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## **Studies of Hygiene Behaviour on Bacteriological Quality Deterioration of Water in Hotels and Restaurants\***

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**Abstract:** Total 225 drinking water samples from hotels and restaurants in Amravati city were analyzed by standard MPN technique for determination of bacteriological quality and hygiene behaviors on quality deterioration of water. Out of these, 143 (63.5%) were non-potable and 82 (36.4%) potable by MPN test. Out of these 143 non-potable water samples, 86 (60.1%) were confirmed fecal contaminated by Eijkman test. Study showed that highest contamination recorded in roadside hotels and dhaba's (83.3%). The 83.3% contamination was recorded in drinking water stored in containers without tap and 100% where drinking water withdrawn directly by dipping hands or utensil without handle. The hygiene behaviors such as the frequency of washing of storage container, hygienic condition of hotels/ restaurants owners and workers, uniform of worker, number of customer per day, health education of workers and owners also affect the potability of drinking water in hotel and restaurants.

**Key words:** Unhygienic practices, drinking water quality, bacterial contamination, MPN

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### **Introduction**

Unhygienic practices play an important role in transmission of diseases caused by pathogenic microorganism in drinking water. Unhygienic storage, handling and serving practices makes the potable water becomes non-potable and source of transmission of infection (WHO, 1996). During storage and handling in hotels and restaurants, people contaminate water with pathogenic microorganisms (Pinfold, 1990). In India 80% of the infectious diseases are contaminated water borne such as typhoid, cholera, dysentery and infectious hepatitis (WHO, 2001a). Water may become contaminated at any point between collection storage, serving or handling in hotels/restaurants. The potable water can be easily contaminated by incorrect method of storage or withdrawing by dipping dirty dipper or the finger of worker or serving to customer by pouring in to dirty glass, jug etc. (Tambekar and Banginwar, 2005). Potability of drinking water in hotels and restaurants was also associated with poor personal hygiene practices as well as unhygienic environments (Mintz *et al.*, 1995).

One way to improve water-handling practices is by promoting water-handling hygiene (Coulson, 2000). A strong pillar of hygiene promotion is hygiene education (International Water and Sanitation Center, 2001). The Amravati, a district place in Maharashtra state, is having more than 500 various types of hotels and restaurants and in average 40,000 customers drinks water per day in these places. The qualities of drinking water available in these hotels/restaurants

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were very poor and may cause infections (Lokmat Daily, 2000). Hence approach was planned to evaluate the potability and cause of contamination in drinking water, potential interventions in the storage, handling and serving practices by hotels owners and workers for controlling the water borne infection to the consumers by contaminated water in hotels and restaurants.

### **Materials and Methods**

A total 225 drinking water samples were collected from the different types of hotels and restaurants which in Amravati city (Maharashtra State, India) were categorized as top class, reasonably good quality, medium quality, road site hotels, road site tapri/dhaba, government office/canteen, bhojanalay/khanawal, pavbhaji/bhelwala, sweet marts/garden restaurants and cold drink/lassiwala etc. The source of water in hotels and restaurants were dug well, tube wells and government water supply.

A detail survey was made for method of storage, over all hygienic condition of hotels and restaurants, formal and health education of owners and workers, frequency of washing of water container, method of serving of drinking water to the customer, dress/uniform of workers. On the basis of these surveys, hotels and restaurants were classified and qualities of drinking water were correlated with above factors.

All water samples were subjected to bacteriological examination by using standard MPN procedure for total coliform by using MacConkey double and single strength broth. Those water samples positive by MPN tests were sub-cultured in Brilliant Green Lactose Bile broth and Tryptone broth (indole test) for detection of thermo tolerant fecal coliform by Eijkman test (APHA, 1998). All the bacteriological culture media were procured from Hi-media Pvt. Ltd. Mumbai. Collected data were analyzed by using SPSS software (SPSS version 8.0 for window) in relation to potability of drinking water.

