SEATO MEDICAL RESEARCH STUDY ON DIARRHEAL DISEASES

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STUDY REPORT

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OBJECTIVE

Several related studies now in progress include (1) a continuing enteropathogen survey of stools from Thai and American patients, (2) monitoring of antibiotic sensitivity patterns of diarrheal agents, (3) determining the prevalence of shigellosis as measured by serum antibodies, (4) qualitative and quantitative studies of bowel flora, (5) a clinical trial of iodochlorhydroxyquinoline in hospitalized cholera patients and (6) a clinical evaluation of colistin and furazolidone in patients with bacillary dysentery.

DESCRIPTION

(1) The enteropathogen study included specimens from inpatients and outpatients of both sexes from hospitals throughout Thailand. Most specimens were from patients hospitalized with diarrhea and were collected during the acute phase of the disease. The laboratory procedure was as follows: In the Bangkok area either fecal specimens or three rectal swabs, moistened in alkaline peptone broth, were obtained from each patient. Two of the swabs were placed in enrichment broths (alkaline peptone, selenite—F) and the third streaked directly onto SS and MC agar plates. The alkaline peptone broth was

subcultured to alkaline lauryl sulfate tellurite agar for isolation of vibrios. After overnight incubation at 37 C, the selenite—F broth was subcultured on SS and DC plates. Specimens from outside Bangkok were submitted in a holding medium designed for the transport of enteric bacteria. Upon arrival at the laboratory, plates of SS and MC were streaked and tubes of selenite—F and alkaline peptone broth were inoculated. The enrichment broths were subcultured as outlined above. All plates were examined after 24 and 48 hours incubation. Lactose—negative colonies were transferred to Kligler's iron agar slants and subsequently to a battery of media to determine patterns of biochemical activity. Those isolates showing biochemical patterns typical of Salmonellae, Shigellae, or vibrios were definitively identified in accordance with the serological methods described by Edwards and Ewing. (2) The plate dilution technique was used to test antimicrobial sensitivities of enteropathogens. (3) A study designed to determine the prevalence of shigellosis as measured by serum antibodies was continued during this period. Briefly the procedure consisted of utilizing the microtiter system to assay sera for antibodies to sheep erythrocytes sensitized by selected Shigellae antigens. Sera assayed were from U.S. personnel with laboratory diagnosed shigellosis and urban and rural Thai nationals. (4) Fecal specimens studied for quantitative changes of microbial flora were obtained from children hospitalized for acute diarrhea. Serial 10—fold dilutions and plate counts were made on 10 media, each designed to favor certain bacterial genera. Processing these specimens for anaerobic incubation usually took one hour. In those instances when the same organism grew on more than one medium, the highest count was recorded. Routine bacteriologic and serologic procedures were utilized for final identification of organisms.

Two therapy studies were in progress during this period. (5) One was a continuation of a clinical trial of iodochlorhydroxyquinoline* (ICHQ) in hospitalized cholera patients and the other was a double—blind evaluation of colistin and furazolidone in patients with bacillary dysentery. For the clinical trial of ICHQ all diarrheal patients admitted to Samut—Prakarn and Songkla Provincial hospitals during periods of cholera outbreaks were considered and patients whose stool specimens were negative for agglutinable vibrios or who had received antimicrobials prior to hospitalization were deleted from the study. On admission suspected cholera patients received fluid and electrolyte replacements but no antimicrobials. Patients with odd admission numbers received drug A (ICHQ) while those with even numbers received drug B (placebo). The dosage of drug A was 250 mg every four hours for 72 hours in the form of tablets for adults and suspension for children 1—10 years of age. Rectal swabs were taken prior to initial medication and at 0600 daily thereafter. Assessment of therapeutic efficacy of ICHQ was by duration of vibrio excretion. (6) Hospitalized patients in Children's Hospital were used in the double blind study of colistin and furazolidone for therapy of bacillary dysentery. Rectal swabs for bacterial cultures were made on admission and daily for the next three days. Patients with a definite history of having received antimicrobials prior to hospital admission were excluded as were those negative for Salmonellae or Shigellae during the first 3 days of hospitalization. Routine intravenous fluids, electrolytes and special diets were prescribed for all patients. Antimicrobial regimens, which were initiated after the first positive culture and continued for 5 days, consisted of 3—5 mg of colistin base or 7.5 mg of furazolidone/kg/day in 4 divided doses.

PROGRESS

1. Results of examinations of 4009 routine specimens from 2153 individuals are included in this report. Most of the 3842 specimens from Thai nationals were from patients in Children's Hospital, Bangkok, Thailand. Other specimens were collected from patients at the Royal Thai Army, Royal Thai Navy, Siriraj, and Praputhabath Hospitals. Most of the 167 specimens from U.S. personnel were from the U.S. Embassy Medical Unit, SMRL and the 5th Field Hospital.

Isolations of enteropathogenic bacteria are summarized in Table 1. Approximately 7.6% of the specimens yielded Salmonellae; 2.5% yielded Shigellae and 8.0% of those tested yielded Enteropathogenic Escherichia coli (EEC). The predominance of Shigellae isolates from Americans and Salmonellae isolates from Thais are consistent with recovery rates found during the preceeding six years. Most of the Salmonellae isolates of Salmonella javiana (a species not isolated here during the last 6 years) were from inpatients in

* Entero—Vioform^{R} — Ciba

the diarrheal ward at Children's Hospital (Table 2). Isolates of Salmonella paratyphi B, the predominant organism during the previous year decreased from 139 to 18 while isolates of Salmonella derby increased from 25 to 48. Isolates of Salmonella typhosa remained low as has been the case for the last seven years.

