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schoolchildren of Thiruvananthapuram district**

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Pattern of Helminthic Infestation in Primary Schoolchildren of Thiruvananthapuram District

V. Raman Kutty, C. R. Soman, K. Vijaya Kumar*

1. Background of the study

Helminthic infestation is a serious public health problem, especially in areas of low environmental quality and of people of low nutritional status. In the growing stage, children are more susceptible to the ill effects of parasitic attacks as their need for nutrients is high. In young children, physical and mental development may be affected by mal-absorption, blood and protein loss and diarrhoea generated often by presence of several types of worms in the gut. There is also the risk of complications. Many parasites interfere with the process of intestinal absorption of nutrients. They feed on the nutrients, depriving the child of its sources of nutrition. The child is thus thrown into a state of acute and chronic malnutrition.

Soil is contaminated with helminth ova through defecation on the ground. In the warm and humid climate of the State, some types of ova have been reported to survive for months. Thus nematode infestations transmitted through soil become a serious issue.

Ascaris lumbricoides (round worm), *trichuris trichura* (whip worm), and *necator americanus* (hook worm) are the common intestinal nematodes found in Kerala. *Ascaris* that is universal is spread largely by local habits in the disposal of faeces. *Necator americanus* is common all over in South India. Earlier, serious complications in children, warranting hospitalisation and sometimes resulting in death used to be caused by intestinal worms. Currently, mortality due to this cause is rare; but morbidity continues to be rampant. Congested living conditions are a major factor behind infections with pin worm and whip worm; poor sanitation and walking bare foot on the soil are major reasons for spreading round worm and hook worm respectively. Thus the prevalence of infestation is intimately related to the conditions of living obtaining at the local level. Topography and geo-climatic environment give a location its specific characteristics in terms of its potential to breed parasitic organisms. The soil of Kerala is favourable for the survival of the helminthic ova, because of its warmth, and moisture content, as well as looseness in many parts of the State. Kerala has three natural

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topographical divisions: highland, characterised by undulating terrain and high rainfall, midland with its variety of flora, and the coast, which is hot and humid with stretches of thickly-populated sandy beaches. This difference may itself be a factor for the difference in the disease pattern in these areas. Round worm ova can survive for months in the favourable soil of the midlands, whereas in the coastal beaches, the hot sands make it difficult for the fragile hook worm ova to last long.

The difference in the density of population in the three natural geographical divisions also has a role in determining their respective disease patterns. More densely populated areas have, other things remaining the same, adverse man-land ratio and hence poor standards of living. Poor sanitation in the midland and the coastal areas trigger epidemics, whereas natural drainage of the highlands affords some degree of protection for their inhabitants.

Awareness of hygienic practices among the population is a factor facilitating reduction in the extent of infestation. Surveys conducted in the erstwhile State of Travancore prior to independence had come up with the observation that nearly all people in the rural areas were heavily infested with the intestinal helminths (Table 1). Though comparable statistics are difficult to generate, a helminthic survey made among schoolchildren during the 1950s and the 1960s gives some evidence about the prevalence of this affliction in the population.

Table 1 Prevalence of Helminthic infestation in Travancore by sex and region

	Specimen examined					
	Urban			Rural		
	Male	Female	Both	Male	Female	Both
Number of specimens examined	3097	777	3874	17254	3135	20389
<i>Hook worm</i>	2920	695	3615	16005	2902	18905
Percentage	94%	90%	93%	93%	93%	93%
<i>Round worm</i>	2305	572	2877	12671	2513	15184
Percentage	74%	74%	74%	73%	80%	74%
<i>Whip worm</i>	2315	583	2398	11988	2315	14303
Percentage	75%	77%	75%	70%	74%	70%
	Specimen examined					
	Male	Estate		Travancore		
		Female	Both	Male	Female	Both
Number of specimens examined	2655	873	3528	23006	4785	27791
<i>Hook worm</i>	2408	786	3194	21331	4383	25714
Percentage	91%	90%	91%	93%	92%	92%
<i>Round worm</i>	1916	631	2547	16892	3716	20608
Percentage	72%	72%	72%	74%	74%	74%
<i>Whip worm</i>	2308	709	2747	16341	3607	19948
Percentage	77%	82%	78%	71%	75%	72%

Source: Travancore Worm Survey, 1930

The Indo-Norwegian Health Project Report 1954-‘65 shows the prevalence rate of helminthic worm infestation in the age group 1-12 yrs. (Table 2). Statistics relating to the differential prevalence of nematodes in the three major geographical strata in the state, viz., highland, midland, and coastal villages, show that the prevalence had continued to be high in all the three regions even during the 1970s. No extensive study on this problem has been taken up since then.

