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Water Hygiene Behaviors in Hotels and Restaurants
and Their Effects on its Bacteriological Quality

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Abstract: Contamination in drinking water is man made and usually due to improper handling, storage and serving which leads to the serious water borne diseases. A total of 340 drinking water samples were analyzed for bacterial contamination, out of them, 69.1% were non-potable by MPN method, 73.2% by MFT indicating presence of *E. coli* and 18.2% showed presence of thermotolerant *E. coli* of human fecal origin. Study concluded that poor hygiene behaviors such as improper method of storage, handling and serving, deteriorates the quality of drinking water which can be improved by imparting water hygiene behavior education to hotels and restaurants owners.

Key words: Drinking water, MPN test, MFT, thermotolerant *E. coli*, water hygiene behaviors

INTRODUCTION

Contamination in drinking water is man made and usually due to improper handling, storage and serving which leads to the serious water borne diseases. Around 2.2 million people die of basic hygiene related diseases like diarrhoea every year (WHO, 1984). WHO (2001) reported that water hygiene behavior on storage, handling affects the quality of drinking water. Potability of drinking water in hotels and restaurants is associated with poor hygiene environment. Tambekar and Banginwar (2004) stated that water become contaminated by incorrect method of collection, storage, serving and handling practices in hotels and restaurants. The improving water-handling practices by promoting water hygiene behavior improved water quality (Pinfold, 1990).

Water may become contaminated at any point between collection, storage, serving or handling in hotels and restaurants. Many hotels authority store drinking water in cement or plastic tanks (on ground or overhead), steel drum, earthenware and water coolers etc., without proper hygienic precautions (Tambekar *et al.*, 2006). Studies have shown that storage water container and handling procedure of water at home or hotel and restaurants causes quality deterioration to such an extent that the water posses potential risk of infection to consumers (Jagals *et al.*, 1999). Mintz *et al.* (1995) studied the health benefit from to the consumer water supply by improving domestic water storage and handling practices. Feachem (1984) studied the interventions for the control of diarrhoea diseases among young children. Due to improper storage and handling of drinking water in hotels and restaurants people get contaminate water with pathogenic microorganisms (Kaltenthaler and Drasar, 1996). Thus it indicated that improper storage handling and serving practices usually contaminate the drinking water in hotels and restaurants thus attempt was made to find out the water hygiene behavior in hotels and restaurants and their effect on the bacteriological quality of drinking water.

MATERIALS AND METHODS

A total of 340 drinking water samples were collected from the different types of hotels and restaurants, which had categorized as high class hotels (03), reasonable good quality (49), medium quality (60), road side hotels (65), road side Dhaba (66), government office canteens (10), bhojanalay/khanawal (21), pavbhaji/bhelwala (35), sweet mart/garden restaurants (27) and cold drinks/lassiwala (04) etc. in Amravati city. The hotel and restaurants owner usually stored the drinking water in water cooler, cement tank, ground level cement tank without tap, overhead tank, earthenware with/without tap and drum.

The collected drinking water samples were examined for potability. All the water samples were examined by MPN test (9 tube-test; containing double and single strength MacConkey purple broth with Durham's tube) for its potability and the coliform contamination in water was recorded within 24 h. At same time all samples were analyzed by Membrane Filtration Test (MFT) using M-EC (M 1095, Hi-media) test agar for testing *E. coli* in drinking

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water and the colony showing yellow color identified as *E. coli*. The MPN positive test broth was further processed for the presence of thermotolerant *E. coli* by sub-culturing in tryptone broth for indole test and brilliant green lactose bile broth (Eijkman's test) and incubated at 45.5°C. All bacteriological media were obtained from Hi-Media Pvt. Ltd, Mumbai, India.

RESULTS AND DISCUSSION

The hotels and restaurants in Amravati city were categorized as high class hotels, reasonably good quality, medium quality, road side hotels, road side tapri/Dhaba, government office canteens, Bhojanalay/khanawal, pavbhaji/bhelwala, sweet mart/garden restaurants and cold drinks/lassiwala etc., on the basis of their hygienic conditions and type of food provided. A total of 340 drinking water samples were analyzed for bacterial contamination, out of them, 235 (69.1%) were non-potable by MPN method, 249 (73.2%) were contaminated by MFT indicating presence of *E. coli* and total 62 (18.2%) water samples were confirmed to be contaminated with thermotolerant coliforms, by Eijkman test indicating *E. coli* of human fecal origin. Out of these samples, 105 (coliform MPN index <10) were found to be potable by MPN but at same time 24 samples were shown positive for *E. coli* by MFT and all 105 samples were negative for TTC. The 24 samples which were shown containing *E. coli* by MFT may not be contain thermotolerant coliform. The MPN index >41 shown more or less same result of water sample either tested by MPN or MFT, indicating similar specificity of the both the test and shown containing *E. coli* of non specific origin. The less number of samples shown contaminations by Eijkman test shown only human fecal originated thermotolerant coliform indicating human fecal contamination in drinking water (Table 1).