### **Results and Discussion**

Contamination of drinking water in hotel and restaurants is associated with domestic and personal hygiene behaviors. The diarrheal diseases are prominent among the community due to unhygienic behaviors and low education, which can be control by water hygiene education programme (Feachem, 1984).

The quality of drinking water of 225 hotels and restaurants were analysed and found 63.4% water non potable and 36.4% potable There were no contamination recorded in high class hotels (0%) as compare to good quality hotels (53.5%), Bhojanalay (54.5%), road side hotels (58.3%) sweet mart/garden restaurants (60%), medium quality hotels (60.5%), government offices/canteen (80.6%), roadside tapri/dhaba (86.6%). It clearly indicated that most of the hotels and restaurants served contaminated drinking water (Table 1).

These finding are in concordance with Nala *et al.* (2003), who stated that the sources storage practices and handling the water from storage container at home and hotels caused quality deterioration and water poses potential risk of infection to consumers. In present study the percentage of drinking water stored in water cooler w/o filter (62.5%), over head tank/ water cooler with filter (60%), cement tank (ground level with tap) (64%), over head tank (55%), rajan (earthenware) with tap (52.9%), rajan (earthenware) without tap (83.3%), drum with tap (78.5%) drum without tap (68.1%). These results indicated that the water of the container with tap or cooler with filter showed comparatively more potability than the container without tap, rajan (earthen ware), drum, ground level tank (Table 2).

**Table 1: Hotels/restaurants and quality of drinking water**

Type of hotels and restaurants	Total	Quality of drinking water	
		Potable	Non potable
High class (3 star)	2	2 (100%)	0 (0%)
Reasonably good quality	28	13 (46.4%)	15 (53.5%)
Medium class (Reasonably clean)	71	28 (39.4%)	43 (60.5%)
Road site hotels (Reasonably clean)	36	16 (44.4%)	21 (58.3%)
Road site tapri/Dhaba	31	06 (19.3%)	25 (80.6%)
Govt. Office/canteen	15	07 (46.6%)	13 (86.6%)
Bhojanalay/Khanawal	22	05 (22.7%)	12 (54.5%)
Pav bhaji/Bhelwala	15	03 (20%)	12 (80.0%)
Sweet mart/Garden restaurants	5	02 (40%)	03 (60.0%)
<b>Total</b>	<b>225</b>	<b>82 (36.4%)</b>	<b>143 (63.5%)</b>

**Table 2: Method of storage and quality of drinking water in hotels/restaurants**

Method of storage	Total	Quality of drinking water	
		Potable	Non potable
Water cooler w/o filter	8	03 (37.50%)	05 (62.5%)
OHT/water cooler w/ filter	15	06 (40.00%)	09 (60.0%)
Cement tank (GL with tap)	12	05 (41.6%)	07 (46.6%)
Cement tank (GL w/o tap)	25	09 (36.0%)	16 (64.0%)
OHT (cement/PVC)	40	18 (45.0%)	22 (55.0%)
Matka, Rajan w/o tap	24	04 (16.6%)	20 (83.3%)
Matka, Rajan w/tap	51	24 (47.00%)	27 (52.9%)
Tank, drum w/tap	28	06 (21.40%)	22 (78.50%)
Tank/drum w/o tap)	22	07 (31.80%)	15 (68.1%)
<b>Total</b>	<b>225</b>	<b>82 (36.4%)</b>	<b>143 (63.5%)</b>

**Table 3: Methods of withdrawing and potability of drinking water**

Methods of storage of drinking water	Total	Quality of drinking water	
		Potable	Non potable
Tap	37	13 (35.1%)	24 (64.8%)
Jug/Mug w/Long handle	80	25 (31.2%)	55 (68.7%)
Jug/Mug w/short handle	33	15 (45.4%)	18 (54.5%)
Direct by dipping hand	05	00	05 (100%)
Tap and Jug	44	16 (36.3%)	28 (63.6%)
Directly by Jug	26	13 (50.0%)	13 (50.0%)
<b>Total</b>	<b>225</b>	<b>82 (36.4%)</b>	<b>143 (63.5%)</b>

The method of withdrawing or collecting the water from storage container also significantly deteriorate the quality of drinking water and resulted into 100% contamination by direct dipping hand, 68.7% by jug /mug without handle or short handle, 54.5% by jug, mug with short handle and least 64.8% by directly through tap indicating that the withdrawing the water by dipping hand or utensil without handle or short handle lead contamination in drinking water (Table 3). Pinfold (1990) had similar finding and showed that during storage and handling in hotels and restaurants, people contaminate water with pathogenic microorganisms.