Table 2 Prevalence of Helminthic infestation in Kerala among children in the age group of 1-12 years: 1954, 1960, and 1965

Age	Year	Hookworm	Roundworm	Whipworm	No worm	Total samples
1- 6 YEARS	1954	33(45.8%)	55(76.38%)	48(66.66%)	1(1.38%)	72
	1960	22(35.48%)	42(67.74%)	29(46.77%)	12(19.3%)	62
	1965	22(43.13%)	41(80.39%)	37(72.54%)	1(1.96%)	51
7 -12 YEARS	1954	18(41.36%)	39(90.69%)	30(69.76%)	0	43
	1960	18(42.85%)	27(64.28%)	19(45.23%)	2 (4.6%)	42
	1965	23(51.11%)	35(77.77%)	32(71.11%)	-	45

Source: Indo-Norwegian Health Project Report, 1954-1965

The fast-changing socio-economic situation, with its attendant changes in the behaviour pattern of the people, also determines disease patterns. Specifically, increasing use of toilets by the growing middle class has come about more as a result of cultural and aesthetic aspirations to imitate a more sophisticated lifestyle than from any perceived health necessity.

This applies to many habits and practices like eating from tables (as opposed to the old practice of squatting on the ground to eat), taking regular baths, and the universal use of foot wear. There have taken place several positive changes attributable to such shifts in behaviour, though a good number of them have had adverse health effects also.

Objectives

The major objectives of the study are the following:

- (i) To estimate the prevalence of intestinal worm infestation in primary schoolchildren in Thiruvananthapuram district, among coastal, midland, highland, and urban schools separately;
- (ii) To study the pattern of infestation and compare it with the profile of helminthic infestations in the past;
- (iii) To initiate control in the selected schools through medical and health education measures.

Method

In this study, we have made an attempt to assess the prevalence of helminthic infestation among primary schoolchildren of Thiruvananthapuram district that covers all the three topographical strata. To get children from all the strata, the schools in the district were classified into three categories on the basis of the three strata and the urban areas; government, aided, and unaided schools were included in the sample. We made random selection of two schools from highland, two from coastal, two from urban, and four from midland areas. This was based roughly on the settlement pattern in the State, where most people lived in the midlands. A total of 10 schools were thus included. Official permission was obtained from the Director of Public Instruction for conducting the study.

We visited the schools to get the list of students as a first step. This was followed by a meeting of parents in each school. The objective of conducting the meeting of parents in selected schools was to sensitise them on the problem of worm infestation. Its magnitude as well as possible preventive measures were explained to the parents. The parents were instructed on the best mode of collecting stool samples. Clean bottles were supplied to all children, with instructions to bring the stools next morning. General information on the panchayat/locality in which the schools were located was collected from the Development Reports of the panchayats.

The objective of this exercise was not to establish one-to-one correlation between high helminthic load in children and poor sanitary environment, as the existence of such a relationship is well known. Rather, it was to test whether the percentage of schoolchildren suffering from helminthic load could be used as an index of the level of environmental hygiene for the whole village. Secondary data as well as primary data from pre-tested protocol were collected for this purpose. Pre-tested protocol included education level, job of parents, hygienic practices of children, usage of toilets, and source of drinking water. Stool samples were collected during October 1998 – March 1999.

Formol-ether sedimentation technique was used for examination of stool (Appendix). For examination, we placed a drop of deposit on a perfectly clean grease-free glass slide (3"x1"). A cover slip (no .0 or 1) was placed over the drop. Examination was done selectively both with low power and high power objectives.

