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Bacteriological analysis of drinking water in selected schools

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Bacteriological analysis was undertaken on 90 samples of water from primary, secondary and high schools in 10 townships of Yangon area. Most of the schools (8.81 % of primary; 55.56% secondary & 70% high schools) have artesian wells. It was also found that 18.18%, 33.33% and 30% of primary, secondary and high schools respectively received water supply from Yangon City Development Committee (YCDC). In this study, only one secondary school used water from hand dug well; one high school had stainless steel tank; some schools had aluminium tanks and some had concrete brick storage containers. Purified water bottles with different brand were used for drinking water in most of the schools. From drinking water sources, coliforms were identified from purified water (66.67%), YCDC water (100%), artesian water (82.35%). Alhough faecal coliforms were not identified from purified water, they were isolated from YCDC water sources (83.33%), and artesian water (64.71%) which were used as drinking water. For domestic water source, coliforms and faecal coliforms were identified from YCDC water (100% & 87.50%) and artesian water (70% & 45%) respectively. From water used as sanitary purposes, coliforms and faecal coliforms were identified from YCDC water (100% & 62.50%) and artesian water (95% & 70%) respectively.

INTRODUCTION

The major causes of disease and death from waterborne illness in the history of humanity have been microbiological factor, and only rarely other components. Waterborne infection occurs through excreta contaminating supply of water or by contaminated through persons. The coliforms bacilli are thus, the most reliable indicators of faecal pollution [1]. Illness in a community, associated with an episode of water contamination with sewage was reported in a rural Irish town [2]. Outbreaks of gastrointestinal illness associated with contamination of main water supply were shown by various investigators [3-17]. Drinking water should contain no impurity that offends the sense of sight, taste or smell. Although water is abundent on the earth, it is becoming more and more difficult problem to provide fresh water, on account of growth of the population and the rise in the standard of living and also due to the development of modern industrial technology. Thus, availability and adequate use of safe water supply round the year would decrease the incidence of a number of specific indicator conditions which in turn would improve the health status of the community. The study was conducted with the following objectives:

General objective:

To determine the bacteriological quality of water in schools.

Specific objective

To determine the sanitary quality of water by determination of coliforms, faecal coliforms, total counts and specific pathogens (Salmonellae, Shigellae, *Escherichia coli* and Vibrios).

MATERIALS AND METHODS

Primary, middle and high schools from 10 townships of Yangon area were selected randomly as study areas from January to March, 2003. Drinking water samples from 24 artesian wells, from one campus in January, 2002 (cool dry) and May 2003 (hot wet) were tested for comparison. Approximately one litre each was collected aseptically from drinking water sources, domestic use water and from the sources of water used for sanitary purposes. All samples were carried under cold chain transportation to reach the laboratory within 3 hours after collection [1].

Bacteriological examination

All procedures were carried out as in the standard manual described by WHO [1]. Examination includes determination of coliforms and faecal coliforms by multiple tube and membrane filtration methods; and isolation, identification, characterization and serotyping of the isolated bacterial pathogens [2].

RESULTS

Types of water sources from Yangon schools

Three different types of water sources were observed from selected schools; 18.18% primary schools received water from YCDC and 81.81% have artesian wells. Among secondary schools, 55.56% have artesian wells, 33.33% have YCDC supply and only one school has hand dug well. It was also observed that 70% high schools also have artesian wells and 30% have YCDC supply (Fig. 1).

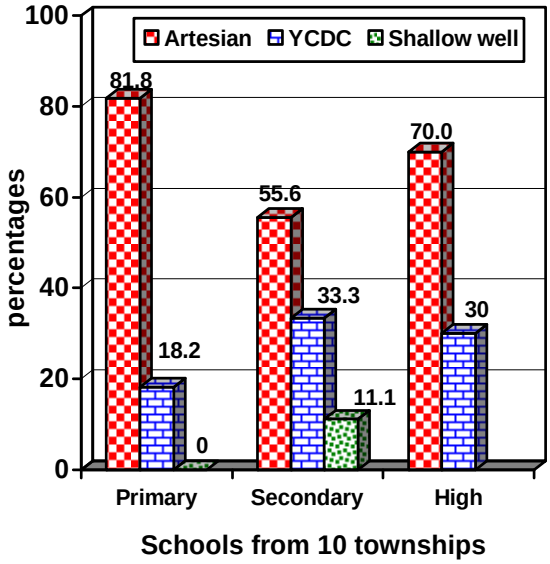

Fig. 1. Types of water source from primary, secondary and high schools from 10 townships of Yangon

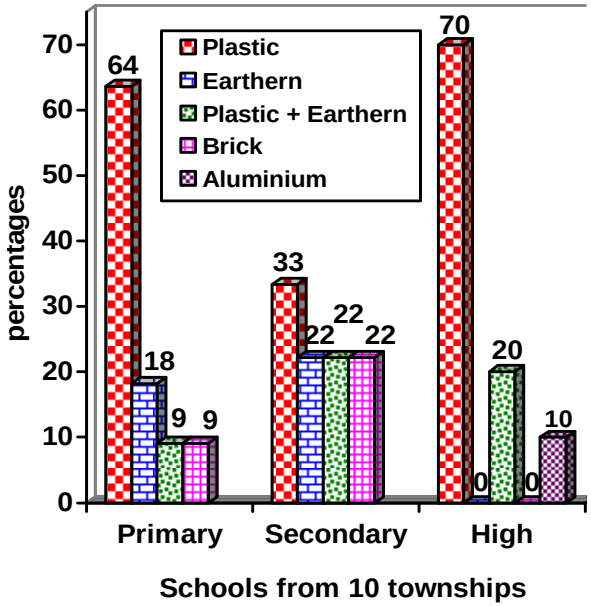

Fig. 2. Types of storage containers used for drinking water in schools

Types of storage containers used for drinking water

Most of the schools provided drinking water in good containers, either in big plastic bottles (20 litres) with cap; or in earthern wares, or they used both type of containers. One of the schools used an aluminium tank provided with taps. Some were made of

