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Research Article

DETERMINANTS OF HOOKWORM INFESTATION AMONG SCHOOL GOING CHILDREN: A CROSS SECTIONAL STUDY

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ABSTRACT
Hookworm infestation is common in school going children especially in the developing countries like India. The WHO estimates that more than 2 billion population is infested with worm infection. Due to worm infestation, Disability adjusted life-years (DALYs) lost due to all causes in girls and boys are 12.3% and 11.4% respectively. The morbidity like malnutrition, anaemia, night blindness due to vitamin A deficiency and impaired cognition are higher among children those infected with hookworm infestation. The study was carried out in the rural block Beri (District Jhajjar, Haryana). A total of 200 students were enrolled i.e. 100 from each government primary school were included in the study. Screening for hookworm infection was carried out by taking samples of fingernail contents of both hands of each subject using sterile-moistened cotton-tipped swab of all those children who had untrimmed nails by a trained laboratory technician. The prevalence of hook worm ova was comes to be 31/155 (20%) subjects. The present study found out the risk factors for worm infestation among study subjects and found out that 87.5% subject wash their hand after defecation, 70% subjects had unclean hand, nearly three fourth (76.5%) subjects had untrimmed nails, 49% subjects said that they cleaned their hand before eating, 38.5% said that they defecate in the open field and 32.5% subjects had habit of eating food fallen on ground. Worm infestation is a global public health problem and is a matter of serious concern for the poor countries. Kattula *et al.*, (2009) carried out a study on prevalence & risk factors for soil transmitted helminthes infection among school children in south India and they reported that there was a wide variation in the prevalence of helminthes infestation across various schools ranging from 0-20.4 per cent. Periodic deworming of schoolchildren as per National iron + initiative programmed, school teachers should be check nails of children once in a week, health education like personal cleanliness should be imparted to children and government health functionaries must visit the schools regularly for health check-up and health education.

Keywords: *Hookworm, Infestation, School Children, Helminthes, Nails, Microscopic Examinations*

INTRODUCTION
Hookworm infestation is common in school going children especially in the developing countries like India. The World Health Organization (WHO) estimates that more than 2 billion population is infested with worm infection.

Over 270 million preschool-age children and over 600 million school-age children live in areas where these parasites are intensively transmitted, and are in need of treatment and preventive interventions. In India, the worm infestation is one of the leading causes of morbidity among children and approximately 7% stool of Indian population has eggs of hookworms and more than 2 million children below the age of 4 have been infested with hookworm (WHO, 2015). Due to worm infestation, Disability adjusted life-years (DALYs) lost due to all causes in girls and boys are 12.3% and 11.4% respectively (Mahajan *et al.*, 1991; Singh *et al.*, 1991 and Singh *et al.*, 1993).

The morbidity like malnutrition, anaemia, night blindness due to vitamin A deficiency and impaired cognition are higher among children those infected with hookworm infestation. In India, even after

running various national nutritional programmes like mid-day meal and national nutritional anaemia prophylaxis programmes, the prevalence of malnutrition is still high among children, to some extent due to the heavy worm infestation in them.

The worm infestation usually occurs in children when they walk barefoot, drink contaminated water in schools or home or come in contact with contaminated soil. Some of the preventive measures like good environmental sanitation, health education and chemotherapy are effective in controlling the worm infestation.

Good environmental sanitation and a high standard of living have resulted in a reduction in the prevalence of intestinal parasites in developed countries (WHO expert committee, 2015)

MATERIAL AND METHODS

The study was carried out in the rural block Beri (District Jhajjar, Haryana). Block Beri is the field practice area attached to Department of Community Medicine, PGIMS, Rohtak, and Haryana. The students of classes 1^{th} to 5^{th} (6-10years) from two government primary school selected randomly were included in the study.

The study was of cross-sectional descriptive type. The study was conducted from July 2014 to August 2014. A total of 200 students were enrolled i.e. 100 from each government primary school were included in the study.

Every school was visited with prior information to the school authorities in school timings. Any student who was not willing to participate in the study was excluded from the study. The purpose of survey was explained to the students. Interview was started with general discussion to build up a rapport with respondents and to gain their confidence.

A pre-tested semi-structured interview schedule was administered to the study subjects and the responses were recorded by the investigator himself. An informed verbal consent was obtained from principal of each school prior to interview.

Screening for hookworm infection was carried out by taking samples of fingernail contents of both hands of each subject using sterile-moistened cotton-tipped swab of all those children who had untrimmed nails by a trained laboratory technician.

The fingernail contents examined microscopically by trained technician for ova of hookworm following direct wet mount preparations in iodine solution. Collected data were entered in the MS Excel spread-sheet, coded appropriately and later cleaned for any possible errors in the SPSS (Statistical Package for Social Studies) for windows- version 18.0.

RESULTS AND DISCUSSION

Results

The study included 200 children (6-10 years) of government primary school of rural area of Block beri. The sample material was collected from nails of those children who had untrimmed nails (155). The prevalence of hook worm ova was comes to be 31/155 (20%) subjects.

The table-1 shows the social characteristics of study subjects and found out that 54% subjects were boys and rests were girls. 56.5% study subjects were belonged to higher caste followed by backward class (16.0%) and schedule caste (27.5%). Father's occupation wise, 27.5% subject's fathers were farmers followed by laborer 32.5%. 28.5% subject's mothers were illiterate followed by 27.5% were educated up to primary.