The data in Table 3 show 9 species to be represented among the 101 Shigellae isolates. Sh. flexneri 2 predominated among the Americans. Shigellae were isolated throughout the year but no specific outbreaks were noted. Strains 025:B19:B23, 0119:B14 and 0125:B15 were the predominant isolates of EEC in those children checked for these organisms (Table 4).

2. Sensitivities of enteropathogens to antimicrobials are shown in Tables 5—10. Overall these "in vitro" studies indicate that the most effective antimicrobial studied was colistin, followed in order of decreasing effectiveness by furazolidone, ampicillin, neomycin sulfate, chloramphenicol and oxytetracycline. All but one of 190 isolates of Salmonellae, one of 200 isolates of Shigellae and 7 of 242 isolates of EEC were sensitive to colistin (Table 5). In general the "in vitro" findings with furazolidone (Table 6) paralelled those of colistin except most isolates of S. paratyphi B were resistant as were approximately 9% of the EEC. Most isolates of Salmonellae and Shigellae tended to be either very sensitive or very resistant to ampicillin with more than 66% of the EEC being resistant to this drug. Based on these and prior "in vitro" studies, the use of chloramphenicol or oxytetracycline is not indicated for therapy of most cases of bacterial diarrhea in Thailand and the finding that most isolates of both Salmonellae and Shigellae have remained sensitive "in vitro" to furazolidone and colistin justify considering them rather than broad spectrum antibiotics when antimicrobials are used arbitrarily to treat diarrheal diseases.

3. Median hemagglutination titers of sera with sheep erythrocytes sensitized with Shigellae antigens are shown in Table 11. Titers of convalescent sera obtained from 6 diarrhea patients whose stools were positive for Sh. sonnei form I indicates minimal hemagglutinative response to infection with this organism. Other sera from shigellosis patients were too few to permit speculation with reference to antibody response. It was noted that median titers of Shigellae antibodies were higher in rural than in urban (Bangkok) Thais. This is in keeping with earlier studies showing more shigellosis than salmonellosis in rural Thais while the converse has been true in Bangkok. The finding of a wide distribution of Shigellae antibodies in the sera of normal children is in agreement with similar studies in Japan and America. However titers found in the sera of these shigellosis patients were lower than those found in similar studies elsewhere. One possible explanation is that effective antimicrobial therapy blunted the antibody responses of these patients.

4. During the period covered by this report 233 specimens were taken from 20 individuals with acute diarrhea with the intent of relating flora changes to clinical improvement. For this study specimens taken during the first 2 days of hospitalization were regarded as "acute" and subsequent specimens were considered "convalescent". Certain species of bacteria were recovered from almost every specimen. These included obligately anaerobic gram negative bacilli, coliforms, lactobacilli, alpha hemolytic streptococci, Streptococcus fecalis and yeasts. The ranks of numerical prevalence of organism recovered are presented in Table 12. In both categories of specimens coliforms and obligately anaerobic gram—negative bacilli respectively composed the largest components of the aerobic and anaerobic flora (10^8—10^9 per gram of wet feces). Genera irregularly recovered from these specimens included Pseudomonas, Proteus and Clostridium

Recognized enteropathogens isolated from stools of three fatal cases included 8 Shigellae, 3 Salmonellae and 1 EEC. One of the fatal cases had not less than 10^6 Shigella sonnei form I/ml of all stool specimens but no qualitative or quantitative irregularities were noted in other genera isolated. Autopsies were carried out shortly after death on two patients from whom no enteropathogens were isolated before death. It was noted in both patients that all portions of the intestinal tract contained 10^9 coliforms/ml of fluid, not less than 10^5 alpha hemolytic streptococci, and from 10^4 to 10^6 Candida albicans.

The gram–negative non–sporulating anaerobic or filamentous bacteria have been little studied and are poorly understood, even though they are known as one of the predominant–if not the predominant–members of the normal intestinal flora of man and despite their being the causal pathogen in serious diseases of man and animals. Some reports indicate they outnumber coliforms 100 to 1 in the human bowel. The theory has been advanced that they act as "stabilizers" of bowel ecology and diarrheal diseases can be associated with changes of their types and numbers in the gastro–intestinal tract. Among other gaps in our knowledge of these organisms, their classification is uncertain. This portion of the study is being done to characterize these organisms preliminary to determining their roles, if any, in diarrhea of children and to compare the characteristics of these organisms isolated from Thais with those described for other ethnic groups.

Biochemical characteristics have been determined for 57 obligate gram–negative anaerobes isolated from stools of these patients and additional characterization by antimicrobial sensitivity patterns is in progress. Using the simplified classification proposed by Rosebury (1959) tentative identifications include 5 isolates of Bacteroides fragilis, 11 isolates of Bacteroides nigrescens, 15 isolates of Bacteroides funduliformis and 9 isolates of Fusobacterium fusiforme. Studies are continuing on the remaining isolates.

