mold and yeast lipase resulting by microorganism activity instances available at the higher humidity during storage (ISIRI, 2014).

According to the world health organization, food borne illnesses is one of the most common nutritional problems in the world (Foodborne illness, 2002).

Nowadays food borne illnesses (FBDs) is one of the biggest concern causes in the world. So far, 250 FBDs have been defined. FBDs cause 76 million illnesses in a year that led 325 thousand hospitalizations and 5200 deaths each year in the world (Le *et al*., 2003).

According to reports by international organizations currently diseases caused by ingestion of contaminated food is one of the most important problems of human societies, especially in developing and held back countries that is caused reduces human development and productivity of these nations. As well as access to healthy and adequate food as food security is human inalienable rights and must be addressed them as main priority (CDC, 1990 and Todd, 1996).

Figures shows that infectious disease still causes 45% of deaths in poor countries and it cause half of early deaths worldwide. Other symptoms particularly diarrhea, dehydrated and acid and alkaline imbalance are the factors that can lead to death in these diseases (Loir *et al*., 2003).

Confectionary products (sweets) form an important part of a balanced diet. The products due to form by eggs and milk nutrients, is a suitable vector for microbes and bacteria (Smith et al., 2004). Spoilage of bakery and confectionary products are three types that include microbial spoilage, physical and chemical spoilage. Microbial spoilage has importance in terms of health and economic matters time during storage confectionary products cause outbreaks of food poisoning (Smith *et al*., 2004)

Bacteria are the most important food contaminants. Mold and yeast are also other factors of food contaminants (Razavilar, 2008).When food becomes contaminated with fungi, these fungus are due to effect on food constituent nutrients, leave behind secondary metabolites called mycotoxins that if toxins are received by living things are induced an extreme and harmful effects such as carcinogenesis, malformations, growth retardation, immune suppression and

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mutagenesis in organisms. Mycotoxins are a group of relatively resistant toxin metabolites that produced by fungi and secondary metabolic path ways of fungal cells and cause food contaminate and possibly environment (Haidary Nia, 2006; Tajic Ahmadi, 2006; Kazemi *et al.*, 2004; Jafari et al., 2006).

According to the cake ingredients and high potential contamination of these nutrients to the microbes and fungi and thereby increase the risk of food poisoning, this study were aimed to determine the prevalence of performed commercial cake factory during the years 1389 to 1393 in urmia of , Entrobacteria, *Staphylococcus aureus*, positive coagulase, salmonella, mold and yeast.

MATERIALS AND METHODS:

Sampling

Sampling was conducted over four years (2010-2013) and during this period, 200 samples were collected for bacterial and fungal tests and were submitted to laboratory.

Mold and yeast enumeration

Mold colony count was done by standard method for counting 1 and 2-10899(LQS-W505112,127) 5gr of confectionary products is mixed with 45 mg Lingers solution and 0-1 sample diluted was mixed. 0-1 ml of the resulting suspension on to agar plates containing DG18 is placed and will be 18-24 hours at 30°C and bacterial colonies will be calculated using the following formula (ISIRI, 2013).

$$N = \sum a / v(n1 + 0.1n2)d$$

In this formula:

$\sum a$: The total number of mold and yeast colonies on selective plates

V: The total fertility per page per ml

N1: Early count selective dilution plate

N2:Second count selective dilution plate

D: Dilution factor according to the selected dilution

Coagulase positive Staphylococcus aureus counting

For enumeration of Staphylococcus aureus (coagulase positive) Iranian National Standard No.6806 was used, If black colonies observed, the sample test will be positive (ISIRI, 2012).

Escherichia coli counting

1 cc of sterile sample was poured and added to laurel sulfate tryptose medium. Then, it was incubated at 37°C. If gas was formed, the sample was reported as negative; and if the gas will be considered, its report was positive. From positive gas samples were taken and added to the second tube. One was added to peptone water tube and incubated at 44ºC and for another tube and other tube to the EC broth. On the third day, if the EC broth was positive of it to pepton water medium is added. Ultimately of the tube shall be counted.

Entrobacter Counting

5gr of cake sample was weighted and added to 45 ml Ringer and after 10 min, the supernatant is used as a dilution of 0.1(ISIRI, 2011)

0.1 ml solution of 0.1dilution was removed and transferred to the medium plate till be inoculated plates and two-thirds VRBDA (bile in red, purple) to be in good condition, after spreading layer and inverse of incubation at 37°C to be for 1-2 days, If you see pink colonies, the colonies are entrobactria and will be used in oxide test (negative) and positive coagulase colonies.

For counting: Colonies were counted and multiplied by the dilution factor. The number is reported based on food amount. (ISIRI, 2010)

Salmonella counting

5gr cake samples was added to 45 CC sterile peptone water and incubated at 37°C. Incubation period was done for 1-2 days. Then, 0.1 ml of each medium were transferred to peptone water and 1mL be added tube containing Tetratiosyanat and incubated 1-2 days. then, 0.1 ml of solution will be cultivated linearly on shigella salmonella agar and be incubated for 1-2 days at 37^{oC} (ISIRI, 2009)

Observing pink to red colonies are suspected salmonella and confirmatory tests are necessary.

