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Abstract: Intestinal Parasitic infections are one of the most common infections in tropics. There is paucity of data on prevalence of intestinal parasite infections among migrant construction workers and their house holds so this study was taken up. A cross sectional study was conducted for eight months with an aim to determine the prevalence and assess the associated risk factors among the households of migrant construction workers at AIIMS Bhopal. A semi-structured interview questionnaire survey was conducted prior to collection of stool samples. Each stool sample was examined macroscopically followed by occult blood testing. Wet mount observation was followed by modified acid fast staining and formal ether sedimentation. Recruits with pathogenic parasites in any of the three samples were considered positive and treated as per the national guidelines for age, drug and dose by clinical consultation. 361 participants were recruited. 122/361 (33.8%) were between 21 to 30 years. 55.2% females, 47.4% had occupation of digging soil, 93.1% practiced open field defecation. 36.9% (133/361) was the prevalence of intestinal parasitic infection. 88.7% monoinfection, *E.histolytica/dispar* (41%) *and H.nana(10.2%) were most prevalent parasites.* 26.7%) was commonest. 11.28%coinfection, *G. intestinalis* with *A. duodenale* (26.7%) was commonest. In our study only hand washing was independent predictor having Odds Ratio of 3.6 with confidence interval 1.00-13.00(those who don't wash hands before meals are 3.6 times more likely to develop infection). Only few studies address migrant construction workers, their nomadic behaviour makes them vulnerable for intestinal parasitic infections and not benefitting from prevention programmes as deworming programme.

Keywords: *Ancyclostoma duodenale*; *Ascaris lumbricoides*; construction workers; *Entamoeba spp*; *Giardia intestinalis*; *Hymenolepis nana*; intestinal parasites; migrant workers; open field defecation; soil transmitted helminths

1. Introduction

Workers represent half the world's population and are major contributors to economic and social development [1]. According to the National Sample Survey Organization (NSSO, 1999-2000), 370 million workers constituted 92% of the total unorganized workforce in the country. [2] The workers' and their families living conditions are poor with denial of basic amenities to maintain the standard of living, making them prone to health problems.[3] Prevalence of intestinal parasitic infections varies with different geographical regions. A recent Indian study, found higher prevalence rates (81.2%) of protozoan parasites compared to helminthes (18.8%) in contrast to studies in other parts of the world. [4,5] Recent studies reported Giardia lamblia to be most prevalent protozoan followed by Entamoeba histolytica. Hymenolepis nana is the most frequent cause of tape worm infection. [6] Among the helminthic parasites, the soil transmitted helminthes (Ascaris lumbricoides, Trichuris trichuria and Ancylostoma duodenale) are the most common. [7]

Diagnosis plays important role in intestinal parasite infections as suggested by the World Health Organization's 4- part strategy to control intestinal parasite infections in diarrheal diseases control

programme. [8] Stool examination for parasitic ova, cysts, trophozoite and larvae remains the gold standard for laboratory diagnosis of intestinal parasite infections. [9] Earlier studies observed increased detection rates of parasites after use of concentration techniques. [10,11] Others recommend screening of at least three stool samples for correct diagnosis. [12]

