INTESTINAL PARASITOSES AND THE NUTRITIONAL STATUS OF VEDDAH CHILDREN IN SRI LANKA

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Abstract. This study describes and compares the intestinal parasitoses and nutritional statuses of primary school children of Veddah (local indigenous population) and Sinhalese (more advanced society) in rural Sri Lanka. Children attending years 1-3 (age range 6-15 years) at Dambana Primary School (Veddah) and Wewatta Primary School (Sinhalese) were included in the study. Stools and blood samples were examined for evidence of intestinal parasites and anemia. The heights and weights of the children were measured and anthropometric indices calculated. There was a high prevalence of *G. intestinalis* and *B. hominis* (*Giardia* 7.8% and 6.2%; *Blastocystis* 17.2% and 17.3% at Dambana and Wewatta, respectively) in both communities, the predominant helminth being *N. americanus* (20.3% at Dambana and 14.8% at Wewatta; $p>0.05$). Other geohelminth infections were scarce in both communities. A greater proportion of boys than girls were underweight and stunted in both communities. Wasting and anemia was significantly high among the Veddah children.

INTRODUCTION

A number of communities exist in the world today whose life styles are based on those that were prevalent in the early phase of human development. These primitive communities are often subject to many infectious diseases and undernutrition owing to their general lack of sanitation and lack of access to the foods of civilization. The Veddahs of Sri Lanka are one such primitive community, residing mostly in the Mahiyangana area, in the south-eastern plains of Sri Lanka. They lead a hunter-gatherer or semi-agricultural way of life. Maize, chillies and vegetables are grown by a form of rudimentary slash-and-burn agriculture, and the flesh of wild animals such as deer, wild boar, ant-eaters and langur monkeys are regular sources of protein. Wild honey also forms an important part of their diet. Today, these communities are being gradually assimilated into more advanced society, with lifestyle modernization resulting from compulsory free education and frequent contact with civilized society. Little is known about the health status of this local indigenous population. Our objective was to study the nutritional status and intestinal parasitoses of Veddah children living in the Mahiyangana area. An age-matched control population of children from an adjacent Sinhala village were also studied and compared with the Veddah children to assess the impact of the primitive life style on health and nutrition.

The Sinhala community studied was a typical rural community and their staple diet consisted of rice consumed with vegetables and fresh water fish or meat (when available).

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MATERIALS AND METHODS

A cross-sectional survey was carried out in the two primary schools serving the selected communities. Children attending years 1-3 at Dambana (Veddah) and Wewatta (Sinhalese) primary schools were included in the study, with parental consent. Ethical clearance for collection of blood and stool samples was obtained from the Ethics Committee of the Faculty of Medicine, University of Kelaniya. The study was conducted

in the period October-November 1999, with the collaboration of the local health authorities, school teachers and principals.

Until this survey, there had been no known parasitological investigation or large-scale deworming program in either area. However some children had been given anthelmintic treatment by local health authorities at clinics and hospital out-patient departments while undergoing treatment for various ailments.

Anthropometric measurements were carried out by trained primary health care workers. Weight was recorded in kilograms to one decimal point using spring scales and height was recorded in centimeters to one decimal point using an anthropometric rod. The date of birth of each child and the date of examination were recorded. Anthropometric indices were computed with Epi Info (Version 6) which uses growth reference curves developed by the National Center for Health Statistics (NCHS) and Center for Disease Control and Prevention (CDC). The children were classified as moderately stunted, underweight, or wasted, if the relevant z score for height for age, weight-for-age or weight-for-height was <-2 standard deviations (SD) below the NCHS median, and severely stunted, underweight, or wasted, if the relevant z score was <-3 SD below the NCHS median. Z scores were not calculated for males > 138 months or over 11.5 years of age, or for females > 120 months or over 10 years of age.

A spot of capillary blood was collected from each child directly onto standard quality filter paper and transported to the Department of Biochemistry, Faculty of Medicine, University of Kelaniya, for estimation of hemoglobin concentration by spectrophotometry, using the method described by Stott and Lewis (1995). A child with a hemoglobin concentration < 11.5 mg/dl was classified as moderately anemic and a hemoglobin concentration < 7 mg/dl was classified as severely anemic, according to the WHO guidelines. Children found to be anemic were referred to the pediatric clinic at the Mahiyangana base hospital ~15 km away, for treatment.

