CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

No one can deny that water is one of the most essential nutrients for growing children who also have the status of "students." Water not only keeps children healthy, but also helps them perform better in schools. Contrary to what people may think about children's small bodies, they need to consume a lot of water. In fact, the smaller they are, the more water they need to drink. Boys between at the age of 11 and 14 need to drink 3.3 litres of water per day and girls at the same age need to drink 2.8 litres per day (Snel, 2003). Exhuasted after playing games, children need a large volume of water to compensate for the loss of sweat and body fluids. A loss of 2% of body fluids causes a 20% reduction in performance, both mentally and physically. In addition, a lack of water leads to symptoms of dehydration. Once the body is dehydrated, the internal temperature rises in the body, and particularly the brain overheats. As most children spend a lot of time in school and drink a large quantity of water, drinking water provided to students should be clean and free of hazardous substances. Contaminants in drinking water can cause health problems and illness such as food poisoning, diarrhea and intestinal diseases. Furthermore, children are more sensitive to food poisoning than adults because their immune systems are not well developed. As many as one-third of pediatric deaths in developing countries can be attributed to diarrhea and the resulting dehydration. Africa, Asia and Latin America experience an estimated 3-5 billion cases of diarrhea, with 5-10 million deaths each year (National Center for Research Resources, n.d.). According to Gordon, Mackay and Rehfuess (2004), deaths worldwide for children under 15 years due to poisoning from consumption of food and water numbered 35,605 cases in the year 2002. In Thailand, a report by the Department of Disease Control, Ministry of Public Health in 2005, stated that there are up to 528 diarrheal cases per 100,000 people from consumption of unhygienic food and water in the group of Thai children at ages between 5 and 14 years (Ministry of Public Health, Department of Disease Control, 2005).

An essential way to prevent diarrheal disease in school children is maintaining awareness of good sanitation in the water supply system in schools for providing clean and safe drinking water. The U.S. Environmental Protection Agency (2003), pointed out that the school administrators have to be responsible for providing clean and safe drinking water for their students. This includes protecting the water source from contamination, regularly testing and reporting monitoring results of water supply system and facilities and maintaining the distribution system. However, in Thailand, school administrators may not know whether the drinking water in their schools is contaminated with waterborne pathogens because investigation of the water quality may have never been done. As a result, they have no opportunity to protect their students from waterborne disease. Moreover, some administrators may neglect the monitoring of drinking water quality for their students because of a lack the knowledge of hygienic conditions. The Department of Medical Sciences (DMSc.), Thailand Ministry of Public Health (MOPH) has been concerned about this problem and has assisted schools in supplying clean and safe drinking water for students; thus, this research was conducted based on the project titled “Community Medical Sciences (Com. Med. Sci.)”, in order to assess the bacterial contamination in drinking water for school students when the school administrators were provided with knowledge of sanitary conditions of water supply and good sanitation practices for improving water quality. Such knowledge can promote the awareness of school administrators in providing clean, safe drinking water to their students. The results of this study may be beneficial to improving the drinking water quality as a means to protect students from waterborne illness and to maintain the sustainable safety of drinking water in schools.

1.2 **STATEMENT OF THE PROBLEM**

This study aimed to answer the following questions.

Main Problem:

What is the microbial quality of drinking water for school students after providing knowledge of sanitary conditions to the school administrators?

Sub problems:

1.2.1 How many samples of drinking water for school students are contaminated with testing bacteria?

1.2.2. What are the concentrations of indicator bacteria found in the drinking water samples?

1.2.3 What kinds of waterborne pathogens contaminated the drinking water samples?

1.2.4. What is the relationship between sanitary conditions of water supplies and drinking water quality?

1 .3 OBJECTIVES OF THE STUDY

Main objective:

To assess the quality of drinking water for school students after providing knowledge of sanitary conditions to the school administrators.

Sub-objectives:

1.3.1 To examine the bacterial contamination in drinking water samples.

1.3.2 To determine the concentrations of indicator bacteria in the drinking water samples.

1.3.3 To identify types of waterborne pathogens in drinking water samples that may cause risk of illness to students.

1.3.4 To evaluate the sanitary conditions of water supplies along with the quality of drinking water.

1.3 DEFINITIONS OF TERMS

Definitions of the terms of this study are as follows:

Bacteria: A kind of microorganisms that cannot be seen by human eyes. Some bacteria are beneficial while some are harmful.