After preliminary examination by the technician, one of the investigators checked every ambiguous slide, to confirm it as either negative or positive. In addition, we also did a random review of about 10 per cent of slides already examined by the technician. A few slides were kept aside, about which doubts remained even after screening by one of the investigators, to be later scrutinised by a parasitology expert. Students testing positive for any helminth were given albendazole, a broad-spectrum antihelmintic. This was distributed with the help of teachers, together with correct instructions.

Results

The records of panchayats in all the areas suggested that water scarcity and environmental

pollution still remain major problems. The majority of the people depend on household wells for drinking water. But these were not sanitary wells in the true sense of the term. Lack of toilets was still a major problem in all the areas except in Kowdiar, a city ward. Malnutrition, water-borne diseases and air-borne diseases were listed as the commonly prevalent diseases in these areas.

Case Studies

Worm infestation is a typical example of a condition that reflects the status of the environment, more than personal attributes. With a view to capturing the status of the microlevel environment within which the children in the sample lived, we carried out in-depth case studies of one school from each stratum.

A coastal school: Vizhinjam Harbour Lower Primary School

Preliminary analysis indicated the highest prevalence of worm infestation in the Vizhinjam School.

Vizhinjam Harbour LP School began functioning in 1974. The school is situated half-a-km away from Vizhinjam harbour. Started in a small way, the school has grown over the years. Currently there are 545 students, 15 class divisions and 18 teachers in the school. Students are exclusively from the Muslim religion. Dropout rates are high by Kerala standards; with the introduction of DPEP, five volunteers have been assigned the task of bringing the dropped out children back to school.

The majority of the children come from the very low socio-economic stratum. Absence of children away in schools has caused problems for their parents. Fishing is their livelihood and many parents reported that they had only low levels of schooling.

The advent of mechanised fishing has cut into their income and the common perception is that the level of real poverty among them has increased. The homes are overcrowded, and the environment is despicable. The density of population is about 3000/sq.km. Open defecation is the norm and safe drinking water, scarce. The public water supply system very often does not function.

Malnutrition and unhygienic living practices make these students vulnerable to diseases. During the previous year there was a small outbreak of cholera, contained by prompt action by public health authorities. The Vizhinjam Community Health Centre is the nearest health facility available to the people. Most of the students and parents seek medical help from the Centre because its services are cheap. School authorities have correctly reportedly lack of knowledge, lack of safe drinking water, crowded houses, and open defecation as the principal causes of high prevalence of worm infestation.

A midland School: Kanyakulangara Lower Primary School

This school showed that 43.11 per cent of its pupils had worm infestation. The Infestation

rate is low when compared with the corresponding rates in highland and coastal schools.

Kanyakulangara LPS was started in 1924. The school is situated 19 km away from Thiruvananthapuram City. At present there are 554 students 14 divisions and 14 teachers in this school. The majority of the students belong to Muslim and Hindu religions. The school has an active Parents Teachers Association (PTA) with 15 members in its executive. Frequent meetings of the PTA are held.

Students come from different backgrounds. Most parents are small businessmen. Rubber tappers, manual workers, farmers, and Gulf employees also constitute a good number of the parents. All parents are literate. Most parents have at least 10 years of schooling. A large number of students have toilet and good drinking water facilities at home. Water scarcity and open defecation are not stated as major problems in this community.

Malnutrition and anaemia are not cited as significant health issues among pupils in this school. The major problem among the students is dental caries. Seasonal diseases like mumps and chickenpox are reported. Absenteeism due to disease is scarce. Students and their parents seek medical care from the nearest community health centre, Kanyakulangara.

Compared with conditions in the other schools, worm infestation rate is low here. It is attributable to the health consciousness of parents, high literacy level, increased knowledge and importance of hygiene in health care.

School authorities suggested a haemoglobin test as a felt need though anaemia is not seen as a problem. One important question that remained unanswered is why despite the otherwise healthy environment, a significant proportion of the schoolchildren still showed worm ova in the stool. This underscores the need for focused health education, emphasising personal hygiene habits among children in the school.