A study by VG Rao et.al, 2001 in Kundam block of Jabalpur district in Madhya Pradesh showed high prevalence (59.5%) of intestinal parasites. [13] Prevalence of 40.7 in a study shows intestinal parasitic infections still an important public health problem in Bhopal (Tripathi K et.al, 2013). *G. intestinalis* commonest protozoa found (43.44%). Among helminths, *A. lumbricoides* predominant (9.84%). Literacy rate of head of family was 85% and 1.67% in rural school children.   49.33% used cloth filter and 41.66% used plain water for drinking in rural area while 15% used cloth filter and 34.66% used plain water for drinking in urban area. 7.33% of children from rural area and 3.0% children from urban area used open field for defecation. Dirty untrimmed nails were found in 86.23% of rural and 28.66% of urban school children.   [14] Intestinal parasitic infections are endemic worldwide and described as constituting the greatest single worldwide cause of illness and disease. Poverty, illiteracy, poor hygiene, lack of access to potable water and hot and humid tropical climate are the factors associated with intestinal parasitic infections. Parasitic protozoa and helminths are responsible for some of the most devastating and prevalent diseases of humans. Intestinal parasitic infections (IPI) constitute a global health burden causing clinical morbidity in 450 million people, many of these women of reproductive age and children in developing countries. [15] Soil-transmitted helminths, namely roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*), affect more than 2 billion people worldwide (WHO 2012b,c). According to the World Health Organization (WHO) estimates, over 1 billion people are infected with roundworm. Like other developing countries, intestinal parasitic infections are a major health problem in India. In previous studies conducted in low-socio economic areas in and around Chandigarh, reported the prevalence of intestinal parasitic diseases ranging from 14.6-19.3%. [16] In one of the studies in children from rural as well as urban areas of the Kashmir valley, India, it has been reported that at least one intestinal helminth was found in 71.2 % of the sampled population. The prevalence of *Ascaris lumbricoides* was highest (68.3%), followed by *Trichuris trichiura* (27.9%), *Enterobius vermicularis* (12.7%) and *Taenia saginata* (4.6%).[17] Therefore, it is important to monitor the problem time to time and tackle it in the interest of public health. [18]

These parasites dwell in the gastrointestinal tract in humans and other animals. In urbanized countries, protozoan parasites commonly cause gastrointestinal infections in contrast to helminthes. Amoebiasis the third most important reason for death from parasitic diseases wide-reaching, has most impact on the people of developing countries. WHO estimates that approximately 50 million people worldwide endure insidious amoebic infection each year, resulting in 40–100 thousand deaths yearly. Current estimates suggested that *Ascaris lumbricoides* can infect over a billion, *T. trichiura* can infect 795 million, and hookworms can infect 740 million people. [19] Intestinal helminths hardly ever cause death. As an alternative, the saddle of disease is related to less mortality than to the chronic and subtle effects on health and nutritional status of the host. In addition to their health effects, intestinal helminth infections also damage physical and mental development of children, prevent educational achievement, and hamper economic development. The common parasites that come upon in most of the preceding systematic investigations include *Ascaris lumbricoides, hookworms (Necator americanus), Trichuris trichiura, Strongyloides stercoralis, Entamoeba histolytica,* and *Giardia intestinalis*. These are reliant on poverty, miserable personal hygiene, piteous environmental care, inadequate health services, and lack of proper and necessary awareness of the transmission mechanisms and life-cycle patterns of these parasites. [20–22] Like other developing countries, intestinal parasitic infections are a major health problem in India. Studies conducted in children of rural and urban location in and around Chennai have reported the prevalence of intestinal parasitic diseases ranging from 60 to 91%, *A. lumbricoides* was the most common helminthic parasite detected (52.8%) followed by *T. trichiura* (45.6%). [23] In a study by Jeevitha et al, a parasitological analysis of 256 stool samples in low socioeconomic areas of south Chennai with special attention to both intestinal protozoa and helminthes documented a high prevalence (75.7%) of intestinal parasites in

the dwellers from south Chennai, India. Saidapet and Thiruvanmiyur dwellers were found to harbor the maximum number of positive cases. The latrines in these two areas were found to be crude and difficult to clean. *Entamoeba coli* was found to be the most predominant parasite in the human communities with 59 (23%) positive cases. And the second most predominant parasite was *Cyclospora sp.* with 57 (22.2%) positive cases. Among the other protozoan parasites, *E. histolytica* was found to be predominant with 56 (21.8%) positive cases followed by *G. intestinalis* with 37 (14.4%) positive cases. In the case of helminthes, *A. lumbricoides* was predominant with 16 (6.2%) positive cases followed by *T. trichiura* with 3 (1.1%) positive cases. Finally, the metazoal parasite *H. nana* was found predominant with 7 (2.7%) positive cases. the examination of personal hygiene as well as routine medical examination and treatment is strongly recommended in the low socio-economic areas. [24]

