Bacteriological Quality of Holywater from Thai Temples in Songkhla Province, Southern Thailand

NUANJIRA PHATTHARARANGRONG, M.Sc.*,
NATHACHOL CHANTRATONG, B.Sc.*,
SIROJ JITSURONG, M.Sc.**

Abstract

Seventy-six holy water samples were collected from seventy-six Thai Buddhist temples in Songkhla Province, southern Thailand. The samples were examined for total heterotrophic aerobic bacterial count and total coliform count. The range of total heterotrophic aerobic bacterial count was 6.5×10^1 - 1.6×10^5 CFU/ml, while the total coliform count was <2- >1,600 MPN/100 ml. *Escherichia coli* was isolated from positive coliform tests in a total of 22 samples (28.95 per cent). According to the World Health Organization's (WHO) standards for drinking water (1993), only 9 of the samples (11.84 per cent) qualified. Interestingly, these 9 samples had originated from rain water.

Many Thai buddhists believe in the curative and restorative powers of the "holy" water given at temples. Most temples in Thailand produce "holy" water for distribution to buddhist devotees. At temples, particularly those that have a famous head monk, there may be thousands of people queueing each day to receive "holy" water. "Holy" water is produced when clean water is poured into a bowl with a lighted candle on its rim. The monks pray and then extinguish the candle. Sometimes a buddha image is placed in the water. The water used for preparing "holy" water may be from rain water, well water or tap water. Most of the buddhists usually drink the "holy" water or splash it on their bodies. If the "holy" water is contaminated with infectious agents or parasites from the base water source or during the process of making it, there is a risk that devotees will be infected through the presence of pathogens. Until the present time, the bacteriological quality of "holy" water in Thailand has not been studied. Investigating the total heterotrophic aerobic bacterial count, the total coliform count and isolating *Escherichia coli* present in "holy" water, then comparing

* Department of Microbiology, Faculty of Science,
** Department of Pathology, Faculty of Medicine, Prince of Songkla University, Hat Yai Songkhla 90112, Thailand.

findings with the WHO standards for drinking water (1993)[1] produced interesting results.

MATERIAL AND METHOD

"Holy" water

One hundred ml. of "holy" water from 76 temples in Songkhla province, Southern Thailand, were aseptically collected in 250 ml sterile screw cap bottle. The samples were placed in an ice bath and transferred to a microbiology laboratory and examined within two hours. The sources of "holy" water were recorded as rain water (40 samples), well water (30 samples) and tap water (6 samples). For tap water samples, 0.1 ml of 3 per cent solution of $Na_2S_2O_3$ was put in the bottle before sterilization in order to neutralize residual chlorine in the samples[2].

Heterotrophic Plate Count (HPC)

The standard method of HPC by using plate count agar (tryptone glucose yeast agar) was followed[2]. "Holy" water was diluted 10-fold to 1:1000 dilution. One ml of the diluted sample was mixed with 15 ml of melted agar (44°C to 46°C) in a 90 mm sterilized plate. A duplicate plate was prepared for each dilution, mixed well and incubated at 35±0.5°C for 48±3 hours. All colonies were counted and reported according to Colony Forming Unit (CFU)/ml.

Total Coliform Count

The standard method of multiple tube fermentation was followed[2]. For presumptive tests, 5 tubes (lactose broth) per dilution of water (10, 1 and 0.1 ml) were used. Production of gas or acid in the tubes within 48 ± 3 hours at 35 ± 0.5°C constituted a positive presumptive reaction. One loopful of culture from a positive presumptive tube was inoculated to a brilliant green lactose bile broth tube and incubated for 48 ± 3 hours at 35 ± 0.5°C. The formation of any amount of gas in the durham tube indicated a positive test. Most Probable Number (MPN) value was calculated from the number of positive brilliant green lactose bile broth tubes and reported as MPN/100 ml.

