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Scientific Research

An Empirical Study on Microbial Load and Acidity in Raw Milk Produced in Malayer and Nahavand Cities, Iran 2012

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Abstract

Milk is very susceptible for growth and development of many microorganisms because it is rich in nutrients and has suitable condition. Thus, it is very vital to respect sanitary conditions at all stages of production and transport of raw milk. The objective of the present investigation was to determine the total bacterial, and acidity in raw milk from milk collection centers in Malayer and Nahavand cities. 52 milk samples were collected from 13 centers in summer 2012 and were analyzed according to standard methods. None of the raw milk samples under investigation, had superior or grade 1 quality. Only 7.7% of the samples were classified as raw milk with grade 2 quality and 92.3% were non-standard. The mean of microbial total count in base was 3.8×10^7 CFU/ml and average acidity in the samples was 0.163. The city of Tochqhaz and Aliabad-e-Damagh has the

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lowest and the highest microbial total count. In general the result of this study showed unsatisfactory conditions of milk in the milk collection centers of the Malayer and Nahavand cities.

Keywords

Food Safety, Milk Collection Centers, Acidity, Microbial Total Counts

1. Introduction

Milk as a valuable food source is rich in calcium, phosphorus, required vitamins and proteins. According to FAO and WHO studies, 50 percent of total daily protein requirements should be coming from animal protein [1].

Milk quality is one of the important indicators along the extent of the consumed quantity. The initial quality of raw milk is affected by factors such as animal nutrition, animal health, chemical composition and microbial activity. So the quality of raw milk will depend on many factors such as duration and conditions of milk production site to delivery to the plant [2]. Determine the total microbial load in milk is a common method and most significant criterion in evaluating the quality of raw milk [3].

The total number of bacteria is important in milk for appropriate assessment for human consumption; its importance is due to the presence of bacteria that can cause illness in the consumer. The pathogenic bacteria such as coliform are important. The presence of fecal coliform, such as *Escherichia coli*, indicates fecal contamination with animal feces. Because these bacteria are common flora of warm-blooded animals, therefore, its presence in milk is harmful to consumers [4].

Milk is delivered to factory for processing from production units or deliver to factory after collection in collection centers in the mobile or stationary stations.

In this cycle increasing microbial load is inevitable but its indiscriminate increase is controllable [5].

Hamadan has important role in milk production in Iran by producing 435.7 thousand tons of milk (more than 4% of the total milk produced in the country) [5]. Major parts of production come from traditional unit that located in village and their produced milk transferred to the factory through milk collection centers, so well be understood the importance of milk bacteriological quality in collection stations in order to identify the most important contaminate foci of raw milk from milking stage to delivery to factory. This study was performed to achieve this goal and assess the microbial contamination (microbial load and total acidity).

2. Materials and Methods

Since the traditional dairy farmers deliver their milk to the collection centers, Milk samples collected from 13 stations of Malayer and Nahavand city. 4 samples from each station were collected in summer 2012.

All samples (52 samples) have been transferred to the microbiology laboratory in cold and sterile conditions.

In the laboratory, Serial dilutions of raw milk samples were produced and cultured for total microbial counts by surface culture method on Plate Count Agar (With three replications). After 3 days incubation at 30˚C microorganisms were counted according to standard methods [6]. Acidity test calculated according to the Dornic degree by Titration with sodium hydroxide.

3. Findings

Table 1 shows the average of total microbial load and acidity in each collection center. The city of Tochqhaz and Aliabad-e-Damagh has the lowest and the highest microbial total count in comparison with other centers (2.56×10^6 and 7.3×10^7).

While the average acidity of the collected samples in Kasb (0.153) and Aliabad-e-Damagh (0.18) had minimum and maximum acidity according to Dornic degree. 92.3% of the samples have a higher microbial load than standard dairy factories for processing (**Table 2**). **Figure 1** and **Figure 2** show the logarithm of microorganisms and acidity of milk collection stations.

Table 1. Microbial and acidity average load per station.