Kattula et al. documented living in a field hut as an important risk factor for acquisition of STH infection, with children residing in such huts six times more likely to be infected than others. In rural south India, people residing in huts in fields, far away from the main village are socio-economically deprived, and children walk barefoot through "faecal fields" that surround the village because open air defaecation is a common practice. [25] Kattula et.al in their study have shown in the univariate analysis, people who worked on farms had higher odds of acquiring hookworm infections when compared to people not doing any agricultural work (OR 1.68; 95% CI 1.31–2.17; P < 0.001). When compared to people who worked on farms for 1–2 days per week, people who worked for 3–4 days and more than 4 days had higher odds of 1.37 times (95% CI 0.94–1.99, P = 0.098) and 1.61 times (95% CI 1.04– 2.47, P = 0.032), respectively, of hookworm infection. Presence of untrimmed long dirty nails, not washing hands before eating, usage of a designated area for defaecation, pig rearing and having domestic animals were not significantly associated with an increased risk of hookworm infection. Washing hands with soap and water after defaecation had a protective effect, as people who never washed hands with soap and water had odds of 1.84 (95% CI 1.27–2.67, P = 0.001) for hookworm infection, which remained statistically significant even after adjusting for other variables in the multivariate model. [25] Due to paucity of data on prevalence of intestinal parasite infections among migrant construction workers and their households from Madhya Pradesh this study is being taken up. The specific objectives of this study were to determine prevalence of intestinal parasitic infections among migrant construction workers and their families; to determine the spectrum of intestinal parasitic infections with age, nature of work, gender and single or multiple intestinal parasitic infections; and to assess major associated risk factors that predisposes construction workers and their households for intestinal parasitic infections

2. Materials and Methods

2.1. Study Design

Descriptive cross section study conducted during the initial construction phase of teriary care medical institute of national importance, AIIMS Bhopal in Madhya Pradesh, central India.

2.2. Study Setting and study population

This study was conducted in the Department of Microbiology AIIMS Bhopal from February 2016 to September 2016. Households of migrant construction workers including the workers themselves working at AIIMS Bhopal both adults and children more than age 6 months were the study participant.

2.3. Sample size and sampling criteria

a. Sample size for this study was 384 considering expected prevalence of 50% (maximum value), because of the absence of recent data on prevalence of intestinal parasites among migrant construction workers from this region or any other region of India.

b. Inclusion criteria was willingness and ability to give informed consent and no anti-parasitic treatment for the last three months. Those not responding to the questionnaire or responding

only to the questionnaire without submitting stool samples for testing were excluded from the study.

2.4. Data Collection and analysis

a. Semi-structured interview questionnaire was   prepared first in English and then translated to Hindi to gather demographic and risk factor information by   asking questions on demographic data (i.e. age, gender and education level), socioeconomic background (i.e. nature of work, household income and educational status), behavioural risks (i.e. personal hygiene such as hand washing and food consumption), environmental sanitation and living condition characteristics (i.e. types of water supply, latrine system) and health conditions with history of symptoms (i.e. diarrhoea, nausea, vomiting and abdominal pain). For children (less than 12 years old), answers from the questionnaire were double-confirmed by interviewing their parents or the guardian who had given informed consent.   The questionnaire survey was conducted prior to the collection of stool samples.

b. For collection of stool samples, each participant was given 3 small screw capped plastic bottles with a wooden scoop and was advised to fill half the bottle and discard the scoop after use. All the containers along with specimen was properly labelled with the respective sample number, age & date.Participants were also instructed not to mix urine with stool sample and also ensure that oily emulsion, barium, or bismuth salts were not taken before stool examination as a precautionary measure to avoid inappropriate samples. Each participant was requested to collect stool samples on alternate days so that three samples were collected from each participant; as only single samples may miss the infection in an individual due to the temporal variation in egg excretion over hours and days. The samples were transported immediately to the microbiology laboratory AIIMS Bhopal.   Once the specimen was transported to the laboratory, saline, iodine wet mount, and modified acid fast staining techniques were performed. The remaining specimen was preserved with 10% formalin and concentration techniques like sedimentation and floatation were performed. Preservation of faecal specimens is essential to maintain protozoal morphology and also to prevent further development of helminth eggs and larvae. In case of delay in processing, the samples were refrigerated at 4^0C. Those participants with either pathogenic protozoan or helminth parasites in any of the three stool samples were considered positive.