Surprisingly, 82.5% of subjects said that teachers had not checked their nail in last one month. The present study found out the risk factors for worm infestation among study subjects and found out that 87.5% subject wash their hand after defecation, 70% subjects had unclean hand, nearly three fourth (76.5%) subjects had untrimmed nails, 49% subjects said that they cleaned their hand before eating, 38.5% said that they defecate in the open field and 32.5% subjects had habit of eating food fallen on ground (Table-2).

Table 1: Socio-characteristics of study subjects (n=200)

Characteristics		Study subjects (%)
Sex	Boys	108 (54.0)
	Girls	92 (46.0)
Caste	Schedule Caste	55 (27.5)
	Backward Caste	32 (16.0)
	Others	113 (56.5)
Father's Occupation	Laborer	55 (27.5)
	Farmer	65 (32.5)
	Govt. employee	10 (5.0)
	Unemployed	61 (12.5)
	Self employed	09 (4.5)
Mother's Education	Illiterate	57 (28.5)
	Primary	55 (27.5)
	Middle	34 (17.0)
	Secondary	30 (15.0)
	Graduate	20 (10.0)
	Post Graduate	06 (3.0)
Type of house	Kutcha	25 (12.5)
	Pucca	175 (87.5)
Teacher checked nails in last 1 month	Yes	35 (17.5)
	No	165 (82.5)

Table 2: Risk factors for worm infestation in study subjects (n=200)

Determinant		Study subjects*(%)
1.	Unclean Hand	140 (70.0)
2.	Defecating in open field	75 (38.5)
3.	Presence of untrimmed nails	155 (76.5)
4.	Habit of eating food fallen on ground	65 (32.5)
5.	Hand wash before eating	98 (49.0)
6.	Wash Hand after defecation	175 (87.5)
7.	Sanitary Latrine	115 (57.5)

**Multiple Responses*

Discussion

Worm infestation is a global public health problem and is a matter of serious concern for the poor countries. Unclean hand, untrimmed nails, contamination of water, poor sanitation and defecation in open field greatly favor transmission of worm infection especially in schools resulting in high endemicity of hook worm infection. Hookworm infections are the most important group of intestinal worms and account for 27% of entire school-age and preschool-age children population in the World, who are in need of anthelminthic treatment (WHO Progress Report, 2012).

In the present study, 200 children from the 2 schools were enrolled, out of these 31 children had hookworm eggs in their nails. The prevalence of hook worm comes out to be 20% from the nails sample of rural children. Kattula *et al.,* carried out a study on prevalence & risk factors for soil transmitted helminthes infection among school children in south India among 6-14 years schooling children in rural-urban areas. They reported that there was a wide variation in the prevalence of helminthes infestation across various schools ranging from 0-20.4 per cent (Kattula *et al.,* 2009).

A study conducted among children in the age group of 9-10 years in Vellore reported 60% prevalence of worm infestation (Rajendran *et al.,* 2006) and another study carried in same area revealed that prevalence

of hook worm infestation among children was 22.8 per cent (Kang *et al.*, 1998). The hook worm infestation could be due to that lack of health education regarding personal hygiene like trimmed nails, lack of hand wash before eating and defecation in open field (lack of sanitary latrine in most houses). These factors again could lead to increased transmission of worm infestation.

Jiraanankul *et al.*, conducted a study on incidence and risk factors of hookworm infection in a rural community of central Thailand in 585 school children and quoted the same prevalence about hookworm infestation as in present study i.e. 22.0% (Jiraanankul *et al.*, 2011). Hoa *et al.*, in their study found out that the worm infestation spread through poor hygienic practices, untrimmed finger nails and unclean hands (Hoa *et al.*, 2010).

The study also evaluated the personal hygiene and found out that 70% of children had unclean hand, 76.5% had untrimmed nails, 38.5% children defecating in open field, 49% children regularly eating food fallen on ground and nearly half (57.5%) of children washed their before eating, this highlighting the importance of hygiene in preventing the hook worms. Kattula *et al.*, carried out a study in 2009, they found out that on univariate analysis, poor living conditions, *i.e.*, a "*kuccha*" house (house with thatched roof) a house with cow dung flooring or residing in a "field hut" (thatched house surrounded by agricultural land, away from village residential areas), and improper hygienic and sanitary practices like habitually eating food that has fallen on the ground or open defecation were found to be significant risk factors for worm infestation (Kattula *et al.*, 2009).

The present study had some limitations which must be kept in mind like the study was cross-sectional in design, small sample size and there might be potential information biases relating to the collection of questionnaire data. The present study was carried out only in two schools and enrolled 200 school children; we can't generalize this study to whole country. Further studies with large sample size are needed to generalize the findings.

Conclusion and Recommendations

Worm infestations are endemic in low income countries like India. The high prevalence of worm infestation occurs in school-age children and is one of the leading causes of morbidity like anemia, malnutrition, growth retardation, night blindness due to vitamin A deficiency etc. For control of worm infestation and to decrease the anemia, the most appropriate step would be to integrate the current national iron + initiative programmed with mid-day meal programmed. This integration might decrease the anemia and malnutrition which would improve the health status of school-age children. The study came out with the following recommendations and suggestions regarding worm infestation among school children: Periodic deworming of schoolchildren as per National iron + initiative programmed, school teachers should be check nails of children once in a week, health education like personal cleanliness should be imparted to children and government health functionaries must visit the schools regularly for health check-up and health education.

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