Station	Number of Samples	Total Microbial Load [Mean ± SD CFU/ml]	Acidity
Jokar	4	$1.64 \times 10^7 \pm 3.6 \times 10^5$	0.166
Kasb	4	$3.8 \times 10^6 \pm 9 \times 10^4$	0.153
Dehno	4	$2.73 \times 10^6 \pm 4.5 \times 10^4$	0.156
Malayer	4	$5 \times 10^6 \pm 6.2 \times 10^4$	0.156
Aliabad-e-Damagh	4	$3.7 \times 10^7 \pm 1.2 \times 10^6$	0.180
Hossinabad-e-Shamlu	4	$2.6 \times 10^6 \pm 9.3 \times 10^4$	0.160
Mehrabad	4	$1.25 \times 10^7 \pm 4 \times 10^5$	0.163
Tochqhaz	4	$2.56 \times 10^6 \pm 8.1 \times 10^4$	0.156
Shiravaran	4	$2.27 \times 10^7 \pm 4.6 \times 10^4$	0.170
Doraneh	4	$5.2 \times 10^6 \pm 1.8 \times 10^5$	0.163
Nahavand	4	$1.14 \times 10^7 \pm 3.2 \times 10^5$	0.170
Kahriz	4	$2.8 \times 10^7 \pm 1.8 \times 10^6$	0.170
Dehfoul	4	$1.2 \times 10^7 \pm 4.6 \times 10^5$	0.163
Mean		**1.2×10^7**	**0.164**
Range		**2.56×10^6 - 3.7×10^7**	**0.153 - 0.180**

Table 2. Distribution of stations in terms of raw milk quality according to Iranian national standard.

Total Counts Standard [CFU/ml]	Number of Stations	Ranking of Milk According to Iranian Standard	Percent
<30,000	0	Excellent	0
30,000 - 100,000	0	First Degree	0
100,000 - 500,000	1	Second Degree	7.7
500,000 - 1,000,000	0	Third Degree	0
>1,000,000	12	Non-Standard	92.3

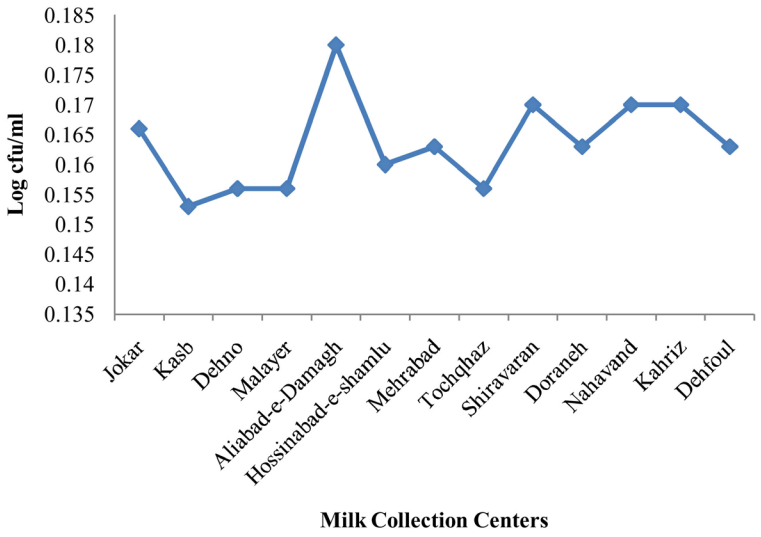

Figure 1. Logarithm of raw milk microbial load in collection centers.

4. Discussion

Pathogenic bacteria in milk have been a major problem for public health concern. Evaluation of raw milk quality in milk collection centers as one of the main focal is important in increasing the quality of raw milk delivered to factory. Because in the absence of hygiene, Milk contamination probability is high. In a study conducted in the