The frequency of washing of storage containers had prominent effect on the quality of water and indicated that higher the frequency of washing, less the contamination and vice versa (Fig. 1). The over all hygienic condition of hotels/ restaurants also affected the quality of drinking water and adequate hygienic showed least coliform contamination as compared to poor or no hygienic conditions (Fig. 2). The workers with clean and neat uniform kept the water clean as compared with dirty uniformed

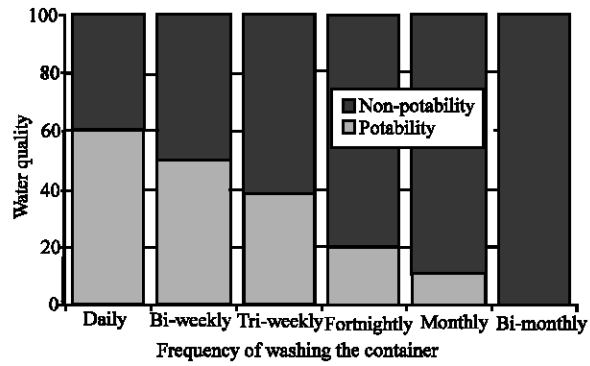


Fig. 1: Effect of frequency of washing of container on quality of water

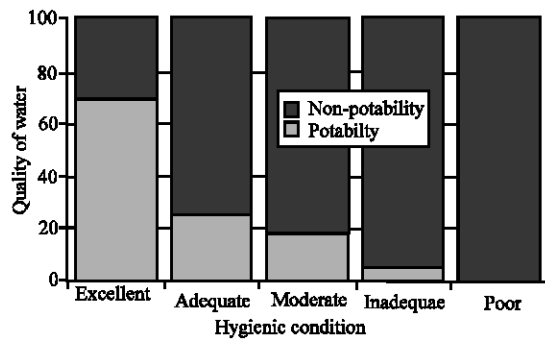


Fig. 2: Effect of hygienic condition on quality of water

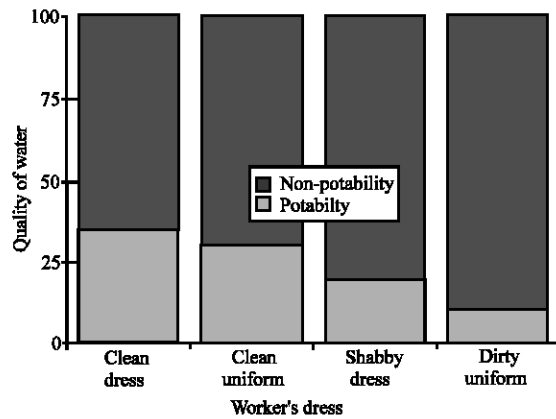


Fig. 3: Effect of worker's uniform on quality of water

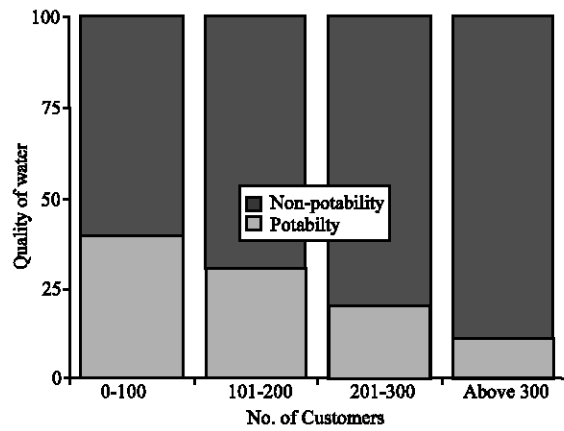


Fig. 4: Effect of number of customers on quality of water

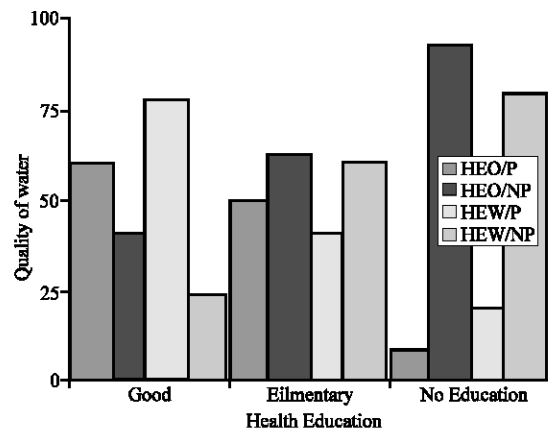


Fig. 5: Effect of health education on quality of water

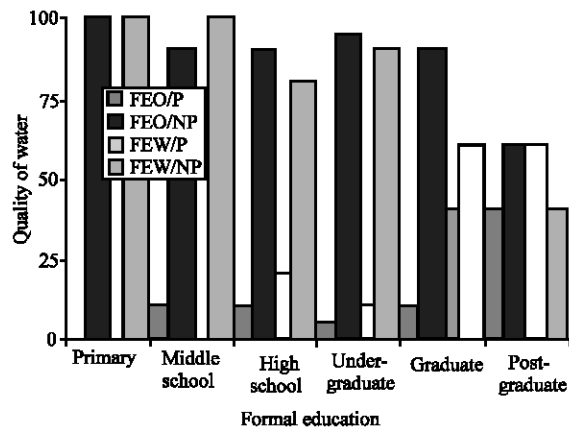


Fig. 6: Effect of formal education on quality of water

workers (Fig. 3). The numbers of customers per day in hotels/restaurants was directly proportional to degree of contamination (Fig. 4). The knowledge of health education affected the quality of water as maximum contamination was recorded in hotels/restaurants where owners/workers did not have knowledge of water hygiene and health. The workers and owners with good knowledge of water hygiene and health kept the water least contaminated indicating that the primary health education is necessary to improve the storage and handling practices (Fig. 5). The educated owner or worker of hotel kept the drinking water free from contamination indicated that the formal education also improved the quality of water (Fig. 6).

