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Intestinal Parasitic Infections of School Children in Kwale District of Coast Province, Kenya

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Abstract: The study was carried out to determine the geographical distribution of intestinal parasitic infection in Kwale district, Kenya in 1981. Stool specimens were obtained from the school children and were examined for the presence of both helminth ova and protozoan cysts. *Entamoeba coli, Ascaris lumbricoides,* hookworm and *Trichuris trichiura* were found to be common in the area. The prevalence of ascariasis and trichuriasis showed similar geographical distribution among divisions. The prevalence were high in both Central and Southhern but relatively low in Kinango and Kubo divisions. However, the geographical distribution of prevalence of *E. coli* and hookworm infections were different from those of ascariasis and trichuriasis. These results might reflect the differences of the population densities, the water sources and the sanitary conditions.

key words: Intestinal parasites, school children, kenya

INTRODUCTION

It has been noted that physicians and public health authorities show little interest in the intestinal parasitic infections, although the health importance of parasitic diseases particularly in tropical regions have been well known (WHO, 1981). For the last 20 years, a number of

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studies on the relationship between nutritional status and parasitic infections have been made in Kenya and the importance of intestinal parasitic infection was newly understood (Stephenson *et al.*, 1980; Latham *et al.*, 1982 and 1983; Hall *et al.*, 1982).

The Kenya-Japan joint research programme on *Schistosoma haematobium* infection in Kwale district was started in 1981. At the beginning of the project, selected school children were examined for *S. haematobium* ova in urine (Ouma *et al.*, in press). At the same time, to determine the distribution of intestinal protozoa and helminths, the stool samples were also collected from the same children. Although the data were collected in 1981, such data could be useful as indicators when we consider the chronological change of health conditions of rural area of Kenya for the last 16 years, where there was no more data systematically collected in the area in early 1980's. The data was analyzed mainly from the geographical point of view and is reported here.

Description of the study area (Fig. 1)

Kwale district is an administrative area, 8,257 square kilometers in size, and located in the southern coast of Kenya. It faces the Indian ocean in the east and bounds the northern part of Tanzania on the south. Geographically, it can be separated into three areas; from sea to inland, the coastal strip, the hills and the hinterland. Among the four administrative divisions, Central and Southern divisions belong to the coastal strip, Kubo division is in hilly area and Kinango division belongs to the hinterland. The hinterland, which is relatively far from the sea, is the driest of the three zones. The population census is shown in Table 1.

Table 1. Population census data of Kwale district in 1979

	Kinango	Kubo	Central	Southern	Total
Male	44, 351	14, 318	23, 377	59, 700	141, 746
Female	50, 362	14, 932	22, 950	58, 373	146, 617
Total	94, 713	29, 250	46, 327	118, 073	288, 363
Size of land (㎢)	3, 837	454	340	3, 331	8, 257
Population density (/㎢)	25	64	136	36	35

Materials and Methods

The stool samples were obtained from the school children, whose urine were also examined for ova of *S. haematobium* during the period between September and November in 1981 (Ouma *et al.*, in preparation). Out of the 135 primary school in Kwale district, 41 (30%) were chosen for the studies; 11 in Kinango, 8 in Central, 7 in Kubo and 15 in Southern divisions. The locations of these schools are shown in Fig. 1. Only the children of standard 4, 5 and 6 who were present on the day of examination were examined.

Each stool sample was examined for the presence of intestinal helminths and protozoa using the formalin ether concentration method (Ritchie, 1948). Potassium iodine solution was used for staining the cysts of protozoa.

