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Physical, Chemical and Biological Quality of Water Used in Food Premises in Makkah

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Abstract:

A study was conducted to investigate the quality of water that used in food premises in Makkah, Saudi Arabia. A total of 288 water samples were collected from different food establishments. The collected samples were taken from underground tanks (6 samples), roof tanks (13 samples), taps (264 samples) and desalination stations (5). Laboratory analysis was done to identify physical and chemical characteristics of water, in addition to determine the presence of bacteriological contamination indicators. The study revealed that, 39(13%) of water samples were chemically unsatisfactory according to World Health Organization standards. Bacteriological contamination indicators were found in 43(14.9%) of samples. About 9(3.1%) of water samples were not satisfied physical standards of water. Half (50%) of samples that collected from underground tanks were unsatisfied the chemical and bacteriological standards, followed by roof tanks (46.2%). In this study 11.4%of tap water samples were chemically unsatisfactory while bacteriological contamination was found in approximately 12.9% of these samples. It was concluded that, a considerable number of food establishments were depending on unsafe water from public health point of view according to World Health Organization.

Key words: Physical, Chemical, Bacteriological, Food, Premises, Makkah.

Introduction

Water is a finite and vulnerable resource. Consequently, consumption of polluted water puts lives and livelihoods at risk because water has no substitute (Ramandeep et al, 2012). Food premises are important from public health point of view. The water that used in these premises should be safe to avoid several diseases and disorders that can be caused by contaminated water and food. According to World Health Organization (WHO), nearly 1.8 million deaths, due to diarrhea and chlorea per year, are attributed to unsafe water supply in conjunction with inadequate sanitation and hygiene whereas improvement in water supply can help reduce morbidity by 6 to 25% (Almas et al, 2013).

In the case of Saudi Arabia, surface water sources are considered to be very limited resources and are exploited for almost every use, so groundwater is still and will continue to be the main source of safe and reliable drinking water, especially in rural areas in Saudi Arabia (Eed, 2009). In Jazan, Saudi Arabia, ground water from wells is an important source of drinking water. However, sometimes ground water may contain chemical constituents that endanger the health of people (Asia, 2011). In Makkah, which is the religious capital of the kingdom, water supply is provided from the aquifers of many valleys inside and around it (Dablool et al 2013). The natural water analysis for physical, chemical properties including trace element contents are very important for public health studies to ensure the safety of water (Soylak et al, 2002). They represent as indirect method of transmission of microbial diseases (Chukwuemeka et al, 2011), as well as disorders caused by chemical and physical agents.

Regarding the quality of drinking water, microbiological contamination is a primary concern of developing countries. In addition, inorganic contaminants concerning health can be present in the waters (Sabrina et al, 2013). Water

contamination with microbial organisms can be occurred at water sources (Saiful et al, 2010) or during distribution process.

Materials and Methods

The Holly Makkah is a biggest town in Saudi Arabia. It is important town due to religious dimension. Millions of people from different regions of the world are coming to it throughout a year, particularly in pilgrimage season. So, there is a need for comprehensive services and good infrastructure includes drinking water and food establishments.

Actually, 6, 13, 264, and 5 water samples were collected from underground tanks, roof tanks, taps and desalination stations respectively. Bacteriological, chemical and physical examinations were done in laboratory to detect coliforms and physical and chemical parameters.

Results

Table one shows that, 39(13%) of water samples were chemically unsatisfactory while the rest 249(86.5%) were within limits of World Health Organization standards. Bacteriological contamination indicators were found in 43(14.9%) of samples as shown in table two. About 9(3.1%) of water samples were not satisfied physical standards of water (table 3). In tables 4 and 5 Half (50%) of samples that collected from underground tanks were unsatisfied the chemical and bacteriological standards, followed by roof tanks (46.2%) and tap water (11.4%) in table 4 and 12.9% in table 5.

Table (1): Satisfaction of chemical standards of water used in food premises in Makkah

Chemical standards	No	%
Unsatisfactory	39	13.5
Satisfactory	24***9***	86.5
Total	288	100

Table (2): Bacteriological contamination of water used in food premises in Makkah

Bacteriological contamination	No	%
Present	43	14.9
Not present	245	85.1
Total	288	100

Table (3): Satisfaction of Physical standards of water used in food premises in Makkah

Physical standards	No	%
Unsatisfactory	9	3.1
Satisfactory	279	96.9
Total	288	100

Table (4): Relationship between chemical standards and source of water in food premises in Makkah

Source of water	Chemical standards				Total	
	Unsatisfactory		satisfactory			
	No	%	No	%	No	%
Underground tank	3	50	3	50	6	2.1
Roof tank	6	46.2	7	53.8	13	4.5
Tap	30	11.4	234	88.6	264	91.7
Desalination station	0	0	5	100	5	1.7
Total	39	13.5	***249***	86.5	288	100

Table (5): Relationship between bacteriological contamination and source of water in food premises in Makkah

Source of water	Bacteriological contamination				Total	
	Present		Not present			
	No	%	No	%	No	%
Underground tank	3	50	3	50	6	2.1
Roof tank	6	46.2	7	53.8	13	4.5
Tap	34	12.9	230	87.1	264	91.7
Desalination station	0	0	5	100	5	1.7
Total	43	14.9	245	87.1	288	100

Discussion

Water is essential substance in preparation of food. Contaminated water that used in food premises might endanger people health, particularly when it contains chemical

pollutants or excessive amount of minerals and heavy metals that usually found in water. Contaminated water leads to spread of diseases, it has been estimated that 50,000 people die daily world-wide as a result of water-related Diseases (Ramandeep et al, 2012). In this study, a considerable number (13.5%) of food establishments were using chemically unsatisfied water in different purposes according to World Health Organization (WHO) standards. It was similar to findings obtained in Jeddah, Saudi Arabia where most of the water samples do not comply with WHO chemical standards for drinking purposes (Masoud, 2005).

Saiful et al (2010) in their study in Dhaka found that 100% of tap water samples were exceeded the drinking water guideline value of World Health Organization. In a study carried out on water sources in Makkah town, it was found that most of water samples were contaminated with different pathogens (Abdullah and Hani, 2013). Such result might affect the quality of food and subsequently endanger the health of clients.

Groundwater is suitable for drinking and other domestic purposes. However, bacteriological analysis of some ground water samples in different studied indicated the existing of bacteriological contamination. In the present study, bacteriological contamination was found in 3.1% of total samples. Although, the heat that used to cook food may kill part of these pathogens, some foods are eaten as fresh without cooking. In a study conducted in Khamis Mushait Governorate, south western Saudi Arabia, it was found that water derived from traditional sources (wells) showed increases in most of the investigated bacteriological parameters, followed by surface water as compared to bottled or desalinated water (Eed, 2009).

The contamination may occur during storage of water in food premises. It was found that underground storage tanks of water were more contaminated rather than roof tanks. This may attributed to different reasons i.e. these tanks are far away

from man-made contamination and during the day time, the water in the overhead tank is exposed to direct sun radiation and the water temperature in the tank warms up, especially in hot climate where the outside temperature may exceeds 50 oC during summer months (Abdullah, 2010).

Conclusion

A considerable number of food establishments were depending on unsafe water from public health point of view according to World Health Organization. Bacteriological contamination indicators were detected in several samples of water that taken from the premises.

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