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# Assessment of microbial quality of industrial and traditional creams in Alborz province, Iran

Monica Aghvami[1], Gholamreza Jahed Khaniki [1,2*], Samira Shokri[1,3], Nahideh Jalali[3]

[1]*Food Safety and Hygiene Division, Department of Environmental Health Engineering, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.*

[2]*Iranian Scientific Association of Food Safety and Hygiene, Ministry of Health and Medical Education, Tehran, Iran.*

[3]*Clinical Skills Center, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.*

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ABSTRACT

Milk and dairy products play an important role in the human diet and society's health. The aim of this study was the assessment of the microbial quality of industrial and traditional breakfast cream in Alborz province, Iran. In this study, 40 different samples of breakfast cream (20 samples of traditional breakfast cream and 20 samples of industrial pasteurized breakfast cream) were collected randomly in Alborz province in 2018. Microbial quality tests were performed according to Iran National Standards on Coliforms, *Escherichia coli*, and *Staphylococcus aureus*, and then the collected data were analyzed. The microbiological examinations revealed that 43% of the samples were contaminated with coliform bacteria that 12 samples (60%) out of 20 samples of traditional cream, 5 samples (25%) out of 20 samples of industrial cream were higher than the allowable microbial limit of the national standard of Iran. About 15% of samples of traditional creams and 10% of industrial creams were contaminated with *Escherichia coli*. 10% of samples of traditional cream were contaminated with *Staphylococcus aureus*, which was not observed in industrial creams. High contamination with bacteria, needs using different methods to control microbial growth, including the promotion of sanitary awareness among laborers, the codification of microbial standards for traditional dairy products, training to staff for preparing the cream and disinfection of tools.

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## 1. Introduction

Microbial contamination of dairy products is important in point of view economic and hygienic and can play an essential role in the food security of humans. Therefore, it is imperative to have complete policy-making and comprehensive planning for quality food and the prevention of the prevalence of foodborne illness (1, 2). Research in the field of food epidemiology shows that the average incidence of foodborne illness in European and developing countries is 38.3 and 915.8 cases per 100,000 population, respectively (3).

*Corresponding author. Tel.: +982142933277
E-mail address: ghjahedkh@yahoo.com

More than 30 percent of foodborne illness in the UK is related to milk and dairy products, and in the United States (4), the prevalence of dairy-related illness causes an average of 760 cases and 22 hospitalizations per year (5). In African and Asian countries, people get 3 to 4 percent of their energy and 7 percent of their fat needs from milk and dairy products, while in European countries, 6 percent of their energy and 12 percent of their fat consumption comes from milk and dairy products (6).

The cream is a type of fat-enriched milk separated from milk by creaming, a source of energy, essential fatty acids, and vitamins that have principal commercial value and it is supplied as a pasteurized and traditional product (7, 8). Many people eat cream as breakfast and some use it in other meals as well as in a variety of foods, desserts, and cake (9). No proper pasteurization or secondary contamination after the process during transportation, storage, packaging, and supply leads to various microbial infections, especially *Staphylococcus aureus* and *Escherichia coli* (10). *E. coli O157: H7* is most associated with the prevalence of milk and dairy products worldwide. According to the Centers for Disease Control (CDC) in the United States, the bacterium leads to the hospitalization of 2,000 people and the death of 60 Americans in a year (11). Staphylococcus aureus poisoning is the most common and one of the top three poisonings in most countries and is caused by eating foods containing 20 to less than 100 ng of toxin (12).

According to the instructions standard and industrial research of Iran (ISIRI), the level of coagulase-positive Staphylococcus aureus and Escherichia coli bacteria per gram in dairy products sample should be zero (13). Jahed-Khaniki et al. (2004) reported that milk can be contaminated with *Staphylococcus aureus* (14). Also, Faramarzi et al. (15) and Imani Favaldi et al. (16) in their study showed that dairy products are contaminated with *E. coli*, *Staphylococcus aureus*, and Coliform bacteria. Most microbial contamination was reported in the cream samples. Studies demonstrated that the reasons for the microbial contamination in the cream samples are the lack of use of pasteurized creams, insufficient cooling, preparation of food in contaminated containers, and the non-observance of personal hygiene by employees (15). Considering the popularity of traditional dairy products in Alborz province and the risk of microbial contamination in cream samples, despite the lack of proper organization and monitoring of the health of these products and which increases the possibility of food-borne diseases, as well as the scarce data in this regard in Alborz province of Iran, the present study was performed to evaluate the microbial quality of traditional and industrial cream in Alborz province.

## 2. Materials and Methods

### 2.1. Sample collection

This descriptive cross-sectional study was conducted in Alborz province of Iran in 2018. To conduct this research, 40 samples (n=20 traditional creams and n= 20 industrial creams) from different brands were purchased randomly by referring to traditional and pasteurized cream sale centers in different parts of Alborz province (Karaj, Mehrshahr phase 2 and 4, Mahdasht, Mohammadshahr, Meshkin Dasht, Fardis, Kianmehr). The samples were transferred to the microbiology laboratory (Beh Azin Lab) under sterile conditions and stored in a refrigerator at 4°C until testing time.

