



## An Investigation of Microbial Contamination of Animal Butter at the Market Level in Zanjan



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### ARTICLE INFO

**Article Type:**  
Original article

**Article history:**  
Received October 23, 2017  
Revised December 2, 2017  
Accepted December 5, 2017

DOI: [10.29252/jhehp.3.1.8](https://doi.org/10.29252/jhehp.3.1.8)

**Keywords:**  
Pasteurized Animal Butter  
Traditional Animal Butter  
Microbial Contamination  
Zanjan

### ABSTRACT

**Background:** Butter is one of the oldest dairy products known in the world and plays an important role in human nutrition. The aim of this study was evaluating of the microbial quality of traditional and industrial butter marketed in Zanjan.

**Methods:** In this descriptive cross-sectional study, a total of 29 samples of butter were investigated in 2 groups which 24 samples were of traditionally produced butter and 5 industrially produced butter samples, randomly collected from the market in Zanjan, Iran. All samples were evaluated for total bacterial count, Staphylococci, coliform, fungi and mold.

**Results:** Fourteen samples of traditional butter had higher coliform load than allowed in standards. Eighteen samples were contaminated with Staphylococcus, and mold was found in 8 samples. Also, fifteen samples were contaminated with *Escherichia coli*. Among the industrial samples, one was contaminated with *Staphylococcus aureus* but no contamination by coliform, *Escherichia coli* and mold and mold was observed.

**Conclusion:** 58.33%, 75%, 33.33% and 62.5% of the traditional butter samples had higher coliform, Staphylococcus, mold and *E. coli* contamination, respectively than standard limit. One of the industrial samples was contaminated with Staphylococcus. It is recommended that higher supervision on the production and distribution of these products is applied.

## 1. Introduction

Butter is one of the oldest dairy products around the world that plays an important role in human nutrition [1]. It has a high nutritional value due to vitamins A, B, E and tocopherol content [2]. Considering the fact that butter is a dairy product made from cream or milk, the quality of produced butter mainly depends on the quality of milk. The storability of butter is also largely dependent on its bacterial load, which in turn

is a function of hygiene and storage conditions [1].

Milk and its byproducts, including butter, are nutritious foods and have high possibilities of microbial contamination. Butter has a carrier role for food borne pathogens and due to high fat content, pathogens cannot proliferate. It is observed that contamination with these microorganisms play a higher role in the occurrence of food poisoning, in compare with chemical and physical contaminations [2].

According to Iranian National Standard No. 2406, microbial contaminations of butter include coliforms, *Escherichia coli*, coagulase positive staphylococci, psychrophilic microorganisms, mold and yeast [3].

Microorganisms can cause disease by entering the consumer's body or producing toxins and heat resistant proteolytic or lipolytic enzymes or butter spoilage [4, 5].

Out of standard range microbial contamination of Butter, is a potential hazard to human health [1]. The traditional production stages of butter and the lack of technological and hygienic criteria in all stages of production, packaging and supply of dairy products could reduce the product quality and even in many conditions, it may be problematic and pathogenic.

Therefore, quality control of this product is very important [6].

Several studies have been conducted on the microbial contamination of various packaged and traditional type of butter through the world including Iran. Saremnejad et al., found a high percentage of microbial contamination in different packaged butter samples [7]. In another study, Tofangsazan et al. (2009) reported high levels of microbial contamination in industrial butter samples in Tehran [1]. Other studies such as Shekarforoush et al. (2013) Sharifi et al. (2010) Idoui et al. (2013) and Vagra et al. also confirmed microbial contamination of different types of butter [2, 4, 8, 9].

Given to high production of traditionally produced butter from cow's milk and its distribution in retail market of Zanjan and high consumption of them by families, this study aimed to evaluate of microbial quality of by traditional and industrially produced butter samples in Zanjan, Iran.

## 2. Materials and Methods

In this study, 24 samples of traditionally produced butters, and 5 samples of pasteurized butters (industrially produced samples) distributed in Zanjan supermarkets, were purchased randomly by a cluster sampling method in the spring of 2016 and transferred to the laboratory in a cold box, immediately.