c. Laboratory parasitological examination procedures included macroscopic examination of stool samples. The collected stool samples were physically examined for properties as colour, consistency (formed, loose or watery), presence of blood, mucus and worms. All stool samples were tested for occult blood by Cancheck – FOBT Rapid test for detection of occult blood in human faeces. Then a direct wet mount with normal saline (0.85% NaCl solution) was prepared and observed for the presence of motile intestinal parasitic forms as larvae, of helminths, trophozoites of protozoan intestinal parasites and helminthic eggs, under light microscope at 100X and 400X magnification.1% Lugol's iodine staining was used to observe cysts of protozoan intestinal parasites. For floatation method , saturated salt solution method was performed. Approx. 1 gm of stool sample in a 30 ml glass vial was mixed with few drops of salt solution and stirred continuously to make as suspension. More salt solution was added to fill the container. Crude matter, which was floating, was removed. The container wass placed on a level surface

and the final filling of the glass container was done until a convex meniscus was formed.A glass slide was carefully laid on top of the container so that its center was in   contact with the fluid. The preparation was allowed to stand for 20–30 minutes after which the glass slide was quickly lifted, turned over, smoothly so as to prevent spillage of the liquid; by putting a coverslip the wet mount was examined under the microscope. Formol-ether concentration technique as a sedimentation method was also performed.A half teaspoon of stool sample (approx.1 gm) was taken in a centrifuge tube containing 10 ml of 10% formalin, and allowed to stand for 30 minutes.Then the faecal suspension was filtered through two layers of gauze in a funnel into a 15 ml centrifuge tube.Saline 0.85% was added to the tube to bring the fluid level within several millimetres of the rim of the tube.The tube was centrifuged at 500g   for 10 min.Supernatant was discarded. Sediment was resuspended in saline nearly filling up to the brim of the tube.Tube was centrifuged again for 10 miutes at 500g.Supernatant was discarded and the sediment was resuspended in 7ml of 10% formalin and 3 ml of diethylether. Tube was closed with a stopper and shaken well for 30 seconds.The tube was centrifuged at 500g for 10 minutes. Then the tube was allowed to stand for 5 minutes.Four layers: were formed. Sediment layer at the bottom of the tube containing parasitic cysts and eggs, formal saline layer, faecal debris on top of formal saline layer, top most layer of ether. The pulg of faecal debris is removed by piercing all around with an applicator stick, taking care not to disrupt the debris.All fluid was then discarded into the discarding jar by one firm swing , leaving behind one or two drops of fluid with sediment.Sediment was   mixed with applicator stick and little amount examined as normal saline and iodine wet mounts under the 10x and 40x of microscope. (Parasitology S.C.Parija).

Modified Zeihl-Neelsen staining for detection of oocysts of coccidian intestinal parasites, was done for those stool samples where the oocysts were suspected on saline wet mount.First thin smears directly from fresh stools as well as from sediments of concentrated stools were prepared and allowed to air dry.Then the slides were fixed with methanol for 2-3minutes. Further fixation with formalin vapour. A control slide was included with each batch of staining.Faecal samples were stained with cold strong carbol fuchsin (Hi media) for 10 minutes.. After washing the slides in tap water, they were decolorized with 1% HCL in 95%ethanol until colour ceased to flood out. Rinsed in tap water Followed by counterstaining in methylene blue for 30 seconds.Then the slide was   rinsed in tap water and allowed to dry. Finally the slides were observed under light microscope with low power magnification to detect the oocysts and oil –immersion objective to identify the oocysts. (Fleck and Moody diagnostic techniques in Parasitology).

2.5. Statistical Analysis

Operational Definition of Variables, dependent variable: Infection and independent variables were age, occupation, family income, family size, source of water and its handling, availability of latrines, personal hygiene, good personal hygiene, hand washing practices, nail trimming, use of footwear, vegetables and fruits, meat; raw or cooked consumption. Collected data was coded, checked and analyzed using SPSS program version 16 Software. Descriptive statistics such as frequency, percentage, mean, standard deviation and range was determined for each intestinal parasite. To test the null hypothesis, inferential statistical analysis of comparisons between two categorical variables was carried out using chi-square (x2) test to verify the relationship between independent factors and the outcome variables. Logistic regression was used to determine strength of association between infection prevalence and potential risk factors using odds ratio (OR) and 95% confidence interval (CI).