A highland School: Thekkada Lower Primary School

Thekkada School was established in 1959. In the beginning, facilities in the school were poor. Now there are 243 students, 8 divisions, and 9 teachers in this school. It is situated 23 km away from Thiruvananthapuram City. The school has an active PTA that meets regularly.

Most of the students come from agricultural families. A few are children of government employees and some come from families of manual labourers. All parents are literate, most having 5-8 years of schooling. The majority of the student population comes from middle class families, but most homes have no toilets. They depend on common taps for water and open ground for defecation. About one-fourth of students use toilets and wells at home. Thus open defecation and lack of safe drinking water are serious issues. Many parents do not seem to be seriously concerned about their children's health. Surprisingly, toilets are not high in the agenda of the people in this area.

Health status of the students is poor as evidenced by the presence of clinical anaemia and signs of vitamin deficiency in a large proportion of the students. Reported immunisation

coverage is only 60 per cent. They take medical care from the Community Health Centre Kanyakulangara. Measles was recently reported in six students. Relatively low educational status of parents, lack of hygiene and safe drinking water are the major problems in the community. The high prevalence of worm infestation may be attributed mainly to these factors.

School authorities believe that school health education and health awareness sessions for parents will go a long way in solving the problems.

Children in highland areas have relatively high prevalence of worm infestation despite low density of population and good drainage. Some factors deserve mention here. Most parents are agricultural workers. Their children also spend part of their time working on land. Most of them defecate in the open. These two attributes together may account for the observed high prevalence.

An Urban School: Saint Shanthal English Medium Lower Primary School

Saint Shantal EMLP School was started in 1984. The school consists of 383 students, 10 teachers, and 8 divisions. It is situated in Thiruvananthapuram City. Children from Hindu and Christian families constitute the majority of the student population. A PTA was constituted in 1997. The majority of the students come from affluent families. Most parents hold salaried jobs. A few do manual work for a living. All parents have had schooling for at least 10 years. All houses have toilets and good drinking water facility. High standard of living is a characteristic of most of the families.

Malnutrition and anaemia were not seen in any student. Common ailments like fever, cough, and cold were reported. Immunisation status is high. In short, most students are healthy. All of them prefer medical care from private hospitals and not from government health care institutions. High standard of living, increased knowledge and awareness of the importance of hygiene are positive factors in maintaining the health of students.

Low prevalence rate of worm infestation among the pupils in the school may be due to the above positive factors. Moreover special care and attention by parents is also a major contributing factor in keeping the children protected from infestations.

School authorities suggest that health awareness class of the type conducted should not be stopped. Awareness should be given on all health-related issues to the parents. Even with such favourable environmental conditions, nearly one out of four children is found to harbour worms. This finding suggests that however good the individual family's efforts may be, community level measures are needed to eliminate helminthic infestation.

Discussion

- (i) Prevalence of worm infestation: Overall, about 58 per cent of specimens examined were positive for some type of ova. Stools from coastal children showed the greatest prevalence, with almost three out of four showing evidence of worms; more than one-

half of midland specimens and almost two thirds of highland specimens were also positive. On the other hand, only around one in four of the urban children showed evidence of helminthiasis in stools. The presence of ova in stools seems to be related to both the geographical setting of the locale (highland, midland, coastal or urban), and the socio-economic background of the families. Coastal children are more prone partly due to poor living conditions, and partly to the lack of awareness of hygienic practices on the part of their parents. In the highlands, though natural drainage exists in the locality and density of population is low, factors conducive for low prevalence, our study brings out that intestinal helminthiasis continues to be a major problem in this area. Insensitivity of the parents to children's hygiene and the children's frequent exposure to ova-laden soil emerged as important factors in the case studies. Midland specimens showed a lower prevalence than in the other two areas, may be due to comparatively better living conditions and greater awareness on the part of parents. Urban children, in whom helminthiasis should have been absent, still show a not-so-low prevalence, of greater than one in four. This fact should sensitise us to the low standards of environmental hygiene even in the State's cities.

