Microbiological Quality of Drinking Water in Hotels and Restaurants of Mysore City, Karnataka, India

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Abstract: Drinking water quality of Mysore city hotels and restaurants was assessed for bacterial contamination particularly for coli forms. The hotels include Star hotels, Medium hotels, Small hotels and Fast food centers (sweet stalls, juice centers, gobi centers, canteen, tea stall etc). A total of 51 Hotel drinking water samples were analyzed for bacterial contamination. The analysis of source wise contamination revealed that 37% of water samples from class II, 73% of water samples from class III and 71% of water samples from class IV were contaminated with coliforms. The MPN index reveled that about 50 % of the samples have more than 10 MPN/100 ml, about 25% of the samples the MPN index was 11-40 and in the remaining samples the MPN index was more than 100. From 51 drinking water samples 93 isolates of coliforms were recorded of which 18 isolates of *E. coli,* 16 isolates of *Klebsiella,* 24 of Citrobacter, 5 isolates of salmonella and 30 isolates are of other bacteria. Of all coliforms *Citrobacter* was dominated in their occurrence.

Key words: Drinking water quality · Coliform · Water hygiene · *E. coli* · MPN

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. For hotels, water is a value-adding factor. Its quality determines the guest's satisfaction, its costs affect the budget. Around 2.2 million people die of basic hygiene related diseases like diarrhea every year [1, 2] reported that water hygiene behavior on storage; handling affects the quality of drinking water. Indicator bacteria influence on quality of drinking water in Hotels, Restaurants and canteens. Generally Coliforms and *Entercoccus* bacteria are "indicator" organisms generally measured to assess microbiological quality of water. However these aren't generally what get people sick. General Coliforms indicate that the water has come in contact with plant or animal life. Coliforms are universally present, including in pristine spring water. Due to improper storage and handling of drinking water in hotels and restaurants people get contaminated water with pathogenic microorganisms [3].

The hygiene behaviors such as the frequency of washing of storage containers, hygienic condition of hotels or restaurants owners and workers uniforms of workers, numbers of customer per day, health education of workers and owners also affect the potability of drinking water in hotels and restaurants [4].

Mysore is a burgeoning industrial center and tourism hub of South India. The population of Mysore city comprises of 11 lakh urbanites, one of the prominent cities of Karnataka. There is more than 4000 Hotels in Mysore. The qualities of drinking water available in these hotels and restaurants has not been studied so far. Hence an attempt has been made to evaluate the potability and cause of contamination in drinking water in hotels and restaurants.

MATERIALS AND METHODS

In the present study the drinking water quality of Mysore city hotels and Restaurants was assessed for bacterial contamination particularly for coliforms. The hotels of Mysore city were separated into Class I, Class II, Class III and Class IV which includes Star Hotels, Medium Hotels, Small Hotels and fast food centers (sweet stalls, juice centers, gobi centers, canteen, tea stall

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etc). A total of 51 Hotel drinking water samples were analyzed for bacterial contamination, out of which 3 water samples were from Class I, 19 water samples were from Class 2, 15 water samples were from Class 3 and 14 water samples were from Class 4.

Standard methods were followed for collection of water samples for the physicochemical analysis and bacteriological analysis are mentioned below. For physico-chemical analysis a clean polythene bottle of 500 or 1000 ml were used for collection of water samples. For bacteriological analysis a cleaned autoclavable polythene bottle is taken and a known normality of sodium thiosulphate is added in drop wise (2-3drops) to the polythene bottle and sterilized by autoclaving and then used for water sampling.

Microbial Examination of Water Samples: The samples collected in replicates were analyzed for microbiological quality according to the standard method. The total plate count was conducted by Total plate count technique on Plate count agar (PCA) and counting the colonies developed after the incubation at 37°C for 24 hrs [5], the count was reported as CFU (colony forming units). The total coliform was determined by multiple tube fermentation technique. In this experiment, three sets of tubes were inoculated with a tenfold difference in inoculums volume between each set: one set of three tubes was inoculated with 10 ml per each tube, one set was inoculated with 1 ml per each tube and the last set was inoculated with 0.1 ml per each tube. After appropriate incubation, the tubes were then examined for the diagnostic reaction: gas production for coliforms. Each set was scored for the number of positive tubes and the score of all three sets was then used with the Most Probable Number. The medium used in the multiple tube technique for coliforms was Lauryl SO4 Lactose Broth and was placed in tubes containing Durham tubes.

The Presumptive Test was followed by the Confirmative Test and the Completed Test. The Confirmative Test consists of streaking a positive Presumptive tube (gas production) onto Eosin Methylene Blue Agar (EMB Agar). A positive Confirmative Test was then the presence of green sheen colonies on EMB streaked from a positive Presumptive Test. The Completed Test was the inoculation of Phenol Red Lactose Broth with a green sheen colony from the Confirmative Test. A positive Completed Test was the production of acid and gas in the medium. Thus, additional biochemical tests are usually done from EMB colonies.

RESULTS AND DISCUSSION

In the present study the drinking water quality of Mysore city hotels and Restaurants was assessed for coliform contamination. A total of 51 Hotel drinking water samples were analyzed for bacterial contamination, Out of 51 Hotel drinking water samples analyzed 21 water samples were potable and 30 water samples were non potable. In the Class 1 hotel water samples have not shown presence of any coliforms whereas the Class 2, 3 and 4 hotel water samples have shown the presence of coliforms. The analysis of source wise contamination revealed that 37% of water samples from class II, 73% of water samples from class III and 71% of water samples from class IV were contaminated with coliforms (Fig. 1).