### 2.2. Isolation and identification of Coliforms and *E. coli*

After preparing the samples according to the instructions of the Institute of Standards & Industrial Research of Iran (ISIRI) (17), they were cultured in the violet-red bail agar by pour plate method and incubated for 24 to 48 h at 37°C to grow possible Coliforms, and then the colonies were transferred to The Brilliant Green Bile Lactose Broth (BGBLB) medium and incubated at 37°C for 24 to 48 h. The result of this step was confirmation of Coliform. Then, one mL of carbonated Durham tubes from the previous stage was added to Brilliant Green Bile Lactose Broth medium (BGBLB) and one ml to the tube containing peptone water, and they were incubated at 44°C for 24 to 48 h. According to the standard method, the growth and production of gas in the environment of BGBLB and the formation of indoles in the environment of peptone water confirm the presence of *E. coli* in the sample.

### 2.3. Detection and count of *Staphylococcus aureus*

The *Staphylococcus aureus* contamination was determined through culturing by plate culture method in Baird Parker Agar medium under aerobic conditions and at 37°C for 24 to 48 h according to the instructions of the Institute of Standards and Industrial Research of Iran (ISIRI) (18-20).

### 2.4. Statistical Analysis

Data analysis was performed using Excel 2013 software and the results were expressed as mean, the percentage of unacceptable sample, and standard limit.

## 3. Results

In this study, results showed that 12 samples of traditional cream (60%) and 5 samples of industrial cream (25%) in terms of the number of coliforms were outside in the defined range of national standard (10 Coliforms per mL). The average contamination of this bacterium in traditional cream and Industrial were reported to be $1.87\times10^2$ and $0.42\times10^2$ cfu/g respectively (Table 1). Also, data analysis showed that *E. coli* contamination in 3 samples (15%) of traditional cream and 2 samples of industrial cream (10%) was higher than the permissible range set by the Iranian national standard (Figure 1 and Table 2). *Staphylococcus* counted in none of the pasteurized creams were outside the standard defined range. Contamination of 10% of traditional creams was higher than the amount recommended by the Iran National Standard (Table 3).

**Table 1**. Frequency of Coliforms contamination in traditional and industrial creams

| Product | Number | Range cfu/g | Average cfu/g | Limit cfu/g | The number of unacceptable samples | Percentage of unacceptable sample |
|---|---|---|---|---|---|---|
| Traditional cream | 20 | <10-3000 | $1.87 \times 10^2$ | <10 | 12 | 60% |
| Industrial cream | 20 | <10-100 | $0.42 \times 10^2$ | <10 | 5 | 25% |
| Total | 40 | | | | 17 | 43% |

**Table 2**. Frequency of *Escherichia coli* contamination in traditional and industrial creams

| Product | Number | Range cfu/g | Average cfu/g | Limit (cfu/g) | The number of unacceptable samples | Percentage of unacceptable sample |
|---|---|---|---|---|---|---|
| Traditional cream | 20 | 0-21 | 13.7 | 0 | 3 | 15% |
| Industrial cream | 20 | 0-30 | 18 | 0 | 2 | 10% |
| Total | 40 | | | | 5 | 13% |

**Table 3**. Frequency of *Staphylococcus aureus* contamination in traditional and industrial creams

| Product | Number | Range cfu/g | Average cfu/g | Limit cfu/g | The number of unacceptable samples | Percentage of unacceptable sample |
|---|---|---|---|---|---|---|
| Traditional cream | 20 | 0-50 | 35 | 0 | 2 | 10% |
| Industrial cream | 20 | 0 | 0 | 0 | 0 | 0% |
| Total | 40 | | | | 2 | 5% |

