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A Survey about Determining the Total Coliforms Bacteria in Process of Introduction of Ice in Yazd, Iran

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Abstract: Consuming water and ice having coliform bacteria may cause fever, flu- like symptoms or other gastro- intestinal illness. This was a cross- sectional study, carried out for determining the total coliform bacteria in the process of production of ice in 5 ice production factories. Water and ice samples were collected from 144 sites(48 samples of water before importing to the mold of ice, 48 samples from water in the mold of ice and 48 samples from ices). Of the 144 samples, 47 plaques were contaminated. The lowest contamination was about the water, before importing to the mold of ice(12.5%) and highest contamination due to the ice (54.2%). The contamination in 5 factories was different and contamination of factories No 4 and 5 were more than others. About 75% of ice of factories No 4 and 5 were contaminated. The results are consistent with the observation of many studies that they described, inadequate sanitation facilities and the use of inadequately treated water are likely responsible for the spread of bacteria. To prevent contaminating the water and ice, it is essential to regularly monitor the water quality and process of production of ice and improve the standard of system.

Key words: Ice production · Process of production of ice · Coliform

INTRODUCTION

Ice factories are required to deliver safe and reliable ice to their customers. If the ice becomes contaminated, then consumers can become seriously ill. Fortunately, many steps are being taken to ensure that the public is provided with safe ice. One of the most important steps is to have the water and ice tested for coliform bacteria.

Coliform bacteria are organisms that present in the environment and in the feces of all warm – blooded animals and humans [1]. coliform bacteria will not likely causes illness. However, the presence of coliform bacteria in drinking water indicates that disease – causing organisms (pathogens) may be present in the water system and process of production of ice. Positive correlation between fecal indicator bacteria and coprostanol concentrations have been reported for several temperature and cold climate regions [2-6]. Most pathogens that contaminate water supply come from the feces of humans or animals. Several reports have implicated water or ice as the source of infection and kinds of diseases [7-9].

Consuming water and ice having coliform bacteria may cause fever, flu- like symptoms or other gastro-intestinal illness [10,11].

When coliform bacteria is found, steps are taken to identify where the contamination may have entered the water and ice system. More repeat samples are collected and an inspection is recommended. Taking repeat samples helps determine whether an actual problem exists in the system. Sometime a sample shows the presence of coliform because of poor sampling techniques or because a contaminated faucet was used – not because an actual problem exists. If any of the repeat samples detect coliform bacteria, the initial findings are considered confirmed.

Wells and springs can become contaminated by faulty construction, poor protection from surface activity including rain and flooding, a shallow water Via rock fractures, close proximity to a sewage disposal system, or reconstruction [12]. Other factors affecting fecal microorganisms survival and distribution in the environment include solar radiation, water salinity, sea ice condition and fecal input by humans and local wildlife

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populations. In Yazd (one of provinces in center of Iran), the weather is hot, the people are oblige in using the ice. If the ice be contaminate, the consumers will be ill. The coliforms in the ice can be alive and cause illness in the consumers. The result of a study that carried out by Monastersky. R [13,14,] showed that the bacteria in ice, are alive and develop. The result of a study that carried out by Dr Kelly [15], in the pathology Department of Hopkins' Hospital, in Meriland state of US, showed that: In the machines that produce ice, mycobacterium can be alive. Result of a study does not support the use of ice immersion as a postharvest method because of the relatively small declines in bacteria numbers and the possibility of concomitant increases in fecal coliform and total bacteria contamination [16]. The purpose of this study was to determine the total coliforms in the process of ice production in the 5 factories that produce the ice.

MATERIALS AND METHODS

This was a cross- sectional study, that carried out for determining the total coliform bacteria in the process of production of ice in 5 ice production factories in Yazd city.

The data was collected by a researcher designed questionnaire.