Feces collecting kits (plastic containers with lids and scoops) were individually labelled with the name of the child and distributed among the parents with clear instructions for collection of stool samples. Every child was given a single dose of 400 mg of albendazole after collection of stool specimens. Stool samples were collected and transported to the Mahiyangana Base Hospital and examined on the day of collection using direct saline smears and the modified Kato Katz technique (Anonymous, 1991). Quantitative estimation of eggs per gram (epg) feces was carried out in all stool samples positive for helminth ova. Harada Mori cultures were performed on stool samples positive for hookworm ova at the Department of Parasitology, Faculty of Medicine, University of Kelaniya (Garcia and Bruckner, 1993). Species determination of the cultured L3 larvae was carried out using standard identification keys (Pawlowski *et al*, 1991).

RESULTS

Anthropometric data of 23 children (7 from Dambana and 16 from Wewatta) were excluded from the analysis because of missing data or inappropriate age. Anthropometric data of 77 children (39 males and 38 females) of 84 examined at Dambana and 109 children (54 males and 55 females) of 125 examined at Wewatta were analyzed. Table 1 shows the mean age and hemoglobin status of the children by gender, and the z scores of the 3 anthropometric indices; weight-for-age, height-for-age and weight-for-height. Around one-third of the children from both communities were stunted and the prevalence of stunting was higher among the boys. Wasting was significantly higher among the Veddah children (~50%). At Wewatta, wasting was significantly higher among the boys. Two-thirds of the children from both communities were underweight and the prevalence of underweight was significantly higher among the boys. Almost two-thirds of the children at Dambana were anemic, in contrast to one-third at Wewatta ($p<0.05$).

Stool samples of 64 children (27 males and 37 females) from Dambana Primary School and of 81 children (36 males and 45 females) from Wewatta Primary School were screened for intestinal parasites. Table 2 summarizes the prevalence of intestinal parasites in the children by community. One or more intestinal parasites were

Table 1
Characteristics of the children surveyed at Dambana (Veddah) and Wewatta (Sinhalese).

Variable	Dambana			Wewatta		
	Males	Females	p-value	Males	Females	p-value
Age (months)						
No.	41	43		63	62	
Mean	99.43	98.45		94.83	93.83	
SD	23.83	18.18		15.74	14.68	
Weight-for-age z score						
No.	39	38		54	55	
Mean	-2.384	-2.041	< 0.05	-2.20	-1.95	< 0.05
SD	0.60	0.68		0.63	0.65	
%<2SD (moderately UWT)	64.1	52.63		57.41	47.27	
%<3SD (severely UWT)	12.82	5.26		7.41	3.64	
Height-for-age z score						
No.	39	38		54	55	
Mean	-1.718	-1.472	0.05	-1.623	-1.584	> 0.05
SD	0.70	0.77		0.845	0.831	
%<2SD (moderately stunted)	43.59	7.89		31.48	27.27	
%<3SD (survery stunted)	0	7.89		1.84	3.64	
Weight-for-height z score						
No.	39	38		54	55	
Mean	-1.995	-1.784	>0.05	-1.769	-1.468	<0.05
SD	8.25	0.83		0.711	0.752	
%<2SD	25.64	50		38.89	25.45	
%<3SD	15.38	5.26		3.7	1.82	
Hemoglobin status(g/dl)						
No.	21	28		30	37	
Mean	9	9.91	>0.05	11.013	11.308	>0.05
SD	4.13	2.65		2.467	2.42	
% moderately anemic	76.2	57.14		40	32.43	
% severely anemic	0	3.57		0	0	

SD - standard deviation; UWT- underweight

Table 2
Prevalence of intestinal parasites in children by community.

Parasites	Dambana No. (%)	Wewatta No. (%)
Hookworm ova	13 (20.3)	12 (14.8)
Enterobius vermicularis ova	2 (3.1)	1 (1.2)
Giardia lamblia cysts	5 (7.8)	5 (6.2)
Entamoeba coli cysts	5 (7.8)	4 (4.9)
Blastocystis hominis	11 (17.2)	14 (17.3)
No parasites	36 (56.3)	55 (67.9)

detected in 43.7% (28/64) and 32.09% (26/81) at Dambana and Wewatta, respectively. Of the pathogenic intestinal protozoa, only *Giardia lamblia* was seen (at a prevalence of 6-7%) in both communities. A significant correlation between malnutrition and *Giardia* infection was not observed in this study.