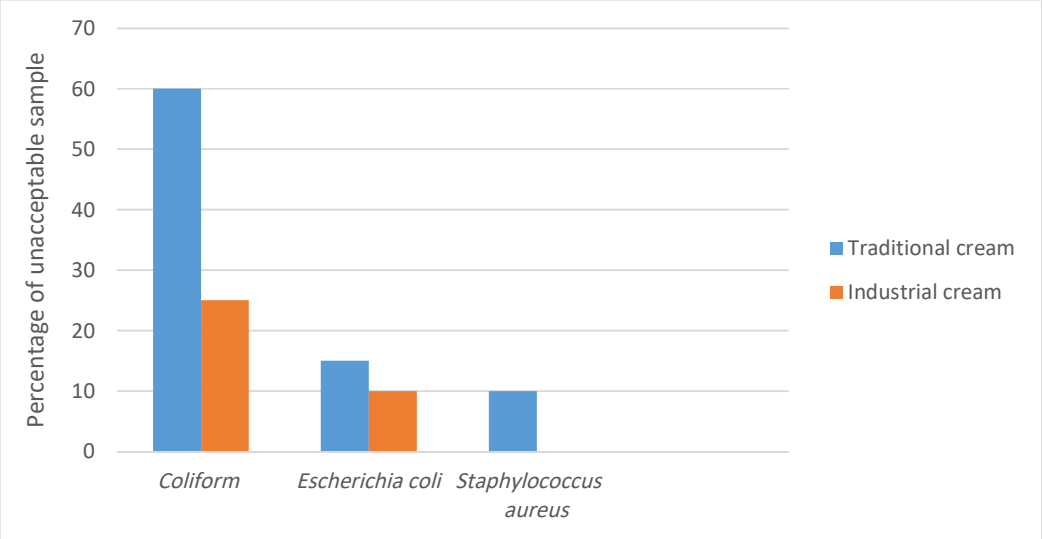


**Figure 1.** Comparing the unacceptable frequency of traditional cream and industrial cream in terms of microbial quality by the Iranian national standard

## 4.Discussion

For most food products, it is important to evaluate the contamination of Coliforms , especially *E. coli*, which is one of the causes of gastroenteritis, a microbial indicator of water and dairy (21). According to the Institute of Standards and Industrial Research of Iran (ISIRI), the amount of *E. coli* bacteria per gram of cream should be zero, but the presence of Coliform bacteria in food is almost inevitable. For this reason, up to 10 cfu/g of sample is allowed (22). The results of the present study indicated that 13% and 43% of the cream samples were infected with *E. coli* and Coliform bacteria, respectively. The presence of Coliform in pasteurized dairy products is a sign of lack of proper pasteurization and secondary contamination after this process (23). In line with the present study, Nateghi and Zarei (2020) in Tehran revealed the contamination of traditional creams with various microorganisms that the conditions of production, distribution, and sale were unsanitary in more than half of the samples (24). Shokri et al. (2017) showed in Arak that 43.2% of the cream samples were contaminated with *E. coli*. Non-compliance with the principles of personal hygiene of employees, tools and equipment hygiene, spatial and construction, food hygiene at the place of production, and supply of cream was associated with this contamination (25). Costard et al. (2017) reported that the consumption of unpasteurized milk or cheese can increase food borne disease by 96% in the United States (5).

In a study performed on pasteurized milk in Tabriz, 50% of the samples became infected with *E. coli* and Coliform bacteria due to insufficient heating system (26). Also, Salari et al. (2006) showed that 10.1% of all samples (yogurt, cream, cheese, etc.) were infected with coliforms, but no cases of *E. coli* were observed. They used new UF techniques to make cheese (27). In

the this study, 13% of the total cream was infected by *E.coli*.

The results of the study by Tasci (2011) in Burdur showed that 10% of the raw milk samples studied were infected with *E. coli* (28). Also, Salehian et al. (2013) reported that 84% of the traditional ice creams samples were infected and 16% were healthy. The relationship between ice cream contamination with raw materials and the worker's hand was significant (29). Transmission of infection through human agents and infected mammary glands is the most important cause of infection of raw milk with *Staphylococcus aureus*, and if the storage and transport temperature is not observed, the microbial load will increase (30). This causes contamination of pasteurized dairy products in factories with poor CIP and causes poisoning (31). More than 12,000 people in Japan were severely poisoned by consuming pasteurized milk contaminated with *Staphylococcus aureus* due to not being clean and the accumulation of bacteria in the milk processing plant's pipes (32). Wouafo et al. (1996) studied the health quality of 300 ice cream samples and they observed that 149 samples (49.6%) are infected with pathogenic *Staphylococcus*. They stated that the use of non-drinking water in washing dishes and non-compliance with hygienic standards during the production process are the most important reasons for these pollutants (33). Gonzales-Barron et al. (2017) reported that the microbial load in traditional yogurt increases. This can be due to lack of hygiene, and non-compliance with the chain cold (34). In the present study, *Staphylococcus aureus* contamination was not observed in industrial creams, but in traditional cream, 10% of the samples were contaminated.

## 5. Conclusion

The rate of microbial contamination in the cream samples is 43%, 15%, and 5% infected with Coliform, *E. coli*, and *Staphylococcus aureus*, respectively, which higher than the tolerable range determined by the national standard. Furthermore, using unpasteurized milk in the production of cream, unprincipled pasteurization, poor CIP, lack of personal hygiene and environmental health, manipulation of dishes and products, and non-compliance with the cold chain in small workshops the main causes of microbial contamination. Therefore, it is recommended to prepare microbial standards for traditional dairy products, further monitoring on raw dairy products, thoroughly wash and disinfect work tools.

## Conflict of interest

The authors have no conflict of interest to declare.

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