Water and ice samples were collected from 144 sites (48 samples of water before importing to the mold of ice, 48 samples from water in the mold of ice and 48 samples from ices). In four seasons respectively in 5 ice production factories. Because, the most common water test for bacteria is, total coliform bacteria, in this study, we tested total coliform bacteria of water and ice in the process of production of ice.

All samples for bacteriological analysis were collected in sterile glass bottles, immediately placed in dark cooling boxes and processed to the laboratory. All samples for sterol analysis were collected in a stainless steel bucket and stored in solvent – rinsed amber glass bottles. The samples were analysis according standard methods.

The standard methods that used, was based on the microbiology of Fine – Gold.

All data which were collected were transferred directly into SPSS (statistical package for social sciences). In all cases, significance was determined at the95% coincidental level. For data analysis, chi- square, analyze -variance were used.

RESULTS

Water and ice quality information obtained at the collection sites is presented in Table 1. Data in showed that, a wide range of total coliform, the lowest in the factory No 1, with total coli forms of 20.5%, to the highest total coliforms of 62.5% in the factory No 4. The difference between the coliform contamination and different factories office was significant ($p<0.006$). The total coliforms bacteria, as an indicator of contamination, in some process of production of ice, was relatively low, but the percent increase during the ice production process is significant. The data in Table 2 showed that: Of the 144 samples, 47 plaques were contaminated. The lowest contamination was about the water, before importing to the mold of ice (12.5%) and highest contamination due to the ice (54.2%). The contamination in 5 factories, was different and contamination of factories No 4 and 5 were more than others. About 75% of ice of factories No 4and 5 were contaminated (Table 3). Shock chlorination can be used to disinfect a well or spring by introducing a high concentration of chlorine to the water for a short time. The amount of chlorine needed to kill bacteria and oxidize all of the impurities in the water is known as the chlorine demand. The goal of continuous chlorination is to provide enough chlorine to satisfy the chlorine demand and still allow for approximately 0.2 to 0.8 milligrams per liter of residual chlorine in the water. The data in Table 4 showed that the residual of chlorine in process of ice production. There is significant difference between demand chlorine in process of production of ice, water before importing in mold of ice ($p<0.012$), water in mold of ice ($p<0.002$) and ices ($p<0.000$).

Table 1: The distribution of coli form contamination based of factures

	No		Yes		Total	
Contamination Factories	N	%	N	%	N	%
No 1	31	79.5	8	20.5	39	100
No 2	26	78.8	7	21.2	36	100
No 3	15	62.5	9	37.5	24	100
No 4	9	37.5	15	62.5	24	100
No 5	16	66.7	8	33.3	24	100
Total	97	67.4	47	32.6	144	100

$P < 0.006$

Table 2: The distribution of coli form contamination in process of production of ice based on place of samples

	Yes		No		Total	
Contamination samples	N	Percent	N	Percent	N	Percent
Water before importing to the mold of ice	6	12.5	42	87.5	48	100
Water in the mold of ice	15	31.3	33	45.8	48	100
Ice	26	54.2	22	45.8	48	100
Total	47	33.6	97	57.6	144	100

P<0.0001

Table 3: The distribution of coli form contamination based of factories and place of samples

		No		Yes		Total	
Factories	Contamination Place of samples	N	%	N	%	N	%
No 1	Water before	12	92.3	1	7.7	13	100
	Water in mold of ice	10	76.9	3	23.1	13	100
	Ice	9	69.2	4	30.8	13	100
No 2	Water before	11	100.0	0	0.0	11	100
	Water in mold of ice	9	81.8	2	18.2	11	100
	Ice	6	54.5	5	45.5	11	100
No 3	Water before	8	100.0	0	0.0	8	100
	Water in mold of ice	4	50.0	4	50.0	8	100
	Ice	3	37.5	5	62.5	8	100
No 4	Water before	3	37.5	5	62.5	8	100
	Water in mold of ice	4	50.0	4	50.0	8	100
	Ice	2	25.0	6	75.0	8	100
No 5	Water before	8	100.0	0	0.0	8	100
	Water in mold of ice	6	75.0	2	25.0	8	100
	Ice	2	25.0	6	75.0	8	100
Total	Water before	42	87.5	6	12.5	48	100
	Water in mold of ice	33	48.8	15	31.3	48	100
	Ice	22	45.8	26	54.2	48	100