5. A total of 30 patients were studied in the clinical trial of ICHQ in cholera patients. Fourteen adults and 5 children received ICHQ while 10 adults and one child received placebo. Results are summarized in Table 13. The range of duration of vibrio excretion in the ICHQ group was from 1 to 8 days and that of the placebo group was from 5 to 9 days. Nine of 19 patients receiving ICHQ were free from vibrios on day 5 while all of the placebo group were still positive. There was one relapse after sodium sulfate purge in a man receiving ICHQ. No side effects of ICHQ were reported and no strains resistant to ICHQ were isolated after treatment as demonstrated by the tube and plate dilution sensitivity tests.

6. Thirty–nine of 170 children in the study evaluating colistin and furazolidone were positive for Shigellae or Salmonellae during this study. However only 10 patients had Shigellae and none had Salmonellae in their stools during the first three days of hospitalization. Results of the efficacy of the antimicrobials will not be known until the study is completed and the treatment regimens are disclosed.

SUMMARY

Shigellae were enteropathogens isolated most frequently from Americans while Salmonellae were isolated most frequently from Thais. Most enteropathogens tested were sensitive "in vitro" to colistin followed in order of decreasing effectiveness by furazolidone, ampicillin, neomycin sulfate, chloramphenicol and oxytetracycline. Median titers of Shigellae antibodies were higher in rural than in urban Thais. Coliforms and gram–negative obligate anaerobes composed the largest components of feces from diarrhea patients. Pure cultures of the latter organism are being characterized in terms of their biochemical characteristics and antimicrobial sensitivity patterns. Studies evaluating iodochlorhydroxyquinoline for the treatment of cholera have been continued and a study was initiated to evaluate colistin and furazolidone for the treatment of bacillary dysentery in children.

Publications Noyes, H.E., Benjadol, P. and Taylor, R.L.: Comparative Antimicrobial Susceptibilities of Enteropathogens Isolated in Thailand from 1963–1967. J. Med. Assn. Thailand 52: No. 2 Feb. 1969, 115–123.

Table 1

Enterobacteriaceae Isolated from Acute Diarrhea Cases in Thailand (1 April 1968 – 31 March 1969)

Month	Thai Nationals					American Nationals				
	No. of Specimens	No. of Patients	Salmonellae	Shigellae	Vibrios	No. of Specimens	No. of Patients	Salmonellae	Shigellae	Vibrios
April 1968	393	189	60	13	1	27	27	2	3	–
May	404	233	38	2	–	20	20	1	7	–
June	232	131	18	6	–	23	23	2	6	–
July	308	173	17	1	–	17	17	–	5	–
August	332	147	41	1	–	16	16	–	3	–
September	353	159	36	5	–	9	9	–	1	–
October	295	131	31	4	–	10	10	–	1	–
November	413	180	16	11	–	8	8	–	–	–
December	338	152	10	9	–	6	6	–	1	–
January 1969	267	141	5	4	–	21	21	–	–	–
February	277	190	19	8	1	5	5	–	–	–
March	230	160	7	10	1	5	5	–	–	–
Total	3842	1986	298	74	3	167	167	5	27	–

Table 2

Salmonellae Isolated from Acute Diarrhea Cases (1 April 1968—31 March 1969)

Species	Thai Nationals				American Nationals			
	Children	Adults	Unknown	Total	Children	Adults	Unknown	Total
paratyphi B	17	1	—	18	—	—	—	—
derby	35	13	—	48	—	3	—	3
typhimurium	3	3	—	6	—	—	—	—
stanley	16	1	—	17	—	—	—	—
tananarive	9	1	—	10	—	—	—	—
typhosa	12	2	—	14	—	—	—	—
weltevreden	15	—	—	15	—	—	—	—
lexington	7	—	—	7	—	—	—	—
anatum	7	2	—	9	—	1	—	1
gr. D. species*	107	2	—	109	—	—	—	—
meleagridis	8	—	—	8	—	—	—	—
heidelberg	1	—	—	1	—	—	—	—
gr. E. species	1	—	—	1	—	—	—	—
gr. B species	10	—	—	10	—	—	—	—
unknown	—	—	—	—	—	1	—	1
abony	2	—	—	2	—	—	—	—
newport	1	—	—	1	—	—	—	—
newlands	1	—	—	1	—	—	—	—
panama	18	—	—	18	—	—	—	—
oslo	2	1	—	3	—	—	—	—
Total	272	26	—	298	—	5	—	5

*Representative isolates sent to the National C.D.C. Laboratory, Atlanta, Georgia were identified as Salmonella javiana

Table 3

Shigellae Isolated from Acute Diarrhea Cases (1 April 1968 – 31 March 1969)

Species	Thai Nationals				American Nationals			
	Children	Adults	Unknown	Total	Children	Adults	Unknown	Total
flexneri 1	4	–	–	4	–	–	–	–
flexneri 2	31	4	1	36	2	5	1	8
flexneri 3	12	3	–	15	–	4	–	4
flexneri 5	–	–	–	–	–	3	–	3
flexneri 6	–	–	–	–	–	1	–	1
sonnei form I	11	1	–	12	1	7	1	9
sonnei form II	4	–	1	5	–	1	–	1
boydii 2	1	–	–	1	–	1	–	1
dysenteriae 2	1	–	–	1	–	–	–	–
Total	64	8	2	74	3	22	2	27