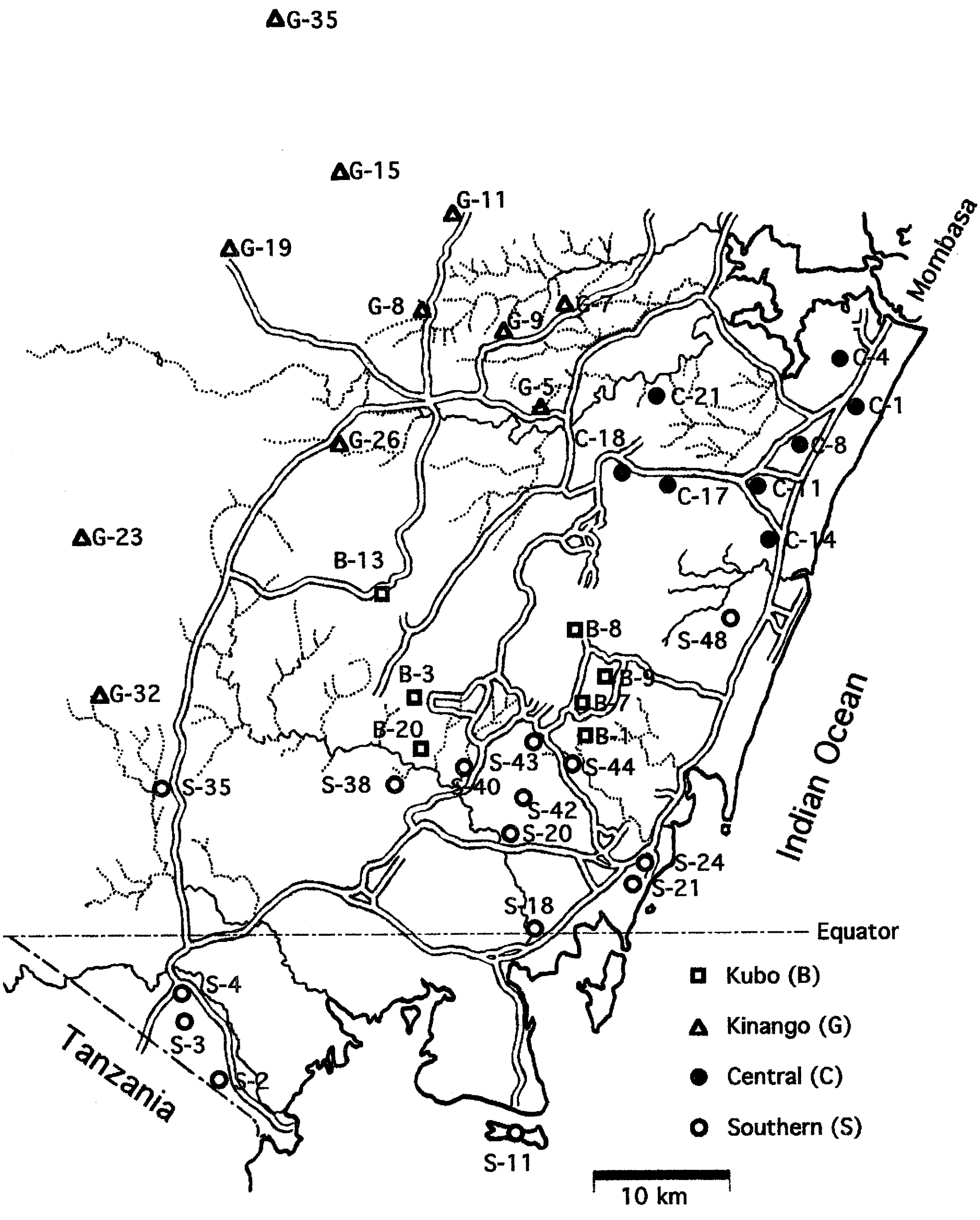

Figure 1 The location of the schools examined in Kwale district.

RESULTS

The results are summarized in Tables 2, 3 and 4. There was no significant differences in parasite infection rates between sexes and age groups. *E. coli, A. lumbricoides,* hookworm and *T. trichiura* were found to be common intestinal parasites in this area. Other parasites were found only in a few cases. *Taenia* spp. were not found at all.

The prevalence of each parasite varied considerably from school to school (Table 2). When they were lumped together by location, some differences in prevalence were found among the four divisions in the results of the common parasites, namely *E. coli, A. Lumbricoides,* hookworm and *T. trichiura* (Table 3 and Fig. 2). Ascariasis was more common in Central and Southern than in Kinango and Kubo and, trichuriasis also showed a similar geographical distribution. The geographical distributions of *E. coli* and hookworm infections were not similar to those of *Ascaris* and *Trichuris* infections. The prevalence of *E. coli* infection in Kinango division was significantly higher than those in Kubo, Central and Southern divisions and hookworm infection was equally distributed in all divisions.

