MONITORING E. coli AND TOTAL COLIFORMS IN NATURAL SPRING WATER AS RELATED TO RECREATIONAL MOUNTAIN AREAS

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Abstract. Natural spring water has unique properties, as it is rich in minerals that are considered to be beneficial to human health. A survey of the microbiological quality of natural spring water was conducted to assess possible risks from the consumption of the water by visitors in recreational mountain areas located in Seoul, South Korea. The densities of total coliforms and Escherichia coli were measured during the spring and the summer of 2002 to investigate the presence of coliform bacteria in the drinking spring waters. Total coliforms were detected in all samples and the mean density of total coliforms was up to a maximum of 228 CFU/mL. Detectable E. coli was found in 78% of all samples and the mean densities of E. coli varied from a minimum of 0 CFU/mL to a maximum of 15 CFU/mL in all samples. Malfunctioning septic systems and wildlife population appear to be the main source of E. coli contamination. Presence of E. coli in natural spring water indicates potential adverse health effects for individuals or populations exposed to this water. The fecal contaminated spring water may present an unacceptable risk to humans if it is used as raw drinking water.

Keywords: E. coli, fecal coliforms, natural spring water, total coliforms

1. Introduction

Total coliforms and Escherichia coli (E. coli), the most common member of fecal coliform bacteria, are the important microbiological parameters of water quality (Dufour, 1977). The presence of E. coli in water indicates that the water was contaminated by fecal material of humans or other warm-blooded animals. The U. S. Environmental Protection Agency (EPA) recommended that E. coli is a better indicator of fecal pollution than fecal coliform for purposes of evaluating ambient fresh water quality (USEPA, 1986). In many cases, E. coli coexists with pathogenic organisms. Thus, its presence may reflect the presence of enteric pathogens. Non-point sources of human and animal waste, municipal wastewater discharge, septic leachate, storm runoff, or wildlife populations can be the source of E. coli contamination (An et al., 2002). Several environmental factors including temperature, pH, dissolved oxygen, nutrients and the native microorganisms also influence the decay
of coliform bacteria (Curtis et al., 1992; Flint, 1987; McCambridge and McMeekin, 1984; Sinclair et al., 1993; Van der Steen et al., 2000).

Natural spring waters originate from groundwater and are usually rich in minerals such as calcium, magnesium, and potassium (Cabassud et al., 2001; Leclerc and Moreau, 2002). Since an adequate mineral uptake is considered to be wholesome to life, people often drink the spring water for health purposes. However, bacteria can contaminate spring waters.

In this study, the densities of total coliforms and E. coli were measured in natural spring waters relating to recreational mountain areas during the summer of 2002 to investigate the presence of coliform bacteria in the drinking spring waters. The mountains studied are located in Seoul, South Korea and they served as important tourist and health resorts. The spring waters are drank by visitors.

2. Materials and Methods

2.1. Field Sampling

Spring water samples were obtained at eight and nineteen different locations from several mountains during the spring (May) and summer (August) of 2002, respectively. Sampling locations are shown in Figure 1. Sterile 300-mL polyethylene bottles were rinsed and filled with the spring water. All samples collected were

Figure 1. Seoul showing the locations of seven mountains studied. Sampling stations 1–3, 4–8, 9–11, 12, 13–15, 16–17, and 18–19 are located in A, B, C, D, E, F, and G mountains, respectively.