Table 4

Pathogenic Escherichia coli Isolated from Acute Diarrhea Cases in Thailand from 1 April 1968 – 31 March 1969

	Thai Nationals	Caucasians
Total number examined	2656	20
Number positive	213	4
Number negative	571	6
Number rough	1872	10
Serotypes:		
0119 : B14	85	1
0125 : B15	39	1
025 : B19 : B23	32	1
0128 : B12	15	—
0127 : B8	14	—
0126 : B16	10	—
0112 : B11	8	—
026 : B6	7	—
0124 : B17	2	—
055 : B5	1	1

Table 5

SENSITIVITIES OF ENTERIC ORGANISMS TO COLISTIN

from 1 April 1968 through 31 March 1969

	No. of strains tested	Isolates Inhibited at mcg/ml									
		0.78	1.56	3.12	6.25	12.5	25	50	100	200	> 200
Salmonella paratyphi B	20	9	11	—	—	—	—	—	—	—	—
S. derby	65	49	14	1	—	—	—	—	—	—	1
S. anatum	8	5	3	—	—	—	—	—	—	—	—
S. montevideo	1	—	1	—	—	—	—	—	—	—	—
S. lexington	6	5	1	—	—	—	—	—	—	—	—
S. stanley	8	4	3	—	1	—	—	—	—	—	—
S. typhosa	15	12	3	—	—	—	—	—	—	—	—
S. weltevreden	6	4	2	—	—	—	—	—	—	—	—
S. saint paul	2	2	—	—	—	—	—	—	—	—	—
S. tananarive	7	6	1	—	—	—	—	—	—	—	—
S. typhimurium	3	2	1	—	—	—	—	—	—	—	—
S. bovismorbificans	2	—	1	1	—	—	—	—	—	—	—
S. panama	15	7	8	—	—	—	—	—	—	—	—
S. newlands	2	1	1	—	—	—	—	—	—	—	—
S. newport	1	—	1	—	—	—	—	—	—	—	—
S. oslo	2	2	—	—	—	—	—	—	—	—	—
S. heidelberg	1	1	—	—	—	—	—	—	—	—	—
S. meleagridis	1	1	—	—	—	—	—	—	—	—	—
S. tennessee	1	1	—	—	—	—	—	—	—	—	—
S. moscow	1	1	—	—	—	—	—	—	—	—	—
S. abony	1	—	1	—	—	—	—	—	—	—	—
S. javiana	21	8	11	1	1	—	—	—	—	—	—
Aeromonas sp.	1	1	—	—	—	—	—	—	—	—	—
Shigella sonnei form I	54	52	2	—	—	—	—	—	—	—	—
Sh. sonnei form II	9	9	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 1	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 2	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 4	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 5	1	1	—	—	—	—	—	—	—	—	—
Sh. flexneri 1	11	11	—	—	—	—	—	—	—	—	—
Sh. flexneri 2	64	62	1	—	—	—	—	—	—	—	1
Sh. flexneri 3	39	39	—	—	—	—	—	—	—	—	—
Sh. flexneri 4	5	5	—	—	—	—	—	—	—	—	—
Sh. flexneri 5	3	3	—	—	—	—	—	—	—	—	—
Sh. flexneri 6	4	4	—	—	—	—	—	—	—	—	—
Sh. boydii 1	1	1	—	—	—	—	—	—	—	—	—
Sh. boydii 2	6	6	—	—	—	—	—	—	—	—	—
Escherichia coli 055:B5	7	5	1	1	—	—	—	—	—	—	—
E. coli 026:B6	6	6	—	—	—	—	—	—	—	—	—
E. coli 086:B7	2	2	—	—	—	—	—	—	—	—	—
E. coli 0127:B8	19	17	1	—	—	—	1	—	—	—	—
E. coli 0112:B11	7	4	3	—	—	—	—	—	—	—	—
E. coli 0128:B12	22	6	13	—	2	—	—	—	—	—	1
E. coli 0119:B14	70	67	1	1	—	—	1	—	—	—	—
E. coli 0125:B15	42	38	—	4	—	—	—	—	—	—	—
E. coli 0126:B16	10	10	—	—	—	—	—	—	—	—	—
E. coli 0124:B17	1	1	—	—	—	—	—	—	—	—	—
E. coli 025:B19:B23	56	45	7	2	—	1	1	—	—	—	—

