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Two thirds of hookworm infected children were anemic at the outpatient department in Jimma Health Center, Jimma, Southwest Ethiopia

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ABSTRACT

Objective: To assess the prevalence of hookworm infections and anemia and also measure their association among children.

Methods: A cross-sectional parasitological and hematological study was conducted on 130 children at Jimma Health Center, Jimma, Southwest Ethiopia. Stool samples were collected and processed for direct microscopic examination. Blood samples were examined by using hematocrit to determine the hemoglobin level. Data were collected using a semi-structured questionnaire from every study participant.

Results: The overall prevalence of hookworm infection and anemia was found to be 18 (13.48%) and 43 (33.07%), respectively. Anemia prevalences were 66.67% (12/18) among hookworm infected children and 33.07% (43/130) among all study participants. Hookworm had a statistically significant association with anemia and predisposing factors such as shoes wearing habits and methods of excreta disposal ($P < 0.05$).

Conclusions: Prevalences of hookworm infection and anemia were low among children. But the prevalence of anemia as compared to hookworm was too high. Attention should be given to contributing factors accordingly to reduce hookworm infection and anemia.

1. Introduction

Intestinal helminthic parasites represent an important group of infectious disease worldwide, being responsible for considerable morbidity and mortality. They are very common and endemic in tropical and sub-tropical countries due to the warm and moist climate which is suitable for the survival of many of the intestinal helminths[1].

Hookworm is one of the intestinal helminthes which is transmitted by penetration of skin by the flair form larva and ingestion of the flair form larva presenting in the soil and rarely transmitted through trans-mammary and trans-placental. It is highly prevalent in locations where there is little or no sanitation especially in rural areas of tropics and sub-tropics between 45° N and 30° S. Hookworm is the major cause of gastro-intestinal blood loss (loss of iron, proteins and vitamins) thereby resulting in iron deficiency anemia (IDA). Hookworms contribute to IDA by actively feeding on blood from the capillaries and arterioles[1-3].

Children may suffer from mental retardation and physical development due to hookworm infection for several years. In severe cases of the infection, hemoglobins may be reduced by 30% or less, which contributes to major public health problem throughout the world, especially in developing countries[4,5].

In tropics, deficiency of essential substances resulting from the effect of blood loss due to hookworm infection is one of the most important factors for reducing hemoglobin in the circulatory system of patients and causes anemia[1].

Anemia is the commonest nutritional problem worldwide, especially more common in developing countries due to poor nutrition and high prevalence of parasitic infections primarily. Hookworm becomes highly prevalent among children and pregnant women. The prevalence of IDA increased as hookworm infection became intense and intestinal blood loss increased. In general, children with hookworm infection and anemia may suffer with slow development in both physically and mentally as well as they

have a difficulty in concentrating, learning and are more prone to be infected due to poor immune response[6,7].

Studies investigating the magnitude of hookworm infection and anemia and identifying their association are less in the study area. Hence, the present study was undertaken to assess the prevalence of hookworm infection, anemia and their associated factors among children attending at Jimma Health Center.

2. Materials and methods

2.1. Study setting and design

A health center-based cross-sectional study was conducted from September to December, 2012 at Jimma Health Center found in Jimma town, Oromia Region. Jimma is located in the southwestern part of Ethiopia, 355 km away from Addis Abeba with an altitude of 1 875 m above sea level, and has about 88 876 estimated populations. The annual temperature ranges from 20 °C–30 °C and the average annual rain fall is 800–2 500 mm^3.

2.2. Study subjects, sample size and sampling techniques

All children who visited the outpatient department (OPD) during the study period were studied because the calculated sample size was greater than the source population. Single population proportion formula was used to calculate the sample size in consideration of the prevalence of anemia among hookworm infected children in rural elementary school (20.6%) with 5% margin of error and 95% confidence interval[8]. The final sample size was 251 children. Since the flow of outpatient children were low (30/month), they were all invited to participate in the study using consecutive sampling technique.

2.3. Data collection procedure

In order to identify the determinants of hookworm, the research team interviewed the parents or legal guardians of those children to collect socio-demographic characteristics, availability of latrine, drinking water, shoe wearing habit and educational background using structured questionnaires.