As a whole, only less than 20% of the children examined in the study were not found to show any evidence of infection with intestinal parasites. Half of the children were infected with more than one parasite (Table 4).

Table 2. Infection rate of common intestinal parasites in each school

School	Location	No of pupil examined	No. of positives (%)							
			E. c.	%	A. l.	%	T. t.	%	H. w.	%
(Kubo)										
Mwagodzo	B-01	49	19	39	1	2	13	27	31	63
Lukore	B-03	107	43	40	2	2	20	19	54	50
Shimba Hills	B-07	67	18	27	1	1	11	16	40	60
Majimboni	B-08	104	41	39	3	3	29	28	67	64
Mwapala	B-09	101	24	24	9	9	34	34	51	50
Baakanda	B-13	48	18	38	0	0	2	4	26	54
Kibuyuni	B-20	59	27	46	7	12	10	17	38	64
subtotal		535	190	36	23	4	119	22	307	57
(Kinango)										
Ngonzini	G-05	24	13	54	0	0	4	17	11	46
Nzovuni	G-07	25	10	40	0	0	8	32	11	44
Mazola	G-08	53	21	40	1	2	4	8	15	28
Yapha	G-09	14	6	43	0	0	1	7	5	36
Mtaa	G-11	32	21	66	3	9	7	22	10	31
Makamini	G-15	17	12	71	0	0	1	6	6	35
Vigorungani	G-19	57	37	65	0	0	0	0	22	39
Mtumwa	G-23	36	21	58	1	3	2	6	11	31
Mwalukombe	G-26	45	25	56	2	4	6	13	22	49
Kilimangodo	G-32	48	31	65	1	2	3	6	23	48
Chanzou	G-35	24	18	75	0	0	2	8	7	29
subtotal		375	215	57	8	2	38	10	143	38

(Central)										
Ngombeni	C-01	116	36	31	43	37	98	84	71	61
Pungu	C-04	92	20	22	27	29	84	91	47	51
Mbweka	C-08	64	10	16	24	38	45	70	29	45
Vinuni	C-11	33	12	36	6	18	13	39	15	45
Mwaligulu	C-14	111	17	15	13	12	90	81	57	51
Bilashaka	C-17	68	21	31	8	12	23	34	27	40
Mwamgunga	C-18	68	17	25	9	13	36	53	29	43
Goloni	C-21	80	19	24	23	29	27	34	46	58
subtotal		632	152	24	153	24	416	66	321	51
(Southern)										
Chuwuni	S-02	67	30	45	2	3	19	28	46	69
Ngadhini	S-03	49	26	53	2	4	7	14	26	53
Mwalewa	S-04	34	12	35	1	3	6	18	26	76
Washini	S-11	—	—	—	—	—	—	—	—	—
Ramisi	S-18	78	27	35	46	59	70	90	57	73
Mwachande	S-20	25	6	24	0	0	8	32	17	68
Mwaembe	S-21	68	16	24	15	22	58	85	42	62
Jomo Kenyatta	S-24	68	11	16	16	24	58	85	40	59
Mwangulu	S-35	56	24	43	0	0	9	16	42	75
Mwandeo	S-38	61	30	49	4	7	10	16	48	79
Kilulu	S-40	19	6	32	0	0	6	32	14	74
Mivumoni	S-42	101	29	29	10	10	33	33	78	77
Nguluku	S-43	51	17	33	2	4	19	37	14	27
Maumba	S-44	25	6	24	11	44	21	84	11	44
Sham	S-48	70	11	16	28	40	66	94	48	69
subtotal		772	251	33	137	18	390	51	509	66

Abbreviations are indicated in Table 3.
The location of each school is shown in Fig. 1.