Table 6

SENSITIVITIES OF ENTERIC ORGANISMS TO FURAZOLIDONE

from 1 April 1968 through 31 March 1969

	No. of strains tested	Isolates Inhibited at mcg/ml									
		0.78	1.56	3.12	6.25	12.5	25	50	100	200	> 200
Salmonella paratyphi B	19	7	—	—	—	—	12	—	—	—	—
S. derby	65	42	18	2	3	—	—	—	—	—	—
S. anatum	9	9	—	—	—	—	—	—	—	—	—
S. montevideo	1	1	—	—	—	—	—	—	—	—	—
S. lexington	7	4	—	1	2	—	—	—	—	—	—
S. stanley	11	10	1	—	—	—	—	—	—	—	—
S. typhosa	15	15	—	—	—	—	—	—	—	—	—
S. weltevreden	7	6	—	—	—	1	—	—	—	—	—
S. saint paul	2	2	—	—	—	—	—	—	—	—	—
S. tananarive	8	7	1	—	—	—	—	—	—	—	—
S. typhimurium	6	4	1	1	—	—	—	—	—	—	—
S. bovismorbificans	2	2	—	—	—	—	—	—	—	—	—
S. panama	15	10	—	5	—	—	—	—	—	—	—
S. newlands	2	2	—	—	—	—	—	—	—	—	—
S. newport	1	1	—	—	—	—	—	—	—	—	—
S. oslo	2	—	—	1	—	1	—	—	—	—	—
S. heidelberg	2	2	—	—	—	—	—	—	—	—	—
S. meleagridis	1	1	—	—	—	—	—	—	—	—	—
S. tennessee	2	2	—	—	—	—	—	—	—	—	—
S. moscow	1	1	—	—	—	—	—	—	—	—	—
S. abony	1	1	—	—	—	—	—	—	—	—	—
S. javiana	21	7	3	11	—	—	—	—	—	—	—
Aeromonas sp.	1	—	1	—	—	—	—	—	—	—	—
Shigella sonnei form I	53	48	3	2	—	—	—	—	—	—	—
Sh. sonnei form II	10	8	1	—	—	—	1	—	—	—	—
Sh. dysenteriae 1	2	1	1	—	—	—	—	—	—	—	—
Sh. dysenteriae 2	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 4	1	1	—	—	—	—	—	—	—	—	—
Sh. flexneri 1	12	8	2	2	—	—	—	—	—	—	—
Sh. flexneri 2	72	51	9	9	1	2	—	—	—	—	—
Sh. flexneri 3	41	33	6	2	—	—	—	—	—	—	—
Sh. flexneri 4	8	7	—	1	—	—	—	—	—	—	—
Sh. flexneri 5	2	2	—	—	—	—	—	—	—	—	—
Sh. flexneri 6	10	10	—	—	—	—	—	—	—	—	—
Sh. boydii 1	1	1	—	—	—	—	—	—	—	—	—
Sh. boydii 2	9	8	—	—	1	—	—	—	—	—	—
Escherichia coli 055:B5	6	3	1	1	—	—	1	—	—	—	—
E. coli 026:B6	7	4	2	—	—	1	—	—	—	—	—
E. coli 086:B7	2	2	—	—	—	—	—	—	—	—	—
E. coli 0127:B8	21	19	—	1	1	—	—	—	—	—	—
E. coli 0112:B11	9	9	—	—	—	—	—	—	—	—	—
E. coli 0128:B12	20	17	3	—	—	—	—	—	—	—	—
E. coli 0119:B14	72	54	4	2	1	8	3	—	—	—	—
E. coli 0125:B15	46	33	5	1	4	2	1	—	—	—	—
E. coli 0126:B16	12	6	1	—	3	2	—	—	—	—	—
E. coli 0124:B17	2	2	—	—	—	—	—	—	—	—	—
E. coli 025:B19:B23	49	47	1	1	—	—	—	—	—	—	—

Table 7

SENSITIVITIES OF ENTERIC ORGANISMS TO AMPICILLIN

from 1 April 1968 through 31 March 1969

	No. of strains tested	Isolates Inhibited at mcg/ml									
		0.78	1.56	3.12	6.25	12.5	25	50	100	200	> 200
Salmonella paratyphi B	19	10	—	—	—	—	—	—	—	—	9
S. derby	65	64	—	—	—	—	—	—	1	—	—
S. anatum	9	8	—	1	—	—	—	—	—	—	—
S. montevideo	1	—	—	—	—	—	—	—	—	—	1
S. lexington	7	7	—	—	—	—	—	—	—	—	—
S. stanley	11	8	—	1	—	—	—	—	—	—	2
S. typhosa	15	12	—	1	—	—	—	—	—	—	2
S. weltevreden	7	7	—	—	—	—	—	—	—	—	—
S. saint paul	2	2	—	—	—	—	—	—	—	—	—
S. tananarive	8	8	—	—	—	—	—	—	—	—	—
S. typhimurium	6	4	—	2	—	—	—	—	—	—	—
S. bovismorbificans	2	2	—	—	—	—	—	—	—	—	—
S. panama	15	1	—	—	—	—	—	—	—	1	13
S. newlands	2	2	—	—	—	—	—	—	—	—	—
S. newport	1	1	—	—	—	—	—	—	—	—	—
S. oslo	2	1	1	—	—	—	—	—	—	—	—
S. heidelberg	2	2	—	—	—	—	—	—	—	—	—
S. meleagridis	1	1	—	—	—	—	—	—	—	—	—
S. tennessee	2	—	—	2	—	—	—	—	—	—	—
S. moscow	1	—	—	—	—	—	—	—	—	—	1
S. abony	1	1	—	—	—	—	—	—	—	—	—
S. javiana	21	1	—	—	—	—	—	—	—	—	20
Aeromonas sp.	1	—	—	—	—	—	—	—	1	—	—
Shigella sonnei form I	53	6	11	34	2	—	—	—	—	—	—
Sh. sonnei form II	10	1	3	2	—	—	—	—	—	—	4
Sh. dysenteriae 1	2	1	1	—	—	—	—	—	—	—	—
Sh. dysenteriae 2	1	—	1	—	—	—	—	—	—	—	—
Sh. dysenteriae 4	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 5	—	—	—	—	—	—	—	—	—	—	—
Sh. flexneri 1	12	9	—	1	—	—	—	—	—	1	1
Sh. flexneri 2	69	59	7	2	—	—	—	—	1	—	—
Sh. flexneri 3	39	32	5	2	—	—	—	—	—	—	—
Sh. flexneri 4	4	2	2	—	—	—	—	—	—	—	—
Sh. flexneri 6	4	3	1	—	—	—	—	—	—	—	—
Sh. boydii 1	1	1	—	—	—	—	—	—	—	—	—
Sh. boydii 2	3	3	—	—	—	—	—	—	—	—	—
Sh. boydii 4	1	—	1	—	—	—	—	—	—	—	—
Escherichia coli 055:B5	6	2	—	—	—	—	—	—	—	—	4
E. coli 026:B6	7	—	2	2	1	—	—	—	1	1	—
E. coli 086:B7	2	—	—	1	—	—	—	—	—	1	—
E. coli 0127:B8	21	1	1	3	1	—	—	—	—	5	10
E. coli 0112:B11	9	—	1	3	—	—	—	—	—	—	5
E. coli 0128:B12	20	2	—	9	1	1	1	—	3	—	3
E. coli 0119:B14	72	1	3	13	—	—	—	1	—	16	38
E. coli 0125:B1525:B15	45	2	4	11	2	—	2	—	—	4	20
E. coli 0126:B16	12	—	—	—	—	—	—	—	—	—	12
E. coli 0124:B17	2	—	1	—	—	—	—	1	—	—	—
E. coli 025:B19:B23	49	3	7	8	3	—	1	1	—	9	17