Isolation of *Escherichia coli*

One loopful of culture from a positive confirmed test was streaked on Eosin Methylene Blue agar (EMB) and incubated at 35 ± 0.5°C for 24 h. The typical metallic sheen colonies were

Table 1. Results of bacterial examination of "holy" waters.

Source of holy water (number/percentages)		Total heterotrophic aerobic bacterial count (number) CFU/ml				Total coliform count (number) MPN/100 ml				Number of samples positive for Isolation of *E. coli*
		0-500	501-5000	5001-10^4	>10^4	<2	2-500	501-1600	>1600	number
Rain water	40 (50.6)	5	14	5	16	9	25	2	4	8
Well water	30 (39.5)	2	8	4	16	0	21	3	6	11
Tap water	6 (7.9)	0	2	2	2	0	5	1	0	3
Total	76(100%)	7(9.2%)	24(31.6%)	11(14.5%)	34(44.7%)	9(11.8%)	51(67.1%)	6(7.9%)	10(13.2%)	22(28.9%)

further identified by using the standard biochemical test[3].

RESULTS

The results of the bacteriological examination of "holy" water are summarized in Table 1. The range of HPC was 6.5 x 10^1 - 1.6 x 10^5 CFU/ml. There were 34 samples (44.7%) that contained an HPC value of more than 10^4 CFU/ml. Only 7 samples (9.2%) had an HPC of less than 500 CFU/ml. The range of total coliform count was <2-> 1,600 MPN/100 ml. There were nine samples (11.84%), all from rain water sources, which had an MPN index result less than 2. *E. coli* was isolated through a positive coliform test in a total of 22 samples (28.95%) No correlation between *E. coli* and coliform count was found, *E. coli* was found in samples with a coliform count ranging from 2->1600 MPN/100ml.

DISCUSSION

In developing countries, gastrointestinal tract infections (e.g. : acute diarrhea, dysentery, typhoid fever, cholera and viral hepatitis A infection) are the most common illnesses[4]. Infected water and food are the most important factors in studies of the epidemiology of these diseases[4-7]. Drinking water that is contaminated with feces from man and animals is a major source of infection[1]. There is more than one bacteriological indicator for evaluating the quality of drinking water such as heterotrophic aerobic bacterial count, coliform count, *E. coli* and other pathogenic bacteria[8,9]. If coliform bacteria are present in drinking water this indicates that it has been inadequately treated or is contaminated with excessive nutrients[1,10]. The number of bacteria in a heterotrophic aerobic bacterial count is an indicator of the general cleanliness of drinking water[11,12]. If the treatment process is perfect, the number of bacteria in this count should be lower than 500 CFU/ml[12]. WHO (1993) stated in their standard for drinking water that no *E. coli* nor coliform bacteria should be present in 100 ml of water[1]. According to the results of this experiment, only 9 samples (11.84%) would have passed the standard set by WHO. All of these samples originated from rain water.

"Holy" water can be contaminated as a result of using water that is not properly treated or it may be a result of using an unclean container, or from unclean items.

If it is considered necessary to drink "holy" water, we should use boiled or filtered water as the water source and ensure it is kept in a container that has a cover, Also the container should be clean and contaminated items not put into it.

This survey of sanitation gives preliminary data on the quality of "holy" water. It shows that people should beware of drinking "holy" water. It would be interesting to study the quality of "holy" water from other Thai buddhist temples, especially those in which consumption of the water may be high, perhaps those that have well-known head monks.

SUMMARY

Seventy six (76) Holy water samples were collected from seventy six (76) Thai Buddhist temples in Songkhla province, southern Thailand. The samples were examined for total heterotrophic aerobic bacterial count and total coliform count. The range of total heterotrophic aerobic bacterial count was 6.5 x 10^1 - 1.6 x 10^5 CFU/ml, while the total coliform count was <2->1600 MPN/100 ml *E. coli* was isolated from positive coliform tests in a total of 22 samples (28.95 per cent). According to the World Health Organization's standard for drinking water (1993), only 9 of the samples (11.84 per cent) qualified. All of these samples originated from rain water.

