Original Article

Effective factors on the growth of E. coli, mold and yeast on creamy sweets

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Abstract

Background: Acute poisoning is caused by consumption of food contaminated with bacteria and mold toxins. More than 70% of human diseases are resulted from contaminated food. Therefore, the aim of this study was to determine the effective factors on the growth of E. coli, mold and yeast on creamy sweets.

Methods: In this cross-sectional study, 129 different creamy sweets were randomly taken from Pastry shop in the city in the months of summer and winter under sterile conditions. The samples were analyzed to determine the Escherichia coli, yeast and mold according to 437 and 997 national standard tests. The data were analyzed using SPSS, ANOVA, T-test and Fisher.

Results: In fact, 17 (13.2%) cases of 129 samples were healthy and 112 (86.8%) had at least one type of contamination including E. coli or yeast or mold. Totally, 48.8% and 51.2% samples were taken in the months of summer and winter, respectively. There was a significant relationship between the growth of yeast and temperature (p>0.001), and between E. coli contamination and temperature (p=0.001). In addition, the type of contamination depended on the location of sampling (p=0.031).

Conclusion: The mold and yeast contamination was higher in summer and E. coli contamination was higher in winter. Since the dairy products are the sources of mold and yeast growth, especially in warm season, so the temperature must be under control to reduce the levels of contamination in dairy products, especially sweets and cream.

Keywords: Escherichia coli, Yeast, Mold, Creamy sweet, Contamination.

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Diseases and food poisoning induced by the consumption of contaminated foods are one of the problems in all over the world.

The consumption of food contaminated with bacteria or molds is followed by serious poisoning. Therefore, many costs are spent on curing these diseases every year (1-2). More than 450 types of viral, parasitic, fungal and bacterial diseases can be transmitted to human through the animal food origins (3).

According to the CDC in the United States, 76 million Americans suffer from these diseases annually and 325,000 of them were hospitalized, and 5,200 of them died. Only their medical costs are 6.5-34.9 billion dollars every year. The World Health Organization estimates that the actual cases of diseases caused by food contamination are more than 300-350 (4).

Unfortunately, there is no comprehensive information in Iran on patients who suffer from the diseases related to contaminated food (5). More than 70 % of human diseases are caused by contaminated foods (6-7). Creamy sweet is one of the most popular sweets among households. The families are concerned about the health of these sweets because these are the suitable environment for different kinds of poisonous germs and even their contaminations are often very high (8).

This kind of research is extremely important to consider the fact that one of the main functions of health authorities is to maintain the health of society, and one aspect of health is eating healthy foods.

The purpose of this study was to determine the germ amount of consumed creamy sweets (in terms of Escherichia coli, mold and yeast) and compare them with national standards of Iran.

Methods

In this cross-sectional study, 31 samples were randomly selected from the confectionery and pastry shop in the months of summer and winter. Totally, 129 samples were randomly taken from pastry shops and these samples contained several types of sweets of creamy sweets such as profiteroles, roulette and other creamy sweets in sterile condition by considering the storage temperature in inside and outside of refrigerators. The samples were sent to the food control laboratory of Babol University of Medical Sciences. In addition, Iran National Standard tests (9263, 997) were used to determine the Escherichia coli, yeast and mold, respectively (9). The standard of Escherichia coli in creamy sweets was negative, that of mold and yeast was 300 and 1000 CFU/g, respectively.

Then the results were compared with national standards of Iran. The data were analyzed using SPSS, ANOVA, t-test and fisher tests.

Results

Among the total number of 129 samples, 17 samples (13.2%) were healthy and 112 cases (86.8%) had at least one type of contamination. It should be noted that 61 (96.83%) of 63 samples collected in the months of summer had at least one type of contamination (E. coli or yeast or mold), and 2 (3.17 %) cases had no contamination and were healthy. Moreover, 51 (77.27%) of 66 samples which were collected in the months of winter had at least one contamination and 15 ones (22.73 %) were healthy (Table 1).

As shown in Table 2, there is a relationship between the type of contamination and type of sweets. Of course, all 10 samples of other creamy sweets were contaminated with mold and yeast, and there was no healthy sample. Table 3 indicates that there is a relationship between types of sweet contamination in different sampling places.