Table 8

SENSITIVITIES OF ENTERIC ORGANISMS TO NEOMYCIN SULFATE

from 1 April 1968 through 31 March 1969

	No. of strains tested	Isolates Inhibited at mcg/ml									
		0.78	1.56	3.12	6.25	12.5	25	50	100	200	> 200
Salmonella paratyphi B	20	2	2	1	—	3	1	—	1	3	7
S. derby	61	18	29	12	—	—	—	1	—	1	—
S. anatum	8	4	4	—	—	—	—	—	—	—	—
S. montevideo	1	—	—	—	1	—	—	—	—	—	—
S. lexington	6	3	3	—	—	—	—	—	—	—	—
S. stanley	8	4	3	—	1	—	—	—	—	—	—
S. typhosa	13	5	5	1	—	—	—	—	—	—	2
S. weltevreden	6	3	2	—	—	—	—	—	1	—	—
S. saint paul	2	—	1	1	—	—	—	—	—	—	—
S. tananarive	7	4	3	—	—	—	—	—	—	—	—
S. typhimurium	3	—	—	—	2	—	—	—	—	—	1
S. bovismorbificans	2	1	1	—	—	—	—	—	—	—	—
S. panama	15	—	1	—	—	—	—	—	—	1	13
S. newlands	2	—	1	1	—	—	—	—	—	—	—
S. newport	1	—	1	—	—	—	—	—	—	—	—
S. oslo	2	—	2	—	—	—	—	—	—	—	—
S. heidelberg	1	1	—	—	—	—	—	—	—	—	—
S. meleagridis	1	—	1	—	—	—	—	—	—	—	—
S. tennessee	1	—	—	1	—	—	—	—	—	—	—
S. moscow	1	—	—	—	—	—	—	—	—	—	1
S. abony	1	—	1	—	—	—	—	—	—	—	—
S. javiana	23	1	—	1	—	—	—	—	1	4	16
Aeromonas sp.	1	—	1	—	—	—	—	—	—	—	—
Shigella sonnei form I	53	1	10	24	18	—	—	—	—	—	—
Sh. sonnei form II	9	—	1	4	—	—	—	—	—	1	3
Sh. dysenteriae 1	1	—	—	—	1	—	—	—	—	—	—
Sh. dysenteriae 2	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 4	1	1	—	—	—	—	—	—	—	—	—
Sh. dysenteriae 5	1	—	—	—	1	—	—	—	—	—	—
Sh. flexneri 1	11	1	—	2	4	4	—	—	—	—	—
Sh. flexneri 2	64	—	1	14	35	14	—	—	—	—	—
Sh. flexneri 3	39	—	—	8	25	4	—	—	—	—	2
Sh. flexneri 4	5	—	—	2	3	—	—	—	—	—	—
Sh. flexneri 5	3	1	—	—	2	—	—	—	—	—	—
Sh. flexneri 6	4	—	—	3	1	—	—	—	—	—	—
Sh. boydii 1	1	—	—	—	1	—	—	—	—	—	—
Sh. boydii 2	6	—	1	4	1	—	—	—	—	—	—
Escherichia coli 055:B5	7	—	2	—	—	—	—	—	1	2	2
E. coli 026:B6	6	—	2	—	3	—	—	—	—	—	1
E. coli 086:B7	2	—	1	1	—	—	—	—	—	—	—
E. coli 0127:B8	19	—	5	4	1	—	—	—	—	2	7
E. coli 0112:B11	7	—	3	—	—	—	—	—	—	2	2
E. coli 0128:B12	22	2	6	2	2	1	1	—	3	4	1
E. coli 0119:B14	70	5	15	6	1	1	1	—	2	6	33
E. coli 0125:B15	42	3	7	2	3	—	—	—	1	4	22
E. coli 0126:B16	10	—	—	1	—	—	—	—	—	—	9
E. coli 0124:B17	1	—	1	—	—	—	—	—	—	—	—
E. coli 025:B19:B23	57	7	17	5	6	—	—	—	—	7	12