2.6. Ethical Considerations

Approval from the Institutional Human Ethics Committee (IHEC AIIMS Bhopal), LOP/2016/STS0078 for carrying out the study was obtained. Written informed consent forms in English and Hindi were prepared to obtain consent from participants; along with, participant information sheet. All the participants both adults and children who were found positive for intestinal parasite infection were recommended treatment with appropriate drug and dosage by dispatching official reports and clinical consultation.

3. Results

A total of 389 migrant workers including their households working at AIIMS Bhopal consented for participation in this study. Out of 389 participants 28 were excluded from the study as they did not participate in questionnaire survey and did not return with their stool samples for study. Out of 361 participants 33.88% were in the age group of 21 to 30 years, 55.2% were females, 62.3 % received primary school education , 47.4% were occupied with daily work of digging soil and carrying mud, 85.6 %   earned > Rs.3000 and < Rs.5000/-, 97.8% were with a family size of < 5 members/family. For 98.6%   of the participants water source was the municipal tap water supply and 96.2% consumed water directly without prior filtering or boiling. 74.2% were careless and neglected personal hygiene. 74% consumed unwashed raw or cooked vegetables and fruits. 8% never wore footwear and 3% did not wash hands prior to eating. 71.2% had unclean and untrimmed nails. 93.1 % participants practiced open field defecation. [Table 1]

Out of 361 respondents 36.9 % showed intestinal parasitic infection. Out of 133 participants with positive intestinal parasite finding 88.72% had mono-infection and 11.28 %   had co-infections with more than one parasitic infection. [Table 2] The commonest parasite found among positive mono-infected respondents was the protozoan parasite E,histolytica/dispar followed by Giardia intestinalis. Among the helminths Hymenolepis nana was the commonest parasite causing mono-infection with strongyloides as the second commonest helminth causing mono--infection. [Table 4] The commonest co-infection of parasites among respondents was of the *Giardia intestinalis with Ancyclostoma duodenale.* [Table 5]

[Table 6] We have used logistic regression analysis to identify independent predictors of infection. For this we have considered infection as a dependent variable which was coded as 1 for positive (presence of intestinal parasitic infection) and 2 for negative (absence of any intestinal parasitic infection). For identification of independent variable we have used data driven approach where in variables in univariate analysis with P, 0.25 were included as independent factors. These variables were educational status, handwashing before eating, source of drinking water. Omnibus test of model coefficients was statistically significant (P = 0.032) which indicates that model is significant. Hosmer and Lemeshow test was not significant, P=0.714 which indicates that data fits the model. [Table 7] shows Odds Ratios and their Confidence intervals through logistic regression. It can be seen from the table that only handwashing was independent predictor having Odds Ratio of 3.6 with Confidence Interval 1.00 – 13.00, indicating that those who do not wash hands before meals are 3.6 times more likely to develop infection.

Table 1. Socio-demographic characteristics of the study participants who responded (n= 361).

Characteristics	Total no(n=361)	Percent%
Age		
6 months to 10 years	65	18
11years to 20 years	79	21.9
21years to 30 years	122	33.8
31years to 45 years	70	19.4
46years to 60 years	18	5

>60 years	7	1.9
Gender		
Male	159	44
Female	201	55.2
Transgender	1	3
Educational status		
Illiterate	123	34.1
Primary school	225	62.3
Seconary school and above	13	3.6
Occupation		
Mason	20	5.5
Plasterer	25	6.9
Heavy machine operator	27	7.5
Plumber	14	3.9
Metal worker and welder	19	5.3
Carpenter	05	1.4
Digs soil and carries mud	171	47.4
Student	35	9.7
No work	45	12.5
Family income		
<Rs.3000/month	3	0.9
>Rs. 3000/month and < Rs.5000/month	309	85.6
> Rs. 5000/month and < Rs.10,000/month	49	13.6
Family size		
< 5	353	97.8
>5	8	2.2
Water source		
Municipal tap	356	98.6
Private tap	3	0.8
Well	2	0.6
Pond	0	0
Drinking Water		
Filtered	0	0
Boiled	12	3.3
Direct consumption	349	96.2
Personal Hygiene		
Good	93	25.8
Careless	268	74.2
Type of Toilet Used		
Private toilet	0	0
Public toilet	22	6.1

