

Random survey of the microbial quality of bottled water in South Africa

Marthie M Ehlers*, Walda B van Zyl, Dobromir N Pavlov and Etienne E Müller

Department of Medical Virology, Institute of Pathology, University of Pretoria, PO Box 2034, Pretoria, 0001, South Africa

Abstract

Due to the increased demand and consumption of bottled water in South Africa, there has been a growing concern about the microbiological quality of this product. Retail outlets sell local as well as imported bottled water to consumers. The microbiological quality of 10 different (8 local and 2 imported) bottled water products were tested over a period of three months on days 1, 30 and 90. Tests for the detection of heterotrophic plate count (HPC) bacteria, total and faecal coliform bacteria, spore-forming *Clostridium perfringens*, somatic and F-RNA coliphages were performed on the samples. In addition samples were analysed for three selected enteric viruses, calciviruses, enteroviruses and rotaviruses using the reverse transcriptase-polymerase chain reaction (RT-PCR). The results indicated that 8/10 of the bottled water samples analysed, met the requirements set by the South African Bureau of Standards (SABS) for HPCs in bottled water of less than 100 counts per mL. However, in two bottled water samples the average HPC bacteria counts were 2.64×10^2 cfu·mL⁻¹ and 8.89×10^3 cfu·mL⁻¹ respectively which exceeded the recommended SABS guideline. HPC counts showed a slight variation during the three-month period in the bottled water samples. Total and faecal coliform bacteria, enterococci, *C. perfringens*, bacteriophages or enteric viruses were not detected in any of the ten bottled water samples analysed. It can be concluded that the microbial quality of eight of the ten selected bottled water samples analysed was within the acceptable limits set by the SABS guidelines and therefore, was safe for human consumption.

Keywords: bottled water, bacteria, coliphages, indicators, enteric viruses

Introduction

Bottled water can be defined as any potable water that is bottled and distributed or offered for sale and specifically intended for human consumption. The source water may be springs, municipal systems or other sources, which are considered to be of safe and sanitary quality and fit for human consumption. However, consumers should be aware that bottled water is not necessarily safer than tap water. Bottled and municipal water may contain the same micro-organisms since both can originate from the same sources (Warburton, 2000). Under improper and/or prolonged storage of bottled water, bacteria can grow to levels that may be harmful to human health (Warburton, 2000). Consequently, when offered for sale to the consumer, these bottled water products should comply with all of the regulations as set by the South African Natural Bottled Water Association (SANBWA). According to SANBWA any harmful bacteria must be absent; however, these bacteria were not specified. Water from springs, wells, boreholes, municipal supplies, bottled water and other sources are known vehicles for enteric pathogens such as bacteria, parasites and viruses (Manaia et al., 1990). The presence of these micro-organisms can have an impact on the health of travellers, immuno-compromised persons and infants if bottled water is used for formula preparations.

Bottled water has been implicated as the source of outbreaks of cholera, typhoid fever as well as traveller's disease in countries such as Portugal and Spain (Blake et al., 1977; Mavridou, 1992; Warburton et al., 1992; Warburton, 2000). Recently, Norovirus (previously known as Norwalk-like viruses) sequences were detected in three European brands of mineral water (Beuret et al.,

2002). However, controversy surrounded the accuracy of the results obtained by Beuret and co-workers (2002).

In Canada and other overseas countries stringent regulations have been implemented for the microbial quality of bottled water (Warburton et al., 1992; Warburton et al., 1998). However, in South Africa little is known about the microbiological quality of bottled water.

Heterotrophic plate count bacteria (HPC) are commonly used to assess the general microbiological quality of bottled water (WHO, 2001). Drinking water quality specifications world-wide recommend HPC limits from 100 to 500 cfu·mL⁻¹ in tap water and 50 cfu·mL⁻¹ in bottled water (WHO, 2001). The South African Bureau of Standards (SABS) specifies an HPC limit of less than 100 cfu·mL⁻¹ for bottled water (SABS, 1996). This limit is endorsed by the Department of Health and Water Affairs. Total and faecal coliform bacteria demonstrate faecal pollution in water and food and the counts of these indicator bacteria should be 0 cfu·100 mL⁻¹ in bottled natural water for consumption purposes (SABS, 1996).

Bacterial indicators do not always indicate the presence of pathogenic viruses and protozoa (Payment et al., 1985; Grabow et al., 1993; Grabow, 1996). Compared to coliform bacteria, viruses and protozoan cysts are known to be more persistent in the environment and more resistant to water treatment processes (Sobsey et al., 1995). The isolation of human enteric viruses in water meeting coliform standards, demonstrated the inadequacy of coliform bacteria to ensure virus-free water (Sobsey et al., 1995). The inability of these bacterial indicators to indicate virus-free water has prompted interest in developing an indicator system more appropriate to the human enteric viruses (Sobsey et al., 1995). Thus, coliphages (phages) have been suggested as potential indicators of the presence of enteric viruses, because of their similar structure and persistence in the environment (Kott et al., 1974; Kott, 1981; Simkova and Cervenka, 1981; Grabow et al., 1984;

* To whom all correspondence should be addressed.

☎+2712 319 2534; fax: +27 12 325 5550; e-mail: marthie_ehlers@up.ac.za
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