Clostridium perfringens (C. perfringens): A bacterium that can cause moderate to severe diarrhea, headache and abdominal cramping. The illness can be transmitted by water.

Coliforms: Commonly-used bacterial indicators of the sanitary quality of food and water. They are abundant in the feces of warm-blooded animals, but can also be found in the aquatic environment, in soil and on vegetation.

Contamination: Making a place or substance dirty or harmful by putting something such as chemical, poison or microbes in it.

Diarrhea: A disease with frequent watery stools, can be a symptom of infection or food poisoning. Commonly, diarrhea is the result of intestinal infection. Severe diarrhea in children can lead to dehydration and death.

***Escherichia coli* (*E. coli*):** A member of Coliforms. *E. coli* is almost exclusively of fecal origin and its presence in food and water thus indicates poor sanitary conditions.

Indicator microbes: Microorganisms that indicate the state of sanitation or hygiene.

Microbes or microorganisms: An extremely small living thing which can be seen only with a microscope. Some of them can cause disease.

Multiple-faucet basin: A dispenser providing drinking water

Salmonellae: Bacteria that may cause food poisoning. Salmonellae cause a moderate illness with nausea, vomiting, crampy diarrhea, and headache. The illness is transmitted by water, undercooked foods such as eggs, poultry, dairy products, and seafood.

***Staphylococcus aureus* (*S. aureus*):** A bacterium that can cause moderate to severe illness with rapid onset of nausea, severe vomiting, dizziness, and abdominal cramping. The illness can be transmitted by water**.**

Waterborne bacteria: Living microorganisms that are spread or carried by water.

Water cooler tank: Water storage container with cooling compressor to provide cold water.

Water dispenser/Drinking water dispenser: Device or container for supplying drinking water to consumers. Here it refers to water filters, water coolers tank and multiple faucet basin.

Water filter: Equipment that is used to remove impurities or unwanted substances from a water supply by passing through a physical substance or a device.

Waterborne illness or waterborne disease: The diseases that are caused by consuming water contaminated with waterborne pathogens.

Waterborne pathogens: Waterborne bacteria that can cause illness with the symptom of diarrhea.

Water supply Drinking Water supply: Equipment, services and activities that, starting with raw water, produce water for consumers.

1.5 SCOPE OF THE STUDY

This study is experimental research with the one-group pretest-posttest design. The research began with a pretest to examine the quality of drinking water provided for school students, followed by the intervention of providing knowledge to school administrators (or the responsible persons) about sanitary conditions of the water supply and good sanitation practices for improving the water quality. Subsequently, the posttest was done as well as the pretest. The study focuses on the investigation of drinking water quality and inspection of sanitary conditions of the water supply in schools for school students in ten Matthayomsuksa schools, both governmental and private schools, which are located in Bangkok, Nonthaburi and Patumthani provinces. The drinking water samples were collected from drinking water dispensers, including water cooler tanks and multiple-faucet basins, that are separately located inside the school areas. The water samples did not include bottled drinking water and drinking water provided by food stall vendors in the school’s canteen.

1.6 SIGNIFICANCE OF THE STUDY

1.6.1 The schools are able to provide clean and safe drinking water for their students.

1.6.2 The school students have a lower risk of getting diarrhea caused by waterborne pathogens in drinking water.

1.6.3 The administrators of the schools are aware of good sanitation utilized for improving and controlling the drinking water quality.

1.6.4 The model of the improvement of drinking water quality from this study can be expanded to schools in other regions of Thailand.

1.7 ORGANIZATION OF THE STUDY

This research is divided into five chapters. Chapter one contains the introduction to the study, statement of the problem, objectives of the study, definition of terms, scope of the study, significance of the study, and organization of the study. Chapter two focuses on the review of water microbiology, the drinking water for school students, the sanitary conditions of water supply in schools, and the relevant research and summary. Chapter three describes the methodology of the study including the subjects, instrument, procedure, data collection and data analysis. Chapter four reports the findings and results of data analysis. Chapter five provides the conclusion, discussion and recommendations for further research.