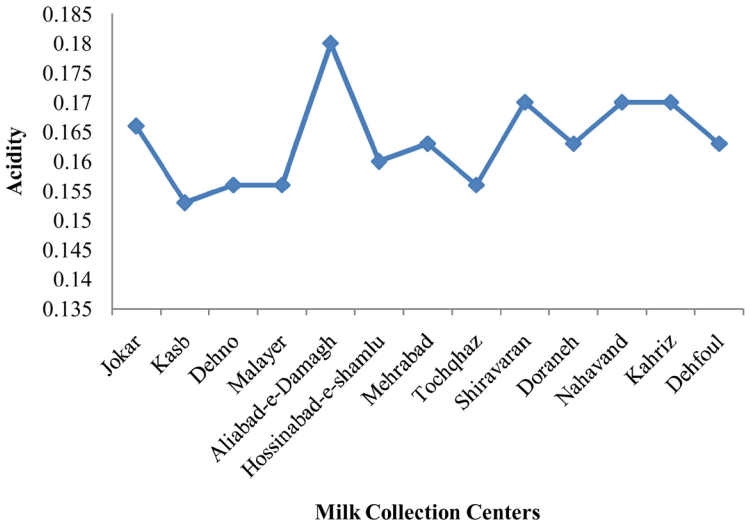

Figure 2. Milk acidity rate according to the Dornic degree in collection centers.

Lorestan province, the logarithm of the average microbial load of milk was 6.43 in collection centers with different capacities during 2003, and the average of *Escherichia coli* was 13.3 over the year [7]. Average logarithm of microbial load of raw milk in traditional dairy collection tank and milk tanker in podium at the factory in the city of Kashmar were reported 6.9 and 6.8 respectively [8].

Kamalzadeh (2010) in a study was conducted on 54 samples of raw milk in milk collection centers in the Khozestan province, none were reported excellence in terms of national standards, and about 88.3% of samples were non-standard [3] which is consistent with results from the present study. Logarithmic average microbial load was 7.1 in milk collection centers, has difference with these results and indicate a higher quality of raw milk in milk collection centers in the Hamadan province. Logarithmic average microbial load of milk tank was 6.9 in milk collection centers in the Fars province, and the results was approximately equal to result of the present study [7]. In the study that conducted in Yazd, average microbial load was 15.96 that in compared with the present results is the very high rate. In the study that conducted by Ibrahim Mohammed (2011) the average of microbial load of milk reported 8.5 in milk collection centers in the city of Mahabad [9]. Yarahmadi reported the average of microbial load of milk 6.8 in a study that conducted on 2560 record of raw milk in the Lorestan province during 1399 to 2001 [1]. In a study in India the logarithmic average microbial loads of milk samples from 124 centers were reported between 2.2 to 2.6 [10], which appear highly desirable when compares with the results of this study. Holm *et al.* (2004) reported that the logarithmic average microbial load of raw milk in 75 milk collection was 2.4 [11]. In the study that conducted by Van Schaik *et al.* (2004) the microbial load of raw milk in 42 milk collection centers in Chile's was 3.8 [12]. This rate reported 2.1 for Ethiopia in the study that conducted by Godefay *et al.* (2000) [13]. The Average logarithmic microbial load of raw milk from Markazi Province was 6.8 CFU/ml which was consistent with our results [14]. The presence of various contaminants in food by authors has also been investigated in other studies in Iran [14]-[19]. Ombui *et al.* (1994) reported that the rate of microbial load of raw milk in collection centers in Kenya was 2.7 and about 50% of the samples had coliform contamination [20]. Differences between the reports and the results of this study could be related to milk collection centers or the product process steps until it is delivered to the center. Due to the high sensitivity of milk, several factors can affect on milk quality; factors such as sanitation and washing the udder before milking, mastitis control, animal health status, hygiene of milking utensils and tankers, time spent between milking milk to transfer it to the center, personal hygiene, maintenance milk in proper temperature, etc. There are many studies in this field represents the significant impact of these factors on milk quality [3] [5] [12] [13] [21] and [22]. Besides these factors, year and season of sampling can also affect on differences between the results [1] [2] [5] and [8].

An outbreak of zoonotic pathogen, Streptococcus zooepidermicus was reported in Australia in 1992 involving three cases who had reportedly consumed unpasteurized milk from a house cow [23]. Disease outbreaks associated with consumption of raw milk are considerably higher than outbreaks associated with the consumption of

pasteurized milk.

The safety of raw cow milk is influenced by a combination of management and control measures along the entire dairy supply chain. Control of animal health, use of correct milking practices, and control over milking parlor hygiene are important factors in reducing the microbial load in raw milk.

5. Conclusion

The results indicate the poor quality of raw milk produced in Malayer and Nahavand cities. Hence, raising the level of food safety for consumers is an essential infrastructural measure to improve conditions, dairy farmers and their family member's education, training operators of milk collection centers and etc.

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