bricks and connected with taps. Those types of storage containers used in primary, secondary and high schools are shown in Fig. 2. It was observed that 63.64% of primary schools used plastic bottles, 18.18% used earthern wares, and 9.09% used both types and 9.09% used brick type. From secondary schools, 33.33% used plastic bottles, 22.22% each used earthern types, plastic and earthern types or brick types respectively. In high schools, 70% used plastic bottles, 20% used plastic and earthern pots and 10% used aluminium tank. The most prominent type they usually used was of polyethylene with polypropylene stopcocks.

Determination of coliforms and faecal coliforms by multiple tube method and by membrane filtration techniques

The presence of coliforms and faecal coliforms from three different sources from each schools is shown. From drinking water sources; faecal coliforms were not identified but coliforms were identified from 66.67% of purified water (with different brands) used in those schools. From YCDC water, all tested samples were contaminated with coliforms and 83.33% with faecal coliforms., Some 82.35% of coliforms and 64.71% of faecal coliforms were isolated from artesian water source (Fig.3).

All samples of domestic water from YCDC source were contaminated with coliforms and 87.50% with faecal coliforms. Artesian water source was contaminated with 70% of coliforms and 45% of faecal coliforms (Fig. 3).

Water for sanitary purposes from YCDC also had coliforms in all the tested samples and 62.50% had faecal coliforms. Artesian water source was with shows 95% of them with coliforms and 70% with faecal coliforms (Fig. 3).

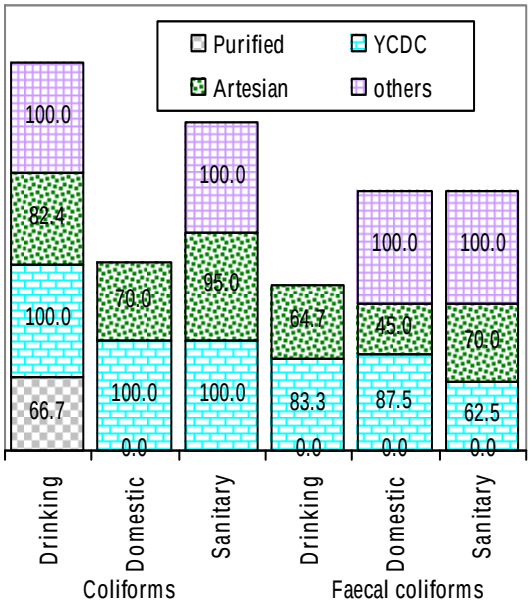

Fig. 3. Contamination of coliforms and faecal coliforms from water sources

When comparing the presence of coliforms and faecal coliforms in cool dry and hot wet seasons in one campus area, the isolation of coliforms 71.43% in cool dry gave rise to 85.71% in hot wet season. Similarly, the faecal coliforms isolated from 14.29% in cool dry increased up to 66.67% in hot wet season (Fig. 4).

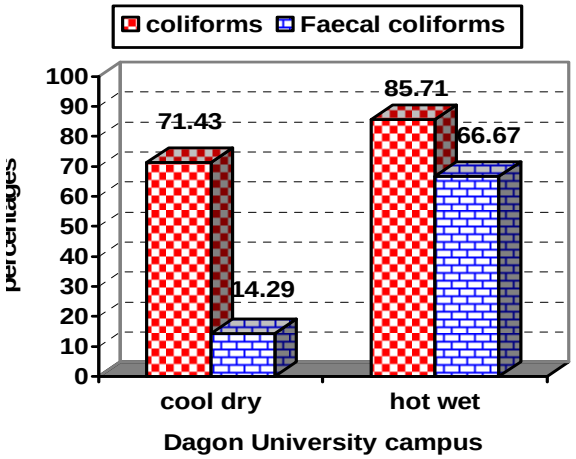

Fig. 4. Changing pattern of coliforms and faecal coliforms in two seasons from drinking water sources from Dagon University campus

Most probable number of bacteria from different water sources

Each sample from different sources varied in bacterial containmation. It was found that all samples from YCDC used for drinking water purposes were contaminated with heaviest growth of coliforms (>1800MPN /100ml).

Distribution of coliforms and faecal coliforms from school water in different townships

From 30 schools, in 10 townships, school water from Thaketa township seems to be contaminated more than in other townships. Faecal coliforms were not isolated from water from all three schools of Insein and South Okkalapa township where they used artesian wells. It indicated that the original source (>200 feet) was found to be free from faecal coliforms which refelects that natural water is pure. It also indirectly indicated that contamination occurs through carriage of water by some means.

DISCUSSION

There are interesting trends in the common causes of gastroenteritis with the aspect of new and re-emerging infectious organisms through water sources. Drinking water was identified as a propable source of infection by enterotoxigenic *Escherichia coli* (ETEC) in homes of children with diarrhoea in Thailand [19] and in Bangladesh [20]. Occurrence of drug-resistant bacteria in water [21, 22] and long term starvation-survival of bacteria [23] were reported.. Environmental research with special emphasis on water was reported and the survival of bacteria in water was described in this locality [24]. In this study, the distribution of coliforms and faecal coliforms was high. It was assumed that these were contaminated more after handling and carrying processes after storage of water. It was suggested that after obtaining of good quality water, a systematic pipeline system should be developed especially for drinking water purpose. More health education measures should be undertaken.

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