- (ii) Types of ova: We specifically looked for four organisms, viz., roundworm, hookworm, whipworm and pinworm. Roundworms were the major intestinal parasite, accounting for most of the ova found. The dramatic disappearance of hookworm ova from the stools of children of the State becomes evident when we compare this data with earlier reports. This achievement is mostly to be attributed to the wide prevalence of footwear use in the State, even among children. Also, the ova of hookworms being rather fragile, breaking the cycle of re-infection at some point results in their being unable to spread in the population. In contrast, roundworm ova that can live for years in the soil continues to be present in all the sample areas. Spread of whipworm and pinworm has much to do with personal hygiene; and it is observed that whipworm prevalence has not come down in the Thiruvananthapuram district to any great extent (Table 3).

Table 3 Helminthic infestation among institutionalised children aged 5-17 years by, natural division in Kerala (in per cent of population)

Type of ova	Highlands	Midlands	Coastal
Round worm	72	77	76
Hook worm	26	2	24
Whip worm	15	15	22
Mixed infection	32	17	28
Total positive stools	100	92	92

Source: P. G. K. Panikar and C. R. Soman, *Health Status of Kerala*, Thiruvananthapuram, Centre for Development Studies 1984, p. 74

- (iii) Prevalence in relation to other factors: As we have seen, prevalence is clearly related to geographical and socio-economic factors. Going into the details, we find that the presence of toilets in the house, washing hands with soap after defecation and before

eating, and use of footwear by children, are all behavioural attributes that afford some protection. These may be seen as pointers of a more enlightened lifestyle and not merely as preventive measures practised for their own sake. The evidence for this is in the clear relationship of parents' educational status with helminthic infestation in children: parents with at least seven years of schooling had children with much lower levels of infestation. However, even in the urban school where most children came from families of educated parents, one in four stool specimens showed round worm ova. We are tempted to suggest that one of the principal reasons may be the consumption of raw, uncooked vegetables, which are grown in the soil. However, as we have not gone into this question, we cannot be sure in this regard. Perhaps an examination of washing of raw vegetables for helminthic ova may throw light on this question.

More importantly, this finding could mean that however good the personal measures of hygiene, our environmental hygiene still leaves a lot to be desired. Improvements can be brought about only by community and civic action and not solely through efforts of individual families.

- (iv) Implications of the findings: Despite the presence of round worm ova in the gut of a large proportion of the children, it does not seem to pose a major health hazard, since from anecdotal evidence we know that instances of acute intestinal obstruction and other medical catastrophes precipitated by a large number of worms in the gut are almost non-existent in recent times. Thus, our findings should not cause any alarm. Moreover, the almost complete absence of hookworms and pinworms, which can be potentially far more distressing, is indeed an encouraging sign. However, the presence of round worms almost universally under all situations should cause concern for our environmental quality. Continuing presence of whipworm ova in stools should also alert us to the need for improvement in personal hygiene. Action for improving this is imperative. In this regard, we find that the prevalence of intestinal worms in primary schoolchildren may be used as an indicator of the environmental status of a village. Local bodies should use worm surveys in schools, which can be completed very easily and at small cost, to monitor periodically the improvement taking place in the living conditions in the areas concerned.

Stool examination

There were 3136 students in the 10 schools selected for the study. Two thousand three hundred and fifty stool samples were examined, making up a response rate of 75 per cent. Response rate was 534/817(64 per cent) in the coastal area, 1115/1396(80 per cent) in the midland area, 470/520 (90 per cent) in the highland, and 241/403 (60 per cent) in the urban area. Detailed results are given in Appendix Tables 1-10.

Appendix

Formol ether sedimentation technique

Approximately 1 gm of stool is emulsified in 7 ml of 10 per cent formol saline, And stained through wire gauze of 40 mesh perish into a centrifuge tube. 3 ml of ether is added into the tube, and shaken vigorously for one minute. The suspension is centrifuged at 2000 r.p.m. for two minutes. Faecal debris if any is carefully loosened and decanted without disturbing the deposit sediment. The deposit is used for microscopic examination.