Table 4: The distribution of demand chlorine based on place of samples

Factories	Chloride statuse	N	Mean of demand chlorine	SD	PV
Water before importing to the mold of ice	Normal	42	0.2800	0.260	0.012
	Un normal	6	0.0000	0.000	
	Total	48	0.2500	0.260	
Water in the mold of ice	Normal	33	0.0028	0.270	0.002
	Un normal	15	0.0600	0.100	
	Total	48	0.2000	0.250	
Ices	Normal	22	0.3200	0.290	0.000
	Ub normal	26	0.0200	0.060	
	total	48	0.1600	0.250	

DISCUSSION

The rapid population growth and urbanization in developing countries have led to serious water pollution problems in this countries. Intensive monitoring, especially of fecal pollution, is important for understanding the extent of this problem. According to the water quality – based limit established by standards in Iran, no detection of fecal coliform is desirable. This indicates a pressing need for improved sanitation to halt the potential spread of waterborne disease in Iran.

This study has emphasized the necessity of reappearing the use of fecal indicator bacteria (total coliforms) in water and ices in 5 factories that produce ice in Yazd, to account for distinctive variations in bacteria counts in process of produce of ice. The wisdom of reliance on water quality standards that are based on indicator bacteria concentrations has been

widely discussed byQuevedo [17] and Wolf [18]. Commented that the predictive relationship between fecal coliforms and nonbacterial pathogens in water was uncertain. This concerns have grown over time and are outlined in recent reviews [19,20]. A major concern has been the possibility that *E. coli* [21-23] and *enterococci* [24-26] and bacteria [27] can multiply in environmental water and sediments, associated soil and ice. The growth of indicator organisms in water and sediments would obviously jeopardize the connection between indicator organism concentration and human health risk. The results of this study showed, there is a wide range of total coliform in different ice factories, the lowest in factory No 1 and the highest in factory No 4(20.5% and 62.5%) respectively. The data in Table 2 showed the different contamination of coliform in process of production of ice. The data of this table revealed that, 59% of ices were contaminated, that are consistent with results of Salak, *et al.* [28], who described that 68% of ices of Tehran city was contaminated. These results revealed the connection between indicator organism and poor protection by workers. The results of this study are consistent with the observation of Guthmann [29], who described, inadequate sanitation facilities and the use of inadequately treated water are likely responsible for the spread of bacteria. The data of this study are consistent with the finding of Paez, [30], who found that the reason of a high number of gastroenteritis cases in Spanish tourists who had traveled to a hotel in Punta Cana on different days during August 2002, was samples of the ice and meals served at the buffet that day, yielded coliform bacteria. Consumption of water from the resort water system was the only risk factor associated with symptoms. A study that carried out by Estevao Belchiors and pucci OH (31), showed that the amounts of aerobic mesophile bacteria increased during manual filleting and packaging, in comparison raw materials, This results are consistent with our results in Table 3.

To prevent contaminating the water and ice, it is essential to regularly monitor the water quality and process of production of ice and improve the standard of system. One of methods for preventing the contamination is chlorinating the water and monitor the demand choler. The result of a study that carried out by Ramakrishna, *et al.* [32] showed that after chlorination the drinking water supply during an epidemic of cholera, the organism was no longer isolated from the water supply and the epidemic subsided [32]. This results are consistent with our results that revealed that the demand chlorine in some case was not adequate (Table 4), Where that the demand chlorine was inadequate, the contamination was more.

This study demonstrated a high degree of variability in the response of fecal indicator organisms to stresses in aquatic environments on all levels investigated.

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