Table 3. The number of children infected with each intestinal parasite by division

Parasites	Kinango	%	Kubo	%	Central	%	Southern	%	Total	%
E. h.	17	4.5	26	4.9	13	2.1	45	5.8	101	4.4
E. c.	215	57.3	190	35.5	153	24.2	251	32.5	809	34.9
E. n.	26	6.9	8	1.5	20	3.2	19	2.5	73	3.2
I. b.	33	8.8	29	5.4	22	3.5	29	3.8	113	4.9
G. l.	3	0.8	4	0.7	2	0.3	6	0.8	15	0.6
C. m.	22	5.9	18	3.4	11	1.7	22	2.8	73	3.2
A. l.	8	2.1	23	4.3	153	24.2	137	17.7	321	13.9
H. w.	143	38.1	307	57.4	321	50.7	531	68.8	1,302	56.2
T. t.	38	10.1	117	21.9	416	65.7	390	50.5	961	41.5
S. m.	0	0.0	2	0.4	1	0.2	11	1.4	14	0.6
R. l.	1	0.3	0	0.0	1	0.2	7	0.9	9	0.4
H. d.	1	0.3	0	0.0	0	0.0	2	0.3	3	0.1
F.	1	0.3	1	0.2	0	0.0	0	0.0	2	0.1
E. v.	2	0.5	1	0.2	0	0.0	0	0.0	3	0.1
No. examined	375		535		633		772		2,315	

E. h.	*Entamoeba histolytica*	A. l.	*Ascaris lumbricoides*
E. c.	*Entamoeba coli*	H. w.	hookworm
E. n.	*Endolimax nana*	T. t.	*Trichuris trichiura*
I. b.	*Iodamoeba butschlii*	S. m.	*Schistosoma mansoni*
G. l.	*Giardia lamblia*	R. l.	rhabditiform larvae
C. m.	*Chilomastix mesnili*	H. d.	*Hymenolepsis diminuta*
		F.	*Fasciola* spp.
		E. v.	*Enterobius vermicularis*

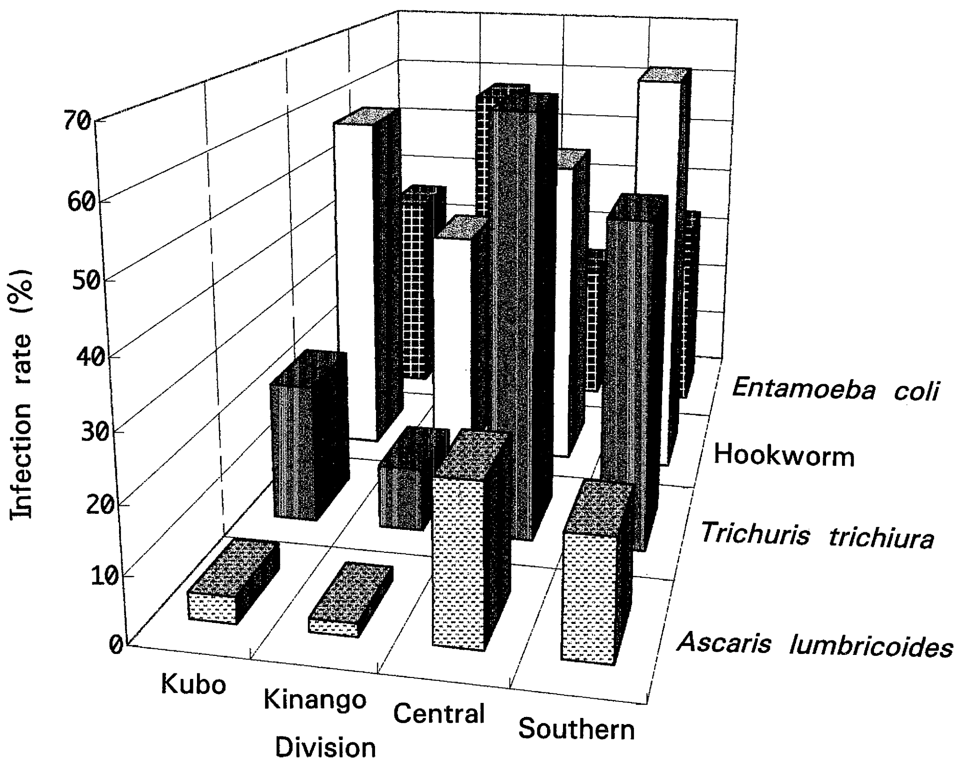

Figure 2 Infection with four common intestinal parasites.