2.3.1. Hematological analysis
Finger blood was collected from all outpatient children attending the health center during the study period using pricking lancet and hemoglobin (the iron-carrying part of the blood cells) value was determined using hematocrit technique.

2.3.2. Parasitological analysis
Stool samples collected during the working hours of the health center laboratory from all outpatient children attending to the health center were examined using direct microscopy by experienced laboratory technicians.

2.4. Data processing and analysis

Data were checked, sorted, categorized and coded manually. The data were entered to SPSS version 20 statistical software for analysis purpose. Data cleaning was done before analysis. Frequencies and cross tabulations were used to summarize categorical variables. A $P < 0.05$ at 95% confidence interval was considered statistically significant. Tables were used to present the data.

2.5. Ethical clearance

Permission letter was obtained from Ethical Review Committee of the College of Public Health and Medical Sciences of Jimma University. Assent was secured from each study participant family or guardian. Children found to be positive for intestinal parasites and anemia were given appropriate treatment.

3. Results

Out of the 130 outpatient children living in the centre of Jimma town, 70 (53.84%) were females. None of the respondents was illiterate. Of the 18 hookworm harboring children, 10 (14.29%) and 8 (13.33%) accounted for females and males, respectively. Anemia prevalence were 66.67% (12/18) among hookworm infected children and 33.07% (43/130) among all study participants. Anemia had statistical significant association with hookworm infection ($\chi^2 = 7.270$, $P = 0.026$) (Table 1).

Table 1

Association of hookworm infection in relation to socio-demographic status and hematocrit levels among children visiting the OPD at Jimma Health Center, Southwest Ethiopia in 2012.

Types of factors	Hookworm infection status		χ^2 and P
	Positive [n (%)]	Negative [n (%)]	
Sex			
Male	8 (13.33)	52 (86.67)	$\chi^2 = 0.246$
Female	10 (14.29)	60 (85.71)	$P = 0.875$
Age group (years)			
< 5	1 (11.11)	8 (88.89)	
6–10	9 (17.31)	43 (82.69)	$\chi^2 = 0.985$
11–15	5 (12.82)	34 (87.18)	$P = 0.805$
16–19	3 (10.00)	27 (90.00)	
Anemic status			
Anemic	12 (27.91)	31 (72.09)	$\chi^2 = 7.270$
Non-anemic	6 (6.90)	81 (93.10)	$P = 0.026$

Among the 130 outpatient children, 102 (78.46%) used latrine always, 3 (2.30%) used some times and 25 (19.23%) never used latrine (used open field for disposal of excretal). Hookworm prevalence were low 5 (4.95%) among always latrine users as compared to their counter parts (non-latrine users) [12 (46.15%)]. Children with shoe wearing habit always also showed low 10 (10.00%) hookworm prevalence in comparison to those had no shoe wearing habit [6 (60.00)]. Latrine use and shoe wearing habit revealed statistically significant association to reduce hookworm infection (Table 2).

Table 2

Association of contributing factors for hookworm infection among children visiting the OPD of Jimma Health Center, Southwest Ethiopia in 2012.

Types of factors	Hookworm infection status		χ^2 and P
	Positive [n (%)]	Negative [n (%)]	
Shoe wearing habit			
No usage	6 (60.00)	4 (40.00)	
Sometimes	2 (10.00)	18 (90.00)	$\chi^2 = 19.350$ $P = 0.000$
Always	10 (10.00)	90 (90.00)	
Latrine usage habit			
No usage	12 (46.15)	14 (53.85)	
Sometimes	1 (33.33)	2 (66.67)	$\chi^2 = 30.410$ $P = 0.000$
Always	5 (4.95)	96 (95.05)	
Water source			
Pipe	12 (12.77)	82 (87.23)	
River	2 (14.29)	12 (85.71)	$\chi^2 = 3.540$ $P = 0.170$
Well	4 (18.18)	18 (81.89)	
Educational status			
Pre-school age	1 (11.11)	8 (88.89)	
1–4 grade	9 (17.31)	43 (82.69)	$\chi^2 = 0.990$
5–8 grade	5 (12.82)	34 (87.18)	$P = 0.805$
> 8 grade	3 (10.00)	27 (90.00)	