Open field defaecation	339	93.1
Hand washing		
Eating without Handwashing	11	3
Both after defaecation and before meals	350	97
Vegetables and fruits consumed		
Washed and eaten cooked or raw	1	0.3
Unwashed and eaten cooked or raw	267	74.0
Only cooked vegetables consumed	93	25.8
Meat Consumption		
Uncooked	0	0
Partially cooked	0	0
Properly cooked	110	30.5
Do not consume	251	69.5
Footwear		
Always	193	53.5
Never	29	8.0
Occasionally use	139	38.5
Trimmed and clean nails		
Yes	104	28.8
No	257	71.2

Table 2. Distribution of respondents based on intestinal parasite findings, (n= 361).

Participants	Total numbers	Percentage (%)
Total number of respondents with positive intestinal parasite infection	133	36.9
Total number of respondents negative for intestinal parasite infection	228	63.7
Total number of respondents with monoinfection	118	32.7
Total number of respondents with co-infections	15	4.2

Table 3. Prevalence of intestinal parasitic infections by various characteristics among migrant construction workers and their households.

Factors	Categories	Infection		Total
		Negative (n=228) %	Positive (n=133) %	**(n=361)**
Age	6 months to 10 years	(45) 19.7%	(20) 15%	(65) 18.0%
	11 years to 20 years	(50) 21.9%	(29) 21.8%	(79) 21.9%
	21years to 30 years	(76) 33.3%	(46) 34.6%	(122)33.8%
	31 years to 45years	(44)19.3%	(26) 19.5%	(70)19.4%
	46 years to 60 years	(9) 3.9%	(9) 6.8%	(18)5.0%

	> 60 years	(4) 1.8%	(3) 2.3%	(7)1.9%
Gender	Male	(96)42.1%	(63) 47.4%	(159)44.0%
	female	(131)57.5%	(70)52.6%	(201)55.7%
	transgender	(1)0.4%	(0)0.0%	(1)0.3%
Educational status	Illiterate	(68)29.8%	(55) 41.4%	(123) 34.1%
	Primary school	(150) 65.8%	(75) 56.4%	(225) 62.3%
	secondary school and above	(10) 4.4%	(3) 2.3%	(13) 3.6%
Nature of work	Mason	(11) 4.8%	(9) 6.8%	(20) 5.5%
	Plasterer	(17) 7.5%	(8) 6.0%	(25) 6.9%
	Heavy machine operator	(14) 6.1%	(13) 9.8%	(27) 7.5%
	Plumber	(10) 4.4%	(4) 3.0%	(14) 3.9%
	Metal worker and welder	(9) 3.9%	(10) 7.5%	(19) 5.3%
	Carpenter	(4) 1.8%	(1) 0 .8%	(5) 1.4%
	digs soil and carries mud	(110) 48.2%	(61) 45.9%	(171) 47.4%
	student	(25) 11.0%	(10) 7.5%	(35) 9.7%
	No work	(28) 12.3%	(17) 12.8%	(45) 12.5%
Family income	< 3000 Rs./ month	(2)0 .9%	(1) 0.8%	(3) 0 .8%
	> 3000Rs and < 5000Rs /month	(198) 86.8%	(111) 83.5%	(309) 85.6%
	> 5000Rs. and < 10,000Rs.	(28) 12.3%	(21) 15.8%	(49) 13.6%
Family size	< 5	(224) 98.2%	(129) 97.0%	(353) 97.8%
	>5	(4) 1.8%	(4) 3.0%	(8) 2.2%
Water Source	Municipal tap	(225) 98.7%	(131) 98.5%	(356) 98.6%
	Private tap	(2) 0.9%	(1) 0.8%	(3) 0.8%
	Well	(1) 0.4%	(1) 0.8%	(2)0 .6%
Type of Drinking water	Boiled	(10) 4.4%	(2) 1.5%	(12) 3.3%
	direct consumption	(218) 95.6%	(131) 98.5%	(349) 96.7%
General Personal Hygiene	Good	(65) 28.5%	(28) 21.1%	(93) 25.8%
	Careless	(163) 71.5%	(105) 78.9%	(268) 74.2%
Type of Latrine used	Public toilet	(14) 6.1%	(8) 6.0%	(22) 6.1%
	Open field defaecation	(214) 93.9%	(125)94.0%	(339) 93.9%
Hand washing	Eating without hand washing	(4) 1.8%	(7) 5.3%	(11) 3.0%
	Both after defaecation and before meals	(224) 98.2%	(126) 94.7%	(350) 97.0%
Vegetables and fruits	Washed and eaten cooked or raw	(0)0 .0%	(1) 0.8%	(1)0 .3%
		(171) 75.0%	(96) 72.2%	(267) 74.0%