Table 4. Multiple infection of intestinal parasites

No. of parasites co-infected	Kinango	%	Kubo	%	Central	%	Southern	%	Total	%
(Helminths)										
0	205	54.7	182	34.0	103	16.3	113	14.6	603	26.0
1	146	38.9	258	48.2	234	37.0	329	42.6	967	41.8
2	24	6.4	90	16.8	230	36.3	242	31.3	586	25.3
3	0	0.0	5	0.9	66	10.4	87	11.3	158	6.8
4	0	0.0	0	0.0	0	0.0	1	0.1	1	0.0
(Protozoa)										
0	135	36.0	310	57.9	440	69.5	462	59.8	1,347	58.2
1	176	46.9	182	34.0	166	26.2	255	33.0	779	33.7
2	53	14.1	36	6.7	26	4.1	49	6.3	164	7.1
3	10	2.7	7	1.3	1	0.2	5	0.6	23	1.0
4	1	0.3	0	0.0	0	0.0	1	0.1	2	0.1
(Helminths and Protozoa)										
0	71	18.9	118	22.1	69	10.9	72	9.3	330	14.3
1	152	40.5	183	34.2	199	31.4	223	28.9	757	32.7
2	111	29.6	172	32.1	219	34.6	278	36.0	780	33.7
3	30	8.0	47	8.8	111	17.5	136	17.6	324	14.0
4	9	2.4	15	2.8	32	5.1	55	7.1	111	4.8
5	2	0.5	0	0.0	3	0.5	6	0.8	11	0.5
>=6	0	0.0	0	0.0	0	0.0	2	0.3	2	0.1
No. examined	375		535		633		772		2,315	

Discussion

Although some of the parasites recovered in the study were not pathogenic, our results showed that intestinal parasites were highly endemic in the study area. Stephenson *et al.* (1980) and also Latham *et al.* (1982, 1983) demonstrated the health importance of intestinal parasitic infections. The high prevalence of Ascariasis, Trichuriasis and hookworm infection, and the existence of *E. histolytica* in children would not be ignored. It indicates that the sanitary condition in this area was poor enough to be improved.

The rhabditiform larvae, which we did not identify the species, found in the stool specimens may indicate the infection of *Strongyloides stercoralis.* The low prevalence of *Enterobius* infection was merely because we did not use the Scotch tape method for the examination. In Kwale district, however, *Strongyloides, Hymenolepsis, Fasciola* spp. and *Enterobius* are likely to be less important.

As the infection routes of both *A. lumbricoides* and *T. trichiura* are by oral ingestion, it is not surprising that those two parasite infections show similar geographical distribution pattern. They were frequently observed both in Central and Southern divisions but were less common in Kinango and Kubo divisions. The high prevalence of infection of *A. lumbricoides* and *T. trichiura* in Central division could be explained by the relatively high density of population in the area. The high prevalence in Southern division, whose overall population density was relatively low, could also be explained by high population density. Because, all of the schools which showed more than 80% of prevalence in *T. trichiura* infection in the area were located along the main road from Mombasa to Tanzania and the population density along the road was considered to be higher than that of whole division.

Although *E. coli* is not generally considered a pathogen, it is a good indicator of the contamination of water with feces. The high infection rate of *E. coli* in Kinango division probably reflects that people had been bound to use the contaminated water in this relatively dry area, where the water sources had been limited in number. The culture of hookworm eggs was not performed in our study and therefore the species were not determined. However, it is likely that the species is *Necator* which transmits through skin penetration of larvae. Hookworm in this area was almost equally distributed in all divisions. The distribution pattern was different from those of *A. lumbricoides* and *T. trichiura,* which are transmitted by oral ingestion. The poor local sanitation may be a main reason of the wide distribution of hookworm.

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