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DIARRHOEAL DISEASES RELATED TO SANITATION AND WATER SUPPLY

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INTRODUCTION

Thailand has about 43 million inhabitants. About 10 million living in more than 45,000 communities of rural area lack adequate potable water. In these villages it is reported that 90% of the population are infected with waterborne intestinal parasites. Water is carried by buckets from the source to the home and stored in earthen pots or jars prior to use. The sources of water are unprotected wells, cisterns, ponds, and streams which are polluted by human and animal excreta. The quality of waters are undoubtedly unacceptable as potable water supplies, but are used by the villages because of the lack of other alternatives.

Health conditions in the home are not only poor but are also conducive to social and economic development. The role of sanitation in diarrhoeal disease control is evident as these diseases decrease with the improvement of personal hygiene and cleanliness in the home. However, one cannot conceive of a healthful and clean home environment without sufficient potable water available. Therefore, housing sanitation program of large scope cannot be proposed without a program in water supply.

The relation of diarrhoeal disease to the death of infants under one year and of young children in 1-4 year age group is so important as to merit special attention. The study of diarrhoeal disease in the South America by Verhoestraete and Puffer (1958) emphasizes that diarrhoeal disease is a major health problem in those countries which are still

underdeveloped economically. Brachman (1970) reported that two-thirds of 45,263 isolates were from children under ten years of age. American Public Health Association (1970) have reported that serious diarrhoea among children under five years, particularly the newborn, is frequently a result of the etiologic agent, enteropathogenic *E. coli*. It was found that *E. coli* was isolated from 1.2% from 15.5% of 385 mothers of newborn infants. Suprapti Thaif *et al.*, (1967) reported that infantile diarrhoea infection rate was the lowest (7.1%) in 6-month age group and the highest (34.2%) in the age group 19-24 months.

Study Area

In consultation with the Health Program Committee, a plan was developed to study villages in Amphur (district) Bang Pa-In about 60 kilometers from Bangkok. It was believed that Bang Pa-In is a representative area of rural villages in general and that the study could obtain the cooperation of the well trained staff and health personnel at Bang Pa-In and use health centres as the base for the study program. Tambons (Sub-district) Bangrasan and Klongchik were selected as the study areas which are about 8 km from the first class health centre at Bang Pa-In. These tambons use river and klong (canal) water respectively for drinking, bathing, and other purposes. Bangrasan and Klongchik tambons consist of sixteen and seven villages respectively. These two tambons were selected for the study because of the close similarity in their socio-economic and cultural standards.

ENVIRONMENTAL FACTORS IN DIARRHOEAL DISEASES

The total sample population in all the three villages of Bangrasan and Klongchik tambons were 329 and 269, respectively. Buddhism is the main religion followed by people in this area. The education status of the population was determined by recording the number of years of school attendance. More or less the level of education stops at Prathom 4 (primary grade 4). The population is mainly engaged in rice cultivation. In general the families are not well off.

With regards to toilet facilities, there were a surprising number of houses with latrines but in general these facilities are more or less of a hazard than a benefit. The bore hole type privy was common in both places. People with no privy in their houses defecated

in the fields in both the tambons. Some families used soap for washing after defecation, some did not; this may due to non-availability of water at that place.

Water samples were collected from each household and placed on ice. Handwashing from mothers were also collected using swab techniques and all the samples processed within 4 hours. Total and fecal coliform were enumerated by five-tube most probable number technique.

RESULTS AND DISCUSSION

The variations of bacteriological quality as measured by MPN and diarrhoeal attack over twelve weeks study period was analyzed

Table 1

Average MPN index, total fecal coliform and diarrhoeal cases in Bangrasan Tambon, weekly record during Jan-March 1973.

Village	Particulars	January 1973				February 1973				March 1973			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
8	MPN Index	440	610	700	600	550	260	330	250	235	205	220	360
	Fecal Coliform	2	3	2	0	2	0	0	0	1	1	0	0
	No. of Cases	9	6	3	8	0	3	1	0	2	1	4	2
	% Cases in Population of 99	9	6	3	8	0	3	1	0	2	1	4	2
9	MPN Index	570	630	845	500	870	685	505	340	320	230	155	240
	Fecal Coliform	2	1	3	0	0	0	1	1	0	1	0	0
	No. of Cases	5	6	5	1	0	0	1	1	0	0	0	1
	% Cases in Population of 118	4	5	4	1	0	0	1	1	0	0	0	1
10	MPN Index	885	925	1180	955	650	535	365	305	325	460	380	330
	Fecal Coliform	0	0	1	0	1	0	0	1	1	0	0	0
	No. of Cases	4	4	4	2	0	0	0	1	0	0	0	0
	% Cases in Population of 112	4	4	4	2	0	0	0	1	0	0	0	0
Total	MPN Index	630	720	910	685	690	490	400	300	290	300	250	310
	Fecal Coliform	4	4	6	0	0	0	1	1	2	2	0	0
	No. of Cases	18	16	12	11	0	3	2	2	2	1	4	3
	% Cases in Population of 329	5	5	4	3	0	1	1	1	1	0.3	1	1

Table 2

Average MPN index, total fecal coliform and diarrhoeal cases in Klongchik Tambon, weekly record during Jan-March 1973.