In addition, the contamination types of samples are illustrated in Table 4. Finally, the results were consistent with the national standards of Iran.

Table 1. Number of samples and sweet contamination based on the seasons

Sampling Time	Number of Samples	Contaminated Samples	Sweet without Contamination	Mold and Yeast	E. Coli	P Value
Summer	63	61 (96.83%)	2 (3.17%)	53 (86.9%)	8 (13.1%)	0.001<
Winter	66	51 (77.27%)	15 (22.73%)	36 (70.6%)	15 (29.4%)	0.001<
Total	129	112 (86.8%)	17 (13.17%)	89 (68.99%)	23 (17.83%)	

Table 2. Types of contamination based on the types of sweets

Types of Contamination / Types of Sweet	Sweet without Contamination	Mold and Yeast	E. Coli	Total	P Value
Profiterole	9 (16.36%)	36 (65.45%)	10 (18.18%)	55	0.25
Roulette	8 (12.5%)	43 (67.2%)	13 (20.3%)	64	0.25
Other creamy sweets	0 (0%)	10 (100%)	0 (0%)	10	

Table 3. Types of contamination in different sampling places

Contamination Type / Sampling location	Sweet Without Contamination	Mold and Yeast	E. Coli	Total	P Value
Confectionary	8 (10.66%)	52 (69.33%)	15 (65.2%)	75 (85.14%)	0.031
Pastry shop	9 (19.1%)	34 (72.3%)	4 (8.5%)	47 (36.43%)	0.031
Juice and ice-cream bar	0 (0%)	3 (49.2%)	4 (57.1%)	7 (5.43%)	

Table 4. Contamination types of samples

Contamination Types	N	%
No contamination	17	13.3
Yeast	84	65.1
Mold	1	0.8
Escherichia	2	1.6
Yeast and mold	4	3.1
Escherichia and yeast	18	14.1
Escherichia and mold	2	1.6
Yeast and Mold and Escherichia	1	0.8
Total	129	100

Discussion

Based on the results of present study, 17 (13.17%) cases had no contamination and 112 (86.83%) samples had at least one type of contamination and were inedible. Also, in this study, the rate of contamination in the months of summer (96.8%) was more than in those of winter (77.3%). The most contaminations were related to cake roll samples and those taken from confectionary.

Analysis of samples showed that there was significant relationship between temperature and rate of yeast growth, mold and E.coli (p<0.001). Many studies conducted in Iran and other countries showed that the milk dairy products are suitable for the growth of bacteria in warm season; so, the temperature must be under control to reduce the levels of contamination in dairy products, especially sweets and creams (10-13).

Previous studies indicated that the yeast is more active in environment with high level of active water, which occurs at the top of the pastry cream, and decay and fermentation in addition to moisture are very important in these products (14-15). However, there was no significant relationship between kind of sweet and rate of contamination (p=0.25). Also, there was a significant relationship between sampling place and the rate of contamination (p=0.031).

However, there was no significant relationship between kinds of sweet and rate of contamination in this study (p=0.25). In addition, there was a significant relationship between sampling place and the rate of contamination (p=0.031). A study conducted by Soltan Dallal et al. in 2002 showed that 73 % of 121 creamy sweets taken from sweet centers in southern Tehran had microbial contamination,

which was more than standard level, and it was unusable (2). The results of their study were consistent with the current study. Another study performed by Naim Abadi et al. in Bojnoord in 2008- 2009 suggested that microbial contamination in some products of confectioneries for E.coli was 64% (5). In the present study, the E. coli contamination in sweets was 53.20 %, which was less than 64% in the study of Naim Abadi et al. In the current study, 13.18 % and 86.82 % samples were healthy and unhealthy, respectively. Another similar study done on the samples of Tehran confectioneries by Djazayeri et al. in 2003 showed that 75% of products in confectionaries had microbial contamination and were unusable (8).

In the current study, 86.82% of samples had contamination and were inedible. The highest contamination in both seasons was related to the yeast. Mold and yeast contamination were higher in summer, and Escherichia coli contamination was higher in winter. Since the dairy products are sources of mold and yeast growth, especially in warm seasons, so the temperature must be under control to reduce the levels of contamination in dairy products, especially sweets and cream. It is necessary for health care centers to have better training and supervision on producing and maintenance of creamy sweets.

Acknowledgements

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