The predominant geohelminthic infection in both communities was hookworm. The hookworm egg counts ranged from 48-7,080 epg /feces, with a mean egg count of 1,334.8 epg/feces (n=13) at Dambana, and 589.1 epg/feces (n=11) at Wewatta. Harada Mori cultures were positive

in 16/29 stool samples yielding a total of 57 L3 larvae. All were identified as *Necator americanus*. There was no correlation between anemia and hookworm infection in this study.

DISCUSSION

The results of the anthropometric survey indicated a high rate of underweight (57.8% at Wewatta and 67.4% at Dambana) and a comparatively low rate of stunting (32.1% at Wewatta and 29.6% at Dambana) among the primary school-age children of both communities. A similar trend was observed among Sinhala children in the adjacent Moneragala district in 1997 (Fernando *et al*, 2000). The stool examination data suggested that the causative factor for nutritional defects in these two communities was most likely dietary inadequacy rather than intestinal parasitic infections. It is likely that these communities experience periodic acute undernutrition during inter-harvesting seasons, in addition to chronic undernutrition. Longitudinal studies of the growth of rural children may provide evidence to confirm this theory. Wasting was significantly higher among the Veddah children, perhaps because the seasonal food shortages during the lean periods (inter-harvest and crop failure) were more pronounced in the primitive community, whose lifestyle was closer to nature.

A significant gender differential in underweight and stunting was observed in both communities: boys were significantly more likely to be undernourished than girls. A similar trend was also reported in the Moneragala study (Fernando *et al*, 2000). The prevalence of anemia was significantly higher among the Veddah children, perhaps reflecting the present-day difficulties of obtaining their regular source of animal protein (flesh of wild animals).

The reported rates of undernutrition among pre-schoolers in a zone consisting of three districts; Badulla which includes the study area, Kandy, and Nuwara Eliya, were much lower than the rates found in this study (Department of Census and Statistics, Sri Lanka, 2000). The rates of stunting, wasting and underweight in this demographic and health survey were 19%, 13%, and 38%, respectively. The possible explanations for this disparity could be a worsening of nutritional status with age, or the presence of isolated pockets of severe undernutrition within the zone.

Approximately one-third to half of the primary school children in both communities were infected by one or more intestinal parasites. Although prevalence rates were higher in Dambana among the Veddah children, the difference was not statistically significant. *N. americanus* was the most common geohelminth seen in this study (20.3% in Dambana and 14.8% in Wewatta). All *N. americanus* infections were of low-moderate intensity. *A. lumbricoides* and *T. trichiura* were not detected in either community. Although the sample size was small, the age group studied (6-15 years) usually shows the peak prevalence of these two infections. Thus, the results indicate that transmission of *Ascaris* and *Trichuris* is not common in this region, possibly because the general environmental conditions (hot and dry for many months of the year) do not permit the maturation of ova in locations frequented by children. Transmission of hookworm may occur in and around latrines where soil is contaminated with feces and environmental conditions (moist and shady) favor the development of larvae.

The high prevalence of protozoan infections (*B. hominis* 17.2 and 17.3; *G. lamblia* 7.8 and 6.2, and *E. coli* 7.8% and 4.9%, at Dambana and Wewatta, respectively) is probably due to the use of fecally contaminated drinking water by both communities. This pattern of a relatively low prevalence of soil-transmitted nematodes with high prevalence of protozoan infections, is similar to that described by Wijesundera *et al* (1993) among school children in Mahaweli System C. Although Mahaweli System C is a newly developed irrigation scheme, and Mahiyangana remains undeveloped, the schools included in both studies served rural communities in the Dry Zone of Sri Lanka. The absence of *E. histolytica* reflects a general decline in the prevalence of this organism in Sri Lanka (Wijesundera *et al*, 1993; de Silva *et al*, 1994).

This comparison of the nutritional status of children in the two communities did not demonstrate any marked difference. However, the higher prevalence of wasting and anemia offer evidence

that the Veddah children suffered more acute dietary inadequacies than the Sinhala children.

It is well known that poor health and nutrition impair both the physical and intellectual development of school children (McGuire and Austin, 1987; Spurr *et al*, 1997). Programs to provide nutritional supplements to school children via schools or otherwise, during periods of low food availability, may contribute greatly towards the prevention of undernutrition and anemia among rural children in Sri Lanka. Such programs should reach isolated communities inhabiting remote parts of the country as well. Adequate drinking water appears to be lacking in both communities, as evidenced by the high prevalence of feco-oral transmission of intestinal protozoa. Hence improvement of sanitation, together with health education and provision of clean drinking water, are remedial measures indicated for both communities.

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