Village	Particulars	January 1973				February 1973				March 1973			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
2	MPN Index	1160	1205	1020	915	450	515	375	390	530	685	490	330
	Fecal Coliform	11	3	3	2	1	1	3	4	3	2	1	2
	No. of Cases	1	0	0	2	0	1	2	0	1	0	0	0
	% Cases in Population of 96	1	0	0	2	0	1	2	0	1	0	0	0
3	MPN Index	1120	950	905	995	720	675	580	370	560	385	300	285
	Fecal Coliform	10	3	2	4	2	0	2	4	5	0	1	1
	No. of Cases	4	3	2	1	1	1	0	0	1	0	0	0
	% Cases in Population of 97	4	3	2	1	1	1	0	0	1	0	0	0
4	MPN Index	560	500	515	545	310	335	270	270	220	145	245	240
	Fecal Coliform	9	0	2	0	1	0	1	2	0	1	1	0
	No. of Cases	2	0	0	0	0	0	0	0	0	0	1	0
	% Cases in Population of 76	3	0	0	0	0	0	0	0	0	0	1	0
Total	MPN Index	950	885	810	820	490	510	410	340	340	380	345	285
	Fecal Coliform	30	6	7	6	4	2	6	10	8	3	3	1
	No. of Cases	7	3	2	3	1	2	2	0	2	0	1	0
	% Cases in Population of 269	3	1	1	1	1	1	1	0	1	0	1	0

village by village and tambon by tambon. The average MPN index per 100 ml of drinking water for each village in each week and the diarrhoeal cases as percentage of the study populations in that village were calculated as shown in Table 1 and Table 2. These two tables represent the variation of water quality in terms of MPN index and diarrhoeal cases as percentage of population in those villages through twelve weeks.

For most villages and for both tambons the numbers of diarrhoeal cases per week is seen to rise and fall with the MPN index. This result suggests that the higher the MPN index in the drinking water, the higher the tendency for an increase number of diarrhoeal cases. The incidence of diarrhoeal cases in

Bangrasan and Klongchik in January 1973 was more than in other months. The water quality in terms of MPN index was the worst in this period. The rise in the deterioration of water quality was followed by heavy attack of diarrhoea in January in both tambons.

For the handwashing samples, analysis of total number of positive handwashing showing fecal coliform and total number of diarrhoeal cases week by week for Bangrasan and Klongchik tambon do not show any relationship between the presence of fecal coliform and mother's hand washing and total number of diarrhoeal cases. All these houses are utilizing river water in the dry season for drinking purposes and they use rain water in the rainy season.

ENVIRONMENTAL FACTORS IN DIARRHOEAL DISEASES

Handwashing from mothers were also collected using swab techniques for fecal coliform. It was found that 50% positive handwash samples were found in Klongchik and only 20% positive handwash samples were found in Bangrasan. It was believed that because mothers in Bangrasan stayed in the houses and might have washed their hands prior to sampling, that their handwashings gave negative results. In Klongchik, mothers were working in the field and handwash samples were collected in the field itself. Therefore they did not have any opportunity to wash their hands and most of the handwash results were positive in Klongchik.

In conclusion, for the period of study 1st December 1972 to 31st March 1973 the diarrhoeal attack rate in Bangrasan were found to be 268 to 454 cases per 1000 persons as compared to 27-71 cases per 1000 persons in Klongchik. In general the water quality seems to influence the incidence of diarrhoeal cases.

The relationship between the quality of water in terms of MPN index and the diarrhoeal attacks were more clear when villages from Bangrasan and Klongchik grouped together than when the same relationship was tried for individual villages. Incidence of diarrhoeal cases were more in January 1973 because of the poorer quality of water when compared to other months. There were variations in the quality of water and diarrhoeal cases as measured by MPN.

A fewer number of handwashings from mothers showed positive fecal coliform in Bangrasan than in Klongchik. About 50% of the families in Bangrasan washed their hands with soap after defecation. Probably this can be considered as the reason for getting less number of positive fecal coliform in Bangrasan and more in Klongchik but the diarrhoeal attack rates were more in Bangrasan than in Klongchik. When a settler diagram was plotted between total fecal coliform and total number of diarrhoeal cases by week

there was no relationship between the presence of fecal coliforms in the handwash and the number of diarrhoeal cases.

All these conclusions must be considered preliminary because the study is in its initial stages. Data throughout both wet and dry seasons will be needed before any definite conclusions can be drawn.

SUMMARY

Three Thai communities using river water and three Thai communities utilizing klong water for their domestic consumption were studied to assess the water quality, sanitation and the incidence of diarrhoea in the communities.

The incidence of diarrhoeal diseases during a four-month period in the three communities of Bangrasan was 454 per 1000 population and in the three communities of Klongchik was 85 per 1000 population. The relationship between water quality as measured by the MPN coliform index and the incidence of diarrhoeal cases showed that an increase in diarrhoeal cases were accompanied by an increase in MPN value. In general the quality of water seemed to influence the incidence of diarrhoeal cases.

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