Table 9

SENSITIVITIES OF ENTERIC ORGANISMS TO CHLORAMPHENICOL

from 1 April 1968 through 31 March 1969

	No. of strains tested	Isolates Inhibited at mcg/ml									
		0.78	1.56	3.12	6.25	12.5	25	50	100	200	>200
Salmonella paratyphi B	20	—	—	4	2	—	—	—	2	2	10
S. derby	65	—	1	30	30	3	—	1	—	—	—
S. anatum	8	—	3	3	1	—	—	—	—	—	1
S. montevideo	1	—	—	—	—	—	—	—	—	—	1
S. lexington	6	—	—	2	3	—	—	—	—	—	1
S. stanley	8	—	—	7	1	—	—	—	—	—	—
S. typhosa	15	1	5	5	1	3	—	—	—	—	—
S. weltevreden	6	—	1	4	1	—	—	—	—	—	—
S. saint paul	2	—	—	—	—	—	—	—	—	2	—
S. tananarive	7	1	1	3	2	—	—	—	—	—	—
S. typhimurium	3	—	—	1	2	—	—	—	—	—	—
S. bovismorbificans	2	—	—	2	—	—	—	—	—	—	—
S. panama	15	—	—	1	5	—	—	1	6	1	1
S. newlands	2	—	—	1	1	—	—	—	—	—	—
S. newport	1	—	—	1	—	—	—	—	—	—	—
S. oslo	2	—	—	—	—	1	1	—	—	—	—
S. heidelberg	1	—	—	1	—	—	—	—	—	—	—
S. meleagridis	1	—	—	1	—	—	—	—	—	—	—
S. tennessee	1	—	—	—	1	—	—	—	—	—	—
S. moscow	1	—	—	1	—	—	—	—	—	—	—
S. abony	1	—	—	—	1	—	—	—	—	—	—
S. javiana	23	—	—	4	17	—	—	—	—	—	2
Aeromonas sp.	1	—	—	1	—	—	—	—	—	—	—
Shigella sonnei form I	53	1	—	4	—	—	—	—	—	—	48
Sh. sonnei form II	9	—	—	—	—	—	—	—	2	1	6
Sh. dysenteriae 1	1	—	—	—	—	—	—	—	1	—	—
Sh. dysenteriae 2	1	—	—	—	1	—	—	—	—	—	—
Sh. dysenteriae 4	1	—	1	—	—	—	—	—	—	—	—
Sh. dysenteriae 5	1	—	—	—	—	—	—	—	—	—	—
Sh. flexneri 1	9	1	—	1	—	—	—	2	1	1	3
Sh. flexneri 2	64	2	1	1	—	1	1	11	29	11	7
Sh. flexneri 3	39	—	—	—	1	—	—	—	20	16	2
Sh. flexneri 4	5	—	1	—	—	—	—	—	—	1	3
Sh. flexneri 5	2	—	—	—	—	—	—	—	1	1	—
Sh. flexneri 6	4	1	—	1	—	—	—	—	—	2	—
Sh. boydii 1	1	—	—	—	—	—	—	—	—	—	—
Sh. boydii 2	6	—	2	—	—	—	—	—	2	1	1
Escherichia coli 055:B5	7	1	—	1	—	—	—	—	2	1	2
E. coli 026:B6	6	—	—	3	—	—	—	—	—	1	2
E. coli 086:B7	2	—	—	—	1	—	—	—	—	—	1
E. coli 0127:B8	19	—	—	2	1	—	—	—	1	3	12
E. coli 0112:B11	7	—	—	2	—	1	—	—	—	3	1
E. coli 0128:B12	22	—	1	2	1	—	—	3	6	4	5
E. coli 0119:B14	70	—	1	8	7	3	1	—	3	13	34
E. coli 0125:B15	42	—	—	—	4	—	—	1	1	5	31
E. coli 0126:B16	10	—	—	—	—	—	—	1	3	1	5
E. coli 0124:B17	1	—	—	—	—	—	—	—	—	—	1
E. coli 025:B19:B23	56	—	1	5	10	3	1	—	6	7	23