RESULTS:

In this study, obtained results showed that 100% of samples were contaminated with mold and yeast but contamination was allowed and standard. Fortunately, 100% of samples were negative for entrobactria, coagulase positive Staphylococcus aureus, E.coli and salmonella bacteria. Therefore, 100% of tested samples were expendable.

Information about the number of samples and contamination level for entrobactria, coagulase positive Staphylococcus aureus, E.coli and salmonella mold and yeast are given in table 1.

As well as additional information about result of bacterial and fungal tests and acceptable and unacceptable items of tests are specified in table 1.

Table 1.

Microbial quality of 200 samples of Cakes produced in commercial cake factories of Urmia city, northwest of Iran.

Sample size	Microbial tests	Numeration	Standard range	Resullt Acceeptable/ unacceptable
200	Entrobacter counting	0	<100	Acceptable
	Coagulase-positive Staphylococcus aureus counting	0	Negative	
	Escherichia coli counting	0	Negative	
	Salmonella counting	0	Negative	
	Mold counting	<10	<100	
	Yeast counting	<10	<100	

DISCUSSION:

Cakes because of their ingredients are a suitable environment for growth and proliferation of microorganisms and microbial agents transmitted infection or food poisoning to consumers. The results of our study, unlike other studies in different parts of the world show the low risk of microbial contamination and their transmission to consumers. The study of Soltandelal and his colleagues showed that contamination of fresh dough to molds, yeasts, Enterobacteriaceae, Bacillus and Staphylococcus differ from 50 to 83%, respectively (Soltandelal *et al*., 2010). Enterobacteriaceae and yeast infections are the most common. The samples were contaminated with other bacteria, in the way that 100% of samples were infected to more than one type of microorganisms (Soltandelal *et al*., 2010)

Result of study by Nickniaz showed that 48.8% of cookies are contaminated by *Escherichia coli*, 8-38% by coli form, 31.2% by staphylococcus and 70% by yeasts. In other study by khezri cookies were contaminated in the rate of 26%, 69% respectively .In current study cakes samples were free from contamination by *Escherichia coli* and *Staphylococcus* (Nikniaz *et al*., 2011).

According to the annual report of Centers for Disease Control (CDC) *Escherichia coli* caused 2,000 hospitalizations and 60 deaths in the United States is. *Escherichia coli* is an indicator of fecal contamination in food (Khezri *et al*., 2007; Josefa *et al*., 2005; Fraser and Vestohovof, 2000). In this study we did not find any reports of major infection of *Escherichia coli* that shows hygienic water and sanitation processes used in factories.

Mold spoilage is a serious and costly problem for bakeries; spoilage of bakery products is caused mainly by molds and yeasts. However, consumers today are not in favor of additives as preservatives and an urge to reduce the quantities used exists within the bakery industry (Desai and Kamat, 1998; Fazara *et al*., 2005; Seiler *et al*., 1989). Mold spores are killed in the baking process (Knight and Menlove, 1961), leaving after contamination to be the source of spoilage problems (Wilderjans *et al*., 2013; Membre *et al*., 2001).

There is several ways to control contamination and food spoilage that include awareness of workers, packaging, suitable ventilation and usage of preservatives. Personal hygiene and good manufacturing practice (GMP) are two important and effective factors in microbial contamination of foods. Poor personal hygiene of workers involved in food preparation and lack of or failure to use proper hand washing detergent in washing their hands also contact with the mouth, nose, and hair during food preparations have an important role in the transmission of bacteria, such as *Staphylococcus aureus* or *Ecshershia coli* (Gerba *et al*., 1996).

Cross contamination is one of the reasons for contamination of cakes by molds. Most of the contaminated factors are destroyed in process because of high temperature of cooking process, so Probably one of the reasons being cake samples free from contamination or in accepted levels in our factory were the worker's personal hygiene. In addition to the importance of personal hygiene, additional activities to promote health and quality level of these products and improve them to global standards and excellent sanitary process must be done (Azadzadeh *et al*., 2014; Teymori *et al*., 2014; Haghighat-Afshar *et al*., 2014; Teymori *et al*., 2014; Kheiri *et al*., 2014; Forouzan *et al*., 2014).

Aflatoxin contamination can occur as a result of improper maintenance and storage of raw plant materials (Hon *et al*., 2011). In this study, 100% of the samples had fungal contamination, which were in standard Range. Therefore, it can be stated that contamination occurred due to undesirable storage conditions.

CONCLUSION:

For prevention of this contaminations all personnel and workers of factory should have safety cards, wash their hands, disinfect their shoes before entrance to production line, and all standards of good hygienic production should be performed. Quality control of using water is another important factor contamination control.

It seems that control of primary food contaminants, increasing the knowledge of workers and dealers in the field of hygienic matters are the effective way to promote hygienic levels of products.

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