Table 1 Distribution of subjects by age and sex, 1998

Sex	Age in years								Total number
	5	6	7	8	9	10	11	12	
Male	138	217	251	293	182	40	8	4	1133 (48.12%)
Female	155	237	273	276	235	41	2	0	1219 (51.88%)
Total	293 12.5%	454 19.3%	524 22.3%	569 24.2%	417 17.7%	81 3.4%	10 0.4%	4 0.2%	2352

Source: Field Survey, 1958

Table 2 Presence of ova in stools by location of school

Ova in stool	Coastal	Midland	Highland	Urban	Total
Yes	407 (77.7%)	578 (51.8%)	300 (63.8%)	65 (27%)	1350 (57.4%)
No	117 (22.3%)	537 (48.2%)	170 (36.2%)	176 (73%)	1000 (42.6%)
Total	524	1115	470	241	2350

Source: Field Survey, 1958

Table 3 Roundworm ova in stools by location of school

Roundworm	Coastal	Midland	Highland	Urban	Total
No	139 (26.5%)	600 (53.8%)	205 (43.6%)	179 (74.3%)	1123 (47.8%)
Yes	385 (73.5%)	515 (46.2%)	265 (56.4%)	62 (25.7%)	1227 (52.2%)
Total	524	1115	470	241	2350

Figures in brackets indicate percentage of the total; Source: Field Survey, 1998

Table 4 Hookworm ova in stools by location of schools

Hookworm	Coastal	Midland	Highland	Urban	Total
No	520 (99.2%)	1100 (98.7%)	470 (100%)	241 (100%)	2331 (99.2%)
Yes	4 (0.8%)	15 (1.3%)	0 (0%)	0 (0%)	19 (0.8%)
Total	524	1115	470	241	2350

Figures in brackets indicate percentage of the total; Source: Field Survey, 1998

Table 5 Pinworm ova in stools by location of school

Pinworm	Coastal	Midland	Highland	Urban	Total
No	521 (99.4%)	1111 (99.6%)	469 (99.8%)	241 (100)	2342 (99.7%)
Yes	3 (0.6%)	4 (0.4%)	1 (0.2%)	0 (0%)	8 0.3%)
Total	524	1115	470	241	2350

Figures in brackets indicate percentage of the total; Source: Field Survey, 1998

Table 6 Whip worm ova in stools by location of school

Whip worm	Coastal	Midland	Highland	Urban	Total
No	399 (76.1%)	936 (83.9%)	381 (81.1%)	234 (97.1%)	1950 (83.0%)
Yes	125 (23.9%)	179 (16.1%)	89 (18.9%)	7 (2.9%)	400 (17%)
Total	524	1115	470	241	2350

Figures in brackets indicate percentage of total.

Table 7 Presence of toilets and ova in stools

Toilets	Ova in stools		
	Yes	No	Total
Yes	891 (52.1%)	818	1709
No	415 (74.1%)	145	560
Total	1306 (57.6%)	963	2269

Figures in brackets indicate percentage of subjects with ova in stools in each category; Source: Field survey, 1998

Table 8 Use of toilets by children and presence of ova in stools

Use of toilets by children	Ova in stools		
	Yes	No	Total
Yes	821(51.6%)	770	1591
No	491(77.7%)	194	685
Total	1312(57.6%)	964	2276

Figures in brackets indicate percentage of subjects with ova in stools in each category; Source: Field survey, 1998

Table 9 Use of footwear by children and presence of ova in stools

Use of footwear	Ova in stools		
	Yes	No	Total
Yes	963(53.8%)	826	1789
No	347(71.7%)	137	484
Total	1312(57.6%)	963	2273

Figures in brackets indicate percentage of subjects with ova in stools in each category; Source: Field survey, 1998

Table 10 Absence of toilets and presence of ova in stools by location

Proportion of subjects with ova in stools by location	Toilets	
	Yes	No
Midland	430 / 892 (48.2 %)	144 / 216(67.7%)
Coastal	241/ 329(73.3%)	159 / 186(85.5%)
Highland	160 / 254(63.0%)	106 / 150(70.0%)
Urban	60 / 234 (25.6%)	5 / 7(71.4%)

Source: Field survey, 1998

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