Microbial contamination of produced traditional butter was evaluated according to Iranian national standard protocols. Total count of bacteria, coliforms, *Escherichia coli*, *Staphylococcus* and mold was

evaluated accordance Iranian national standard No. 2406 [3].

## 3. Results and Discussion

In this study, total bacterial count, *S.aureus*, *E.coli* coliforms, fungus and mold enumerated in all 29 samples of butter samples Microbiological tests showed that 14,15, 18 and 8 samples of traditionally produced butters had contamination higher than standard levels with coliforms, *E. coli*, *Staphylococcus aureus* and mold, respectively. Among the industrial samples, no contamination was observed with coliform, *E. coli* and other microorganisms. Contamination with *S. aureus* was seen just in one sample of industrially produced butters.

**Table 1:** Enumeration and types of microorganisms per gram of traditional butter samples

Sample No	Total bacterial count	<i>S. aureus</i>	Total coliforms	Mold and yeast
1	0	6	0	0
2	1.99×10 <sup>4</sup>	56	2×10 <sup>4</sup>	2×10 <sup>2</sup>
3	1.99×10 <sup>4</sup>	40	1.96×10 <sup>2</sup>	2×10 <sup>2</sup>
4	1.99×10 <sup>4</sup>	56	1.99×10 <sup>4</sup>	0
5	1.99×10 <sup>4</sup>	56	2×10 <sup>2</sup>	20
6	20	6	20	20
7	2×10 <sup>3</sup>	0	0	2
8	2×10 <sup>3</sup>	60	2×10 <sup>3</sup>	2×10 <sup>2</sup>
9	2×10 <sup>2</sup>	6	2×10 <sup>2</sup>	0
10	0	6	4	7
11	2×10 <sup>4</sup>	6	2×10 <sup>2</sup>	2×10 <sup>2</sup>
12	20	56	0	2
13	2×10 <sup>2</sup>	56	2×10 <sup>2</sup>	2×10 <sup>2</sup>
14	0	56	6	2
15	0	56	4	0
16	2×10 <sup>4</sup>	0	1.99×10 <sup>4</sup>	2×10 <sup>4</sup>
17	1.99×10 <sup>4</sup>	0	1.99×10 <sup>4</sup>	2×10 <sup>4</sup>
18	1.99×10 <sup>4</sup>	6	2×10 <sup>4</sup>	20
19	1.99×10 <sup>4</sup>	60	2×10 <sup>2</sup>	20
20	4	0	0	5
21	1.99×10 <sup>4</sup>	0	0	2×10 <sup>2</sup>
22	1.99×10 <sup>4</sup>	56	2×10 <sup>2</sup>	20
23	4	0	2×10 <sup>2</sup>	0
24	0	56	0	0
Max.	2×10 <sup>4</sup>	60	2×10 <sup>4</sup>	2×10 <sup>4</sup>
Min.	0	0	0	0
Mean	9.33×10 <sup>3</sup>	29.17	3.56×10 <sup>3</sup>	1.72×10 <sup>3</sup>

In the present study, *S. aureus* contamination was observed in 75% and 20% of traditional and industrial butter samples, respectively which did not conform to the Iranian National standard (Table 1, 2). The permitted number of microorganisms is summarized in Table 3 considering to Iranian National Standard No. 2406 [3].

Present microflora in the butter is an indicator of microbial quality of used raw milk or cream, the hygienic conditions of environment and used equipments and also noted hygienic conditions during butter packaging and distribution [10].

