Microbiological Quality of Bottled Water Available in Lahore City

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ABSTRACT

BACKGROUND: A large number of infectious diseases are transmitted primarily through the water supplies contaminated with human and animal excreta. This study was undertaken for the microbiological testing of bottled water used for drinking purposes by the public in the Lahore city.

METHODS: This descriptive study was undertaken for the microbiological testing of bottled water used for drinking purposes by the public in the Lahore city.

RESULTS: Twenty-four samples were collected at investigator's convenience. Microbiological testing was performed using the membrane filter technique. Of the 24 samples tested, two (8.3%) were found to be contaminated with bacteria found in human or animal excreta.

CONCLUSION: Although only 8.3% samples were found to be unsafe bacteriologically, this emphasizes that all bottled waters should not be taken for granted to be safe for consumption and may need to undergo additional processing by the consumers.

Key Words: Bottled Water; Total Coliform; Membrane Filter Technique; Microbiological Analysis; Lahore

INTRODUCTION

Over one billion people out of seven do not have access to safe drinking water. Reasonable access to safe drinking water is defined as the availability of at least 20 liters per person per day from an improved source within 1 kilometer of the user's dwelling. Approximately 40,000 humans die daily from diseases directly related to consumption of contaminated water. Four thousand childhood deaths every year worldwide are caused by the use of contaminated water [1]. Safe and wholesome water has been defined as "water that is free from pathogenic agents, free from harmful chemical substances, pleasant to taste and smell" [2]. In developing countries, such as Pakistan, 60% of the population has no access to pure drinking water [3]. Eighty-eight percent of the functional water supply schemes in Pakistan provide water that is unsafe for drinking because of microbiological contamination [4]. A large number of infectious diseases are transmitted primarily through water supplies, contaminated with human and animal excreta [5]. Outbreaks of water borne diseases occur throughout the world but are especially common in developing countries [6, 7, 8].

The human pathogens, that present serious risk of diseases whenever present in the drinking water, include Salmonella species, Shigella species, Yersinia enterocolitica, Campylobacter species, various viruses such as Hepatitis A virus, Hepatitis E virus, Rota virus and parasites like Entamoeba histolytica, Giardia lamblia and others [9, 10, 11].

Safe and fresh water supplies are at risk in many areas of Pakistan. Pakistan is in "high water stress condition", which occurs when the ratio of use to availability exceeds 40 percent [12].

Due to the importance of safe drinking water, drinking water is routinely examined to ensure safety in developed countries. It is not practical to monitor the drinking water for every possible pathogen. Therefore, normal intestinal organisms, such as coliform bacteria, are used as indicator of fecal pollution [13, 14, 15, 16] because they are easy to detect and count [17].

The term bottled water is defined as "portable water obtained from approved underground water source and preserved in a sealed container or package and is offered for sale for human consumption or other consumption uses" [18]. In

Pakistan, very few studies have been carried out in different parts of Pakistan showing that the bacterial contamination of bottled water is quite high [19-24]. The present study was carried out to determine the current status of bacteriological quality of bottled water available in Lahore city and whether it meets the required standard.

METHODS AND MATERIALS

Bottled water samples were collected in 500 ml capacity bottles with intact seals. These water samples were transported to the microbiology laboratory of the Combined Military Hospital (CMH), Lahore. In laboratory, all samples were tagged and then tested for total coliforms count. The tests were performed according to the standard procedure using the membrane filter technique [25].

Briefly, under aseptic conditions, 100 ml of water from each sample was poured into autoclaved containers, brought to the room temperature, and then subjected to complete vacuum suction of water into the flask through the porcelain filter paper having pores of 0.45 μm each.

Then the filter paper was transferred with the help of sterilized flamed forceps to the Petri dish containing McConkey's agar. These agar containing Petri dishes were then covered and placed in the incubator for 12 hours. Growth was detected as visible colonies.

RESULTS

Of the 24 brands of mineral/bottled/pure water samples available in the market, two brands were found positive for bacterial contamination, and therefore were found unfit for human consumption by the microbiology laboratory at CMH Lahore.

The two brands declared unfit for human consumption were found to be highly contaminated with total coliform count of 180+/100 ml of water sample subjected to testing.

Remaining 22 brands showed no bacterial contamination and were found fit for the human consumption.

DISCUSSION

Lahore is the second largest city of Pakistan, with estimated population of over 10 million. In the present study, we assessed the bacteriological quality of drinking bottled water available in Lahore. According to WHO, there should be no

coliform bacteria/100 ml of water meant for consumption by human. In the present study, two water samples were positive for bacterial contamination and unfit for human consumption.

It is essential to test the drinking water regularly and frequently throughout the year to ensure the safe supply of water to the public as contamination may be intermittent. An appropriate routine monitoring system should be adopted to prevent or diminish the chances of water contamination.

The samples included in the research were of the following brands: Masafi, Wimbleoon, Sufi, Springley, Blu, Aqua Safe, Natural, Aqua Pure, Aqua Fina, Pharmagen, Nation, Pure Life, Splash, Kinley, Gourmet, Klinz, Himalaya, IWT, Volvic, Aqua One, Classic, MUM, Premeik, and Aqua.

Membrane filter method was chosen as it demands less preparation time compared to other traditional methods while at the same time it is highly reliable. The water quality can be tested by observing the presence of bacteria, counting the colonies as an optional step for more accurate result descriptions. Membrane filter technique helps to culture different types of bacteria present in the same. It is widely accepted and effective technique used in government and private sector for quality control.

A study that examined the bacteriological quality and mineral content of the drinking water collected from different local sources in two different seasons consumed at Lahore found that approximately 21% of the samples tested were positive for water contamination [24].

Although these studies were conducted on drinking water from sources other than bottled water in Pakistan, our study concludes that even bottled water is not absolutely safe and its quality needs to be monitored closely.

Another study found that the bacterial contamination of water varied through different parts of the Punjab province. The contamination was noted in 96% samples from domestic pumps, 91% samples from rural tap water, and 43% from tap water within Lahore [26].

The problem of contaminated water is not unique to Pakistan but is prevalent in developing countries. For example, in Trinidad, microbial quality of domestic and imported brands of bottled water was assessed in a study [27]. Of the 344 water samples tested, 262 (76.2%) were domestic and 82 (23.8%) were imported brands. Eighteen (5.2%) of the 344 samples contained coliforms with a mean count of 0.88+/-6.38 coliforms per 100 ml, while 5 (1.5%) samples

contained E. coli. The prevalence of total coliforms in domestic brands of bottled water was 6.9% (18 of 262) as compared to 0.0% (0 of 82) detected in imported brands [27].

Similarly, in Fiji, bacteriological quality and risk assessment of the imported and domestic bottled mineral water sold was examined in a study. Seventy-five samples of bottled mineral water belonging to three domestic brands and 25 samples of one imported brand were analyzed for heterotrophic plate count (HPC) bacteria and fecal coliforms. Between 28% and 68% of the samples of the various domestic brands failed to meet the WHO standard of having less than 100 colony-forming units (CFU) per 100 ml at 22 degrees Celsius and 7% of these also tested positive for fecal coliforms [28].

CONCLUSION

Of the 24 brands of bottled water available in the Lahore market for public consumption, two brands were found to be contaminated and thus unsafe for drinking. The sale of the bottled water should be closely monitored so that a safe and reliable water supply is available for public consumption and for maintenance of public health.

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