Table 10

SENSITIVITIES OF ENTERIC ORGANISMS TO OXYTETRACYCLINE

from 1 April 1968 through 31 March 1969

	No. of strains tested	Inhibited at mcg/ml									
		0.78	1.56	3.12	6.25	12.5	25	50	100	200	>200
Salmonella paratyphi B	20	—	1	6	—	—	—	1	—	2	10
S. derby	65	—	15	31	9	5	3	—	—	1	1
S. anatum	8	—	—	7	—	—	—	—	—	—	1
S. montevideo	1	—	—	—	—	—	1	—	—	—	—
S. lexington	6	—	—	2	2	—	1	—	—	—	1
S. stanley	8	—	1	5	2	—	—	—	—	—	—
S. typhosa	15	1	6	4	1	—	—	—	—	—	2
S. weltevreden	6	—	—	5	—	—	—	—	—	—	1
S. saint paul	2	—	—	—	—	—	—	—	2	—	—
S. tananarive	7	1	—	4	1	—	1	—	—	—	—
S. typhimurium	3	—	—	—	2	—	—	—	—	—	1
S. bovismorbificans	2	—	—	1	—	—	1	—	—	—	—
S. panama	15	—	—	1	4	—	—	—	—	—	10
S. newlands	2	—	1	—	1	—	—	—	—	—	—
S. newport	1	—	—	—	—	1	—	—	—	—	—
S. oslo	2	—	—	—	—	1	1	—	—	—	—
S. heidelberg	1	—	—	—	—	—	1	—	—	—	—
S. meleagridis	1	—	—	1	—	—	—	—	—	—	—
S. tennessee	1	—	1	—	—	—	—	—	—	—	—
S. moscow	1	—	—	—	—	—	—	—	—	—	1
S. abony	1	—	—	—	1	—	—	—	—	—	—
S. javiana	23	—	1	—	—	1	—	—	—	2	19
Aeromonas sp.	1	—	—	—	—	—	1	—	—	—	—
Shigella sonnei form I	54	—	1	3	1	4	10	16	9	1	9
Sh. sonnei form II	9	—	—	—	—	1	—	1	2	—	5
Sh. dysenteriae 1	1	—	—	—	—	—	—	—	1	—	—
Sh. dysenteriae 2	1	—	—	1	—	—	—	—	—	—	—
Sh. dysenteriae 4	1	—	—	—	—	—	—	—	—	—	1
Sh. dysenteriae 5	1	—	—	—	—	—	—	—	—	—	1
Sh. flexneri 1	12	—	1	1	—	1	1	4	2	1	1
Sh. flexneri 2	64	—	3	4	—	7	20	17	—	3	10
Sh. flexneri 3	39	1	—	—	—	1	3	5	1	20	8
Sh. flexneri 4	5	—	—	1	1	—	1	2	—	—	—
Sh. flexneri 5	3	—	1	—	—	—	—	—	—	2	—
Sh. flexneri 6	4	—	—	2	—	—	—	—	2	—	—
Sh. boydii 1	1	—	—	—	—	—	—	—	—	—	1
Sh. boydii 2	6	—	—	2	—	1	—	—	—	—	3
Escherichia coli 055:B5	7	—	1	—	1	—	—	—	—	—	5
E. coli 026:B6	6	—	—	—	1	—	—	1	—	1	3
E. coli 0127:B8	19	—	—	2	1	—	—	—	1	1	14
E. coli 0112:B11	7	—	—	—	1	—	—	—	—	—	6
E. coli 0128:B12	22	—	—	1	—	—	1	—	—	3	17
E. coli 0119:B14	70	—	1	1	2	5	—	—	1	7	53
E. coli 0125:B15	42	—	—	—	3	1	—	1	4	1	32
E. coli 0126:B16	10	—	—	—	—	—	—	—	—	—	10
E. coli 0124:B17	1	—	—	—	—	—	—	—	—	—	1
E. coli 025:B19:B23	56	—	—	8	4	4	1	—	5	4	30

Table 11

Median Hemagglutination Titers of Sera with Sheep Erythrocytes Sensitized with Shigellae Antigens

Source of Sera	No. of Sera	Shigellae Antigen				
		Sh. dysenteriae 1	Sh. Sonnei 1	Sh. Sonnei 2	Sh. flexneri 2	Sh. flexneri 3
Shigella sonnei form I patients	6	8	16	8	8	8
Other Shigellosis Patients	2	16	8	8	32	16
Urban Thai Nationals (Non–diarrheal)						
5–9 yrs	25	4	16	8	0	0
10–12 yrs	45	4	16	8	4	4
13–15 yrs	13	4	16	8	4	4
Rural Thai Nationals (Non–diarrheal)						
<5 yrs	61	32	16	16	64	16
5–9 yrs	92	32	32	16	16	32
10–12 yrs	73	32	32	16	32	32
13–15 yrs	23	16	16	16	64	16
> 16–19 yrs	116	16	8	8	16	16
20 +	163	16	16	4	32	16

Table 12

Rank Order* of Viable Counts of Fecal Bacteria in Stools of Thai Infants

Organism	Rank Order	
	Acute Specimens	Convalescent Specimens
Coliforms	1	1
Gram negative anaerobic bacilli	2	2
Alpha—hemolytic streptococci	3	4
Lactobacilli	4	3
Streptococcus fecalis	5	5
Yeasts	6	6
Staphylococci	7	7

* Highest counts, 1; lowest counts 7.

Table 13

Effect of Iodochlorohydroxyquinoline on Vibrio Excretion of Cholera Patients at Samut—Prakarn and Songkla Provincial Hospitals

Treatment	Patient groups	No. of Patients Excreting Vibrios Through Day									
		1	2	3	4	5	6	7	8	9	10
ICHQ	Adults	14	13	18	8	6	5	1	1	0	0
	Children	5	5	4	4	4	1	1	1	0	0
Total		19	18	14	12	10	6	2	2	0	0
Placebo	Adults	10	10	10	10	10	8	5	4	2	0
	Children	1	1	1	1	1	0	0	0	0	0
Total		11	11	11	11	11	8	5	4	2	0