**Table 2:** Enumeration and types of microorganisms per gram of industrial butter samples

Sample No	Total bacterial count	<i>S. aureus</i>	Total coliforms	Mold and yeast
1	4	6	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	2x10 <sup>2</sup>	0	0	0
Max.	2x10 <sup>2</sup>	6	0	0
Min.	0	0	0	0
<b>Mean</b>	40.8	1.2	0	0

**Table 3:** Standard limits of microorganisms in butter [3]

Microorganism	Standard limits (CFU/ gr)
Coliform	Maximum 20
Escherichia coli	Negative
Staphylococcus aureus	Negative
Molds and Yeast	Maximum 100

The results of this study were not consistent with the results of other studies, including Saremnezhad et al. (2007) Tofangsazan et al. (2009) Idoui et al. (2013) and Karagozlu and Ergonul (2008) who did not report *S. aureus* contamination in butter samples [1, 7, 9, 11]. However, similar studies in Iran have reported different rates of microbial contamination in butter samples collected from different cities; for example, Haji-Mohamadi et al. (2008) in Malekan, Eslamloo et al. (2009) in Orumieh, Shekarforoush et al. (2013) (in Isfahan reported 3.5%, 41.6% and 58.5% contamination with *S. aureus*, respectively [2, 4, 12]. The presence of this bacterium can be attributed to the contamination of the raw milk or cream, poor personnel hygienic, manipulation and transfer of contaminating agents during the packaging.

Considering the fact that pathogenic strains of *S.aureus* can produce heat-resistant enterotoxins, and even its very low levels are harmful to consumers, absence of *S.aureus* can ensure that no problems will be encountered by consumption of this food.

In the present study, total and fecal coliforms were over than standard limit in 58.33% of the traditional butter samples. In several studies, coliforms have been reported in various types of butter. For instance, Saremnezhad et al. (2008) Tofangsazan et al. (2013) and Meshref (in Egypt) reported that 20%, 64.58% and 36.7% of butter samples are contaminated with coliforms, respectively [1, 7, 10]. Presence of total coliforms in butter indicates low hygienic standards in the production process and the potential risk of food poisoning. Coliforms may contaminate butter samples by packaging equipments and personnels. Therefore, care should be taken during processing food and sanitize the equipments to decrease these contaminations and prevention the prevalence of diseases and their severe complications. In addition,

monitoring the storage conditions and temperature by butter suppliers and also proper control of the cold chain (freezing) in a hygienic manner will be effective in preventing contamination until the consumption of butter [1].

In this study, 62.5% of the traditionally produced samples were contaminated with *E. coli* and were not in conforming to the Iranian National Standard (Table 1). The presence of this bacterium in the butter samples is due to the fecal contamination of raw milk or cream used to produce butter, or transferring fecal contamination by personnel involved in the production, packaging, transport and distribution of samples [10].

Obtained result was in accordance with the results of other studies, such as Haji-Mahamai et al. (2008) Eslamloo et al. (2009) Shekarforoush et al. (2013) Tofangsazan et al. (2009) who reported 8.2%, 10, 40 and 16.66% contamination in the butter samples from different cities, respectively, [1, 2, 4, 7]. All of these reports indicate the need to pay more attention to the quality of the raw material and hygiene of practitioners in the supply and distribution of butter.

The mold contamination were seen in 33.33% of traditionally produced butter samples; and molds count was higher-than standard range (over than 100 CFU/gr). Two samples had mold counts much higher than the standard (Table 1). Previous studies have also shown mold and yeast contamination in different types of butter with different percentages; for example, Saremnezhad et al. (2007) and Tofangsazan et al. (2009) reported 10 and 25.6% contamination of various types of butter in Iran, respectively [1, 7]. Presence of mold and yeast in the foodstuff is very important because they can lead to change in surface color and make unpleasant odors in the foodstuff, including butter, due to their ability to grow at different pH and temperatures. More importantly, molds can produce toxic metabolites called mycotoxins, which some of these metabolites, are carcinogenic like aflatoxins [10].

#### 4. Conclusion

The results reveal that the traditionally produced butter samples marketed in Zanjan were not hygienic and high count of pathogenic bacteria and microorganisms in butter threaten the public health of the community. Therefore, consider to the hygienic conditions of the production as well as education of Good Hygiene Process (GHP) and proper transportation methods is necessary to those involved in the production, packaging, transporting, and distribution of this type of food. Also, the raw

materials used in the production of butter should have the best quality.

## Conflict of Interest

Authors declare there is no conflict of interest regarding the publication of this article.

## Acknowledgement

Authors thanks to student research center of Zanjan University of Medical Sciences for the financial and moral support of present study (Grant No. A-11-940-5).

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