(Received for publication on November 11, 1996)

REFERENCES

1. World Health Organization. Guide lines for drinking water quality vol 1. recommendations. 2nd ed. Geneva 1993.
2. American public health association. Standard methods for the examination of water and waste water. 18th ed. USA. 1992.
3. Murray PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH. Manual of clinical microbiology 6th ed. American society for microbiology. USA. 1995.
4. Annual epidemiological surveillance report. Division of epidemiology office of the permanent secretary for public health, ministry of public health Thailand. 1993.
5. Hagen TC, Toranzos GA. Tropical source water. In. Drinking water microbiology. Mcfeter GA. editor. Springer-verlag New york Inc, New york. 1990:32-53.
6. Payment P, Franco E, Richardson H, Siemiatyeki J. Gastrointestinal health effects associated with the consumption of drinking water produced by point-of-use domestic reverse osmosis filtration units. Appl Environ. Microbiol. 1991; 57: 945-8.
7. Walker A. Drinking water doubts about quality. Brit Med J 1992; 304: 175-8.
8. Collin JF, Zmirou D, Ferley JP, Charrel M. Comparison of bacterial indicators and sampling programs for drinking water systems. Appl Environ Microbiol 1988; 54: 2073-7.
9. Pipe WO. Bacterial indicators of pollution. CRC press USA, 1982.
10. Lechevallier MW, Schulz W, Lee RG. Bacterial nutrients in drinking water. Appl Environ. Microbiol 1991; 57: 857-62.
11. Gelreich EE. Microbiological quality control in distribution systems in water quality and treatment 4th ed. American water works association USA. 1990: 1116-58.
12. Reasoner DJ. Monitoring heterotrophic bacteria in portable water. In. Drinking water microbiology. edit. Mcfeters GA. Springer-verlag New york Inc, New york. 1990: 452-77.

คุณภาพทางแบคทีเรียของน้ำมนต์จากวัดไทยในจังหวัดสงขลา

นวลจิรา ภัทรรังรอง, วท.ม.,*

ณัฐชล จันทร์ทอง, วท.บ., ศิโรช จิตต์สุรงค์, วท.ม.***

ได้เก็บตัวอย่างน้ำมนต์ จำนวน 76 ตัวอย่าง จากวัดไทย จำนวน 76 วัดในจังหวัดสงขลา นำตัวอย่างมาตรวจหาจำนวนแบคทีเรียทั้งหมด และนับจำนวนโคลิฟอร์มแบคทีเรีย ผลการศึกษาพบว่ามีจำนวนแบคทีเรียทั้งหมดอยู่ในช่วง $6.5x10^{1}$–$1.6x10^{5}$ ซีเอฟยู/มิลลิลิตร และมีจำนวนโคลิฟอร์มแบคทีเรียอยู่ในช่วง <2>1,600 MPN/100 มิลลิลิตร สามารถแยกเชื้อ *Escherichia coli* ได้จากหลอดที่ได้ผลบวกในการทดสอบโคลิฟอร์มจำนวน 22 ตัวอย่าง คิดเป็นร้อยละ 28.95 มีตัวอย่างน้ำมนต์เพียง 9 ตัวอย่าง คิดเป็นร้อยละ 11.84 ที่มีคุณภาพตามมาตรฐานน้ำดื่มขององค์การอนามัยโลก (2536) เป็นที่น่าสนใจว่าน้ำมนต์ทั้ง 9 ตัวอย่างดังกล่าวเป็นน้ำที่ได้จากน้ำฝน

* ภาควิชาจุลชีววิทยา, คณะวิทยาศาสตร์,

** ภาควิชาพยาธิวิทยา, คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์, จ. สงขลา 90112