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SUPPRESSION OF WATER BORNE PATHOGENS BY HERBAL CONSTITUENTS IN DRINKING WATER

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ABSTRACT

Drinking water or potable water is the water, pure enough to be consumed or used with low risk of immediate or long term harm. Water has always been an important and life sustaining drinks to humans and is essential to the survival of all organisms. Water composes approximately 70% of the human body by mass. Over large parts of the world, humans have inadequate access to potable water and use sources contaminated with disease vectors, pathogens or unacceptable levels of toxins. Drinking or using such water food preparation leads to widespread illness. So, the present study was aimed to analyse the bacterial quantification of drinking water, commonly used in our area. A comparison was also made between the mineral water of top brands and the traditionally used water boiled with Jeerakam and Karingali pattai. From the present investigation, it could be noted that bacterial load was increasing in the mineral water bottles with increase of time, where as in other two samples; it was negligible even after 10 hours from disinfection.

KEYWORDS: Water borne pathogens, Medicinal plants, Drinking water

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INTRODUCTION

Water the elixir, is essential for the survival of all forms of life. Even though 80% of earth's surface (80% of the total 50,000 million hectares in area) is covered by water, the fresh water supply has increasingly become a limiting factor, owing to the industrialization on one side and exploding population on the other. The World Health Organization (WHO, 1984) emphasizes that water for the consumers should be free from pathogenic organisms and toxic substances (Thillai Arasu *et al.*, 2007). The transmission of waterborne diseases is still a matter of major concern, despite worldwide efforts and modern technology being utilized for the production of safe drinking water (Venter, 2000).

This problem is not confined to the developing world where water treatment may not exist or is inadequate. There may also be contamination during storage, a lack of regulations and limited understanding and awareness among the population (AAM, 1996). Over large parts of the world, humans have inadequate access to potable water and use sources contaminated with disease vectors, pathogens or unacceptable levels of toxins. Drinking or using such water food preparation leads to widespread illness and is a major cause of death and misery in many countries (Chatterjee *et al.*, 2007).

Monitoring the bacteriological quality of drinking water is a need to control the presence of microorganisms that can cause illness or disease. Since it is not practical or technically feasible to monitor all pathogens in drinking water, the microbiological quality of drinking water is evaluated based on indicator microorganisms, such as coliforms and *E.coli* (Reynolds, 1999). So, the present study was aimed to analyse the bacterial quantification of drinking water, commonly used in our area. A comparison was also made between the mineral water of top brands and the traditionally used water boiled with Jeerakam and Karingali pattai.

MATERIALS AND METHODS

Water samples

The present study was conducted using 5 different kinds of water samples, which includes 3 packaged mineral water of different brand namely Aquafina, Kinley & Mc dowelle's and 2 ordinary drinking water boiled with Jeerakam (*Cuminum cyminum*) and karingali pattai (bark of *Acacia catechu*) separately.

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Microbial analysis

The quality of drinking water was estimated using most probable number (MPN) method and quantitative method was done by standard platecount method. The determination of faecal contamination was achieved by performing MPN test. The total viable heterotrophic bacterial population (THB) present in the water sample was estimated by Standard Plate Count Method (SPC). Zobelle's agar plates were prepared and the samples were incubated into it and were incubated 37ºC. The plates were examined and counted for the total number of colonies in each plate. The average was found out and multiplied with the dilution factor to obtain the total number of organisms per ml of the water sample.

RESULTS AND DISCUSSION

The results of the Most probable number (MPN) in case of different water sample tested were almost negative. None coliforms were detected from the water samples indicating the potability of water samples tested (Table 1). The standard total plate count showed varying results in each plate (Table 2).

Table 1. MPN index and potability of water sample

Water sample	MPN	Potability
Mineral water Aquafina	<4	Yes
Mineral water Kinley	<4	Yes
Mineral water Mc dowelle's	<4	Yes
Cumin boiled water	<4	Yes
Karingali boiled water	<4	Yes

Table 2. Bacterial population in water samples with increasing time interval

SAMPLE	INITIAL CFC/ml	5^{th}hr CFC/ml	10^{th}hr CFC/ml
Mineral water Aquafina	TFTC	TFTC	1350
Mineral water Kinley	TFTC	TFTC	12000
Mineral water Mc dowelle's	TFTC	1500	TNTC
Cumin boiled water	TFTC	TFTC	TFTC
Karingali boiled water	TFTC	TFTC	32

TFTC-Too Few To Count; TNTC-Too Numerous To Count; CFU- Colonies Forming Units

The samples that are initially plated did not show any considerable number of colonies,

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but as time increased, bacteria started multiplying and the plates showed colonies and some of which are too numerous to count. The bacterial load of the mineral water samples increased considerably high at 10^{th} hour sampling. This indicates that the mineral water should be consumed as soon as possible after breaking the seal. But it is clear that the traditionally boiled water with cumin and karingali pattai is more resistant to bacterial growth even at the 10^{th} hour sampling.

Heterophilc plate count (HPC) is a microbial method that uses colony formation on culture media to approximate the levels of heterotrophic flora. It is noted that the results obtained using an HPC test are not an accurate assessment of total heterotrophic concentration but, instead are indications of culturable organisms present. For example, it has been shown that only approximately 1% of the total bacteria found using direct microscopy are enumerated using HPC procedures (Wagner *et al.*, 1993). Derakhshan *et al.* (2008) investigated the activity of cumin seed oil and alcholic extract against *Klebsiella pneumonia* ATCC 13883 and clinical *K.pneumoniae* and noted good results.

The recovered microorganism can include those naturally found in the water environment and other from diverse polluted sources.This may include the species within general *Psuedomonas, Aeromonas, Alcaligens, Acinetobacter, Klebsiella, Flavobacterium, Chromobacterium* and many others. HPC tests recover a broad range of bacterial species some of which may be opportunistic bacterial pathogens (Singleton and Sainsbury, 2001). No guideline value has been established for HPC levels in drinking water, but effective treatment including disinfection can yield water with a concentration of HPC bacteria as low as 10CFU/ml. Significant increase in the HPC values above normal levels suggest changes in raw water quantity, treatment or disinfection as well as regrowth or poor design and or maintenance in the distribution system (Lakshmi and Ravishankar, 2012).

Phytochemical extracts contain many chemical compounds which are biologically active within the human body. For centuries, humans have used plants and its extracts to teat various disease conditions and more recently to produce new drugs. Still most of the plants carry a large number of unidentified compounds which can be really useful of

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making new drugs and for the identification of lead compounds. Plant produces phytochemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases. Past some years, there has been a lot of interest in the investigation of natural materials as sources of new antibacterial agents (Murugan *et al.,* 2013; Wins *et al.,* 2013).

From the present investigation, it could be noted that bacterial load was increasing in the mineral water bottles with increase of time, where as in other two samples; it was negligible even after 10 hours from disinfection. So the traditional methods of disinfecting drinking water using the phytoextracts (cumin and karingali) proves to be safe and best for consumption than the potable mineral water available in the markets with different brand names. Even if we are using those bottled water for consumption, care should be taken to consume water as soon as possible after opening it.

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