WHO (2001b) reported that hygiene education on people behaviors in storage, handling of drinking water potability in hotels and restaurants can be associated with poor hygiene environment. Tambekar and Banginwar (2004) also stated that water may become contaminated by incorrect method of collection storage, serving and handling practices in hotels and restaurants, Kaltenthaler and Drasar (1996) showed that hygiene education changed people's behaviors into positive domestic water hygiene practices such as regular hand washing, proper collection, storage and handling of water.

The poor personal and domestic hygiene can increase the incidence of water borne infection and the improvement in over all water hygiene behaviors could be interpreted as an increased awareness towards maintaining cleanliness in a more hygienic condition. Water should be collected from the storage tank or container through the tap or container having long handle, be served to customer without dipping the hands and fingers in the storage tank or glass. The owner of hotels and restaurants should have good knowledge of water hygiene and health education, and worker should be clean and neatly uniformed. The WHO, Rajiv Gandhi Water Mission and other Government health agencies should properly implement water hygiene education programme to keep good quality water to prevent water borne infection.

Study concluded that poor hygiene behaviors such as improper method of storage, improper handling, number of customer per day, owners health education, uniform of hotel workers, handling of water without tap or utensils without handle leads to bacteriological quality deterioration of water but which can be improved by imparting water hygiene behavioral educational programme to the peoples in hotels and restaurants.

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