The maximum bacterial contamination in drinking water was recorded in Pavbhaji/Bhelwala (88.6%), sweet mart/garden restaurants (81.5%), road side Dhaba (77.2%),

Bhojanalay Khanawal (80.9%), government offices canteen (80.0%) as compared to medium quality (60.0%), road side hotels (60.0%), good quality hotels (55.1%) and top class hotels (33.3%). Indicating poor hygiene condition while storage, handling and serving of drinking water. Comparatively low bacterial contamination was recorded in high class and good quality restaurants indicating good hygienic condition. Maximum thermotolerant coliform contamination was recorded in sweet mart (44.4%), Govt. office canteen (30%), cold drink and Lassiwala (25%), medium quality hotels and restaurant (18.3%), roadside Dhaba (16.8%) and roadside hotels (13.8%) as compare to good quality hotels and restaurants, Bhojanalay/Khanawal and Pavbhaji/Bhelwala by Eijkman test (Table 2).

In the hotels, it is important to maintain the hygienic conditions for customer's health. The finding suggested that drinking water might get contaminated during or after storage in container. Hazen (1988) studied on drinking water and diarrhoeal disease due to *Escherichia coli* and reported that, prevention of fecal contamination prevents water borne out breaks. Water may become contaminated at any point between collection, storage, serving or handling in hotels and restaurants. The potable water can be easily contaminated by incorrect method of storage, serving and handling practices (Tambekar and Banginwar, 2005).

The poor personal and domestic hygiene behaviors could be interpreted as an increased awareness towards maintaining cleanliness in a more hygienic condition. In case of withdrawing the water, the hotel owner and worker

Table 1: Potability of drinking water with various tests

MPN index	No. of positive samples		
	MPN	MFT	TTC
<10	105	24	0
11-40	60	50	5
41-100	49	45	10
101-240	37	37	10
241-500	12	12	2
501-2400	81	81	35
Total	340	249	62

Table 2: Quality of drinking water in hotels and restaurants

Types of hotels and restaurants	Total samples		MPN		MFT		TTC	
High Class Hotel	3	(1%)	1	(33%)	1	(33%)	0	
Reasonable good quality hotels	49	(14%)	27	(55%)	31	(63%)	6	(13%)
Medium quality Hotels	60	(18%)	36	(60%)	40	(67%)	11	(18%)
Road side Hotels	65	(19%)	39	(60%)	42	(65%)	9	(14%)
Road side Dhaba	66	(19%)	51	(77%)	53	(80%)	11	(17%)
Govt. Office Canteens	10	(3%)	8	(80%)	8	(80%)	3	(30%)
Bhojanalay/Khanawal	21	(6%)	17	(80%)	17	(80%)	2	(10%)
Pavbhaji/Bhelwala	35	(10%)	31	(89%)	31	(89%)	7	(20%)
Sweet Marts/restaurants	27	(8%)	22	(82%)	23	(85%)	12	(44%)
Cold drinks/Lassiwala	4	(1%)	3	(75%)	3	(75%)	1	(25%)
Total	340	(100%)	235	(69%)	249	(73%)	62	(18%)

should not directly dip hands or without handle or short handle and serve water hygienically in the try which prevent the secondary contamination as the hand or finger of hotels owner or worker make the contact and water get contaminated (Tambekar *et al.*, 2006). Thus, study concluded that poor hygiene behaviors such as improper method of storage, handling and serving, deteriorates the quality of drinking water which can be improved by imparting water hygiene behavior education to hotels and restaurants owners.

REFERENCES

Feachem, R.G., 1984. Interventions for the control of diarrhoea diseases among young children promotion of personal and domestic hygiene. Bull. World Health Organization, 63: 467-476.

Hazen, T., 1988. Fecal coliforms as indicators in tropical waters-A Review. Toxic Assessment, 3: 461-477.

Jagals, P., T.C. Bokaka and W.O.K. Grabow, 1999. Changing consumer water patterns and their effect on microbiological water quality as a result of an engineering intervention. Water SA., 25: 297-300.

Kaltenthaler, E. and B. Drasar, 1996. The study of hygiene behavior in Botswana - A Combination of qualitative and quantitative methods. Trop. Med. Intl. Health, 1: 690-698.

Mintz, E.D., E.M. Reiff and R.V. Tauxe, 1995. Safe water treatment and storage in the home: A practical new strategy to prevent water borne disease JAMA., 273: 948-953.

Pinfold, J.F., 1990. Faecal contamination of water and fingertip-rinses as a method for evaluating the effect of low-cost water supply and sanitation activities on faeco-oral disease transmission II, A hygiene intervention Study in Rural North-East Thailand. Epidemiol. Infect., 05: 377-389.

Tambekar, D.H. and Y.S. Banginwar, 2004. Studies on intervention for control of water born diseases: Promoting of personal and domestic hygiene in hotel's/restaurant's owner and workers. J. Comp. Toxicol. Physiol., 1: 267-276.

Tambekar, D.H. and Y.S. Banginwar, 2005. Studies on potential intervention for control of water born diseases: Promotion of storage, handling and serving practices of drinking water in hotels and restaurants. Pollut. Res., 24: 371-375.

Tambekar, D.H., N.B. Hirulkar, D.D. Bhokre, S.R. Gulhane and Y.S. Bhanginwar, 2006. Studies of hygiene behavior on bacteriological quality deterioration of water in hotels and restaurants. Res. J. Microbiol., 1: 183-189.

World Health Organization, 1984. Guidelines for Drinking Water Quality Vol. 2, Health Criteria and Other Supporting Information, World Health Organization, Geneva.

World Health Organization, 2001. Guidelines Standards and Health, Assessment of Risk and Risk Management for Water-Related Infectious Disease, World Health Organization Geneva, Switzerland.