The MPN index reveled that about 50 % of the samples have more than 10 MPN/100 ml, about 25% of the samples, the MPN index was 11-40 and in the remaining samples, the MPN index was more than 100 (fig 3). From 51 drinking water samples 93 isolates of coliforms were isolated of which 18 isolates of *E. coli* 16 isolates of *Klebsiella*, 24 of *Citrobacter*, 5 isolates of salmonella and 30 isolates are of other bacteria. Of all coliforms *Citrobacter* was dominated in their occurrence (Fig. 2).

The results of Physico chemical parameters of 51 drinking waters samples have showed that all the samples were Colourless, Tasteless and Odourless and the pH of all the samples varied from 6.9 to 8.2 whereas temperature varied from 29°C to 34°C. This may be due the changes in the weather and the storage condition of the hotels. Turbidity of all the samples which was recorded by the Nephlometer showed zero. The chlorine content of all the samples which was tested by the Senthil Chloroscope was less than 0.1ppm.

Drinking water quality of hotels is always critical. Contaminated drinking water is one of the leading sources of health problems for travelers and can cause anything
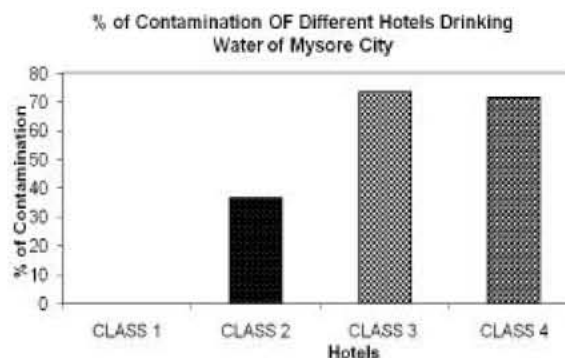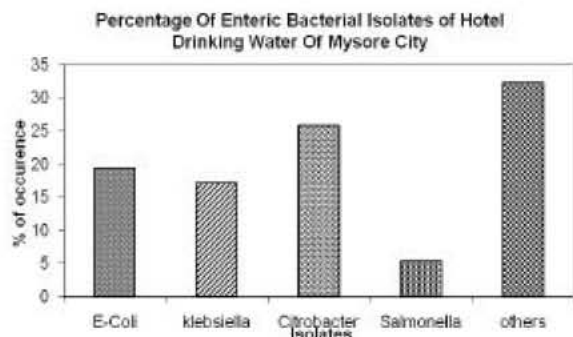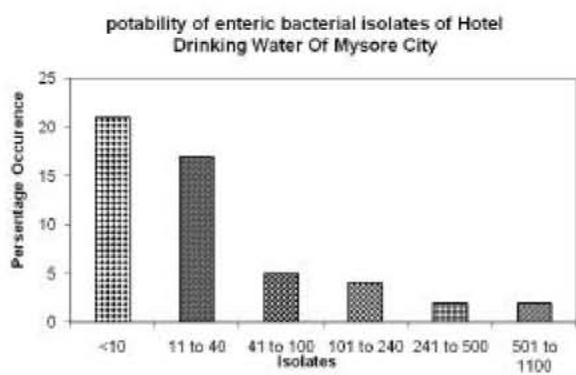

Fig. 1:

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from mild to serious bacterial diseases. The study of drinking water quality of different hotels revealed that, the hygienic conditions of the majority of the hotels were not under WHO standards. Physicochemical parameters, such as pH, temperature and turbidity have a major influence on bacterial population growth [6-9]. Chlorination of drinking water was a major factor in the reduction in the mortality rates associated with waterborne pathogen. But decreased concentration of chlorine in stored drinking water indicates the storage of water long for long time which leads to the contamination. The presence of *E. coli* in drinking water must be considered as harm to human health [10]. These may exert hazard on customer's health. The findings suggested that drinking water might get contaminated during or after storage in container.

These findings are in concordance with Nala *et al.,* [11], 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. Hazen [12] studied on drinking water and diarrheal disease due to *Escherichia coli* and reported that, prevention of fecal

contamination prevents water borne out breaks. The potable water can be easily contaminated by incorrect method of storage, serving and handling practices.

The number of customers per day in hotels and restaurants was directly proportional to degree of contamination. The knowledge of health education affected the quality of water as maximum contamination was recorded in hotels or restaurants where owners or workers did not have hygiene and health. The workers and owners with good knowledge of water are necessary to improve the storage and handling practices. 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 [13].

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 should not directly dip hands or without handle and serve water hygienically as the hand or finger of hotels owner or worker make the contact and water get contaminated [4]. One complex, but necessary, approach must be to change people's habits that contribute to the pollution of drinking-water. Strategies to promote proper household storage must be encouraged because stored water, touched by hands and unclean vessels, can become significantly more contaminated than the source [14]. 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. So, the water and sanitation related diseases could be considerably reduced by adopting simple positive behaviors such as hand washing with soap at critical times, proper handling and storage of water, food protection and improving domestic hygiene.

The water that comes out of the taps in a hotel must be absolutely perfect in terms of hygiene, taste, smell and clarity. If the mains water supply is unable to deliver top quality drinking water, the hotelier must find a way to treat it, so that guests can obtain drinking water that is perfectly hygienic, free from unpleasant tastes and smells and perfectly clear. The hotelier assumes even greater responsibility if the hotel's water does not come from a municipal supply, but from alternative sources like wells, brackish or sea water and has to be rendered drinkable before it can be used.

CONCLUSION

Overall study concluded the poor personal and domestic hygiene can increase the incidence of water borne infection and the improvement in overall water hygiene behaviors could be interrupted as an increased awareness towards maintaining cleanliness in a more hygiene condition. Water should be collected from be 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 should be clean and neatly uniformed.

ACKNOWLEDGEMENTS

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