	Unwashed and eaten cooked or raw Only cooked vegetables consumed	(57) 25%	(36) 27.1 %	(93) 25.8%
Meat	Properly cooked	(68) 29.8%	(42) 32.6%	(11 0) 30.5%
	Do not consume meat	(160) 70.2%	(91) 68.4 %	(251) 69.5%
wearing shoes	Always	(122) 53.5%	(71) 53.4%	(193) 53.5%
	Never	(20) 8.8%	(9) 6.8%	(29) 8.0%
	Occasionally use	(86) 37.7%	(53) 39.8 %	(139) 38.5%
Trimmed and clean finger nails	Yes	(69) 30.3%	(35) 26.3%	(104) 28.8%
	No	(159) 69.7 %	(98) 73.7%	(257) 71.2%

Table 4. Distribution of intestinal parasites among monoinfected n=118.

Parasites found	Total number	Percent (%)
Entamoeba histolytica/dispar	48	40.67
Giardia intestinalis	37	31.45
Hymenolipes nana	12	10.17
Strongyloides sps.	10	8.47
Ancyclostoma duodenale	09	7.62
Enterobius vermicularis	2	1.69

Table 5. Distribution of intestinal parasites among Co-infected n=15.

Parasites found	Total number	Percent (%)
E.histolytica + Giardia intestinalis	03	20
E.histolytica + H.nana	02	13.3
E.histolytica + Ancyclostoma duodenale	03	20
Giardia intestinalis+ H.nana	03	20
Giardia intestinalis+ Ancyclostoma duodenale	04	26.7

Table 6. chi-square (x2) test to verify the relationship between independent factors and the outcome variables.

Variables	Chi-square	df	P value
Educational status	4.570	2	0.102
Nature of work	6.293	8	0.614
Water Source	0.180	2	0.914
Type of Drinking water	2.016	1	0.156
General Personal Hygiene	1.895	1	0.169
Type of Latrine used	0.001	1	0.972
Hand washing	3.758	1	0.053
Vegetables and fruits	2.232	2	0.328

Meat	0.324	1	0.570
Wearing shoes	0.633	2	0.729
Trimmed and clean finger nails	0.698	1	0.403

Table 7. Analysis of risk factors associated with intestinal infections using Logistic regression.

	Variables	B	S.E.	Wald	df	P-value	OR	95.0% C.I. for OR	
								Lower	Upper
Step 1a	Education			4.305	2	0.116			
	Education(1)	0.791	0.691	1.311	1	0.252	2.206	0.569	8.545
	Education(2)	0.341	0.682	.250	1	0.617	1.407	0.370	5.350
	Drinking_water(1)	-1.097	0.802	1.872	1	0.171	0.334	0.069	1.608
	Hand_washing(1)	1.286	0.654	3.872	1	0.049	3.618	1.005	13.026
	Constant	-1.077	0.667	2.604	1	0.107	0.341		

a. Variable(s) entered on step 1: Education, Drinking_water, Hand_washing.

4. Discussion

Recent efforts at providing deworming, toilet facilities, hand washing awareness among general public and schools are very crucial to prevent intestinal parasitic infections. There have been very few studies addressing the migrant construction workers who are different from agricultural workers as migrant workers and their families do not stay in one place. Due to their nomadic behaviour and work requirements they are usually very susceptible for the intestinal parasitic infections and at the same time it is difficult to include them in various prevention programmes. Nonspecific symptoms as weakness, abdominal pain justify observation and screening for intestinal parasites among the construction workers and their families as they are the most vulnerable group. The present study comprised of 361 participants, out of which 133 were positive for one or more intestinal parasitic infections and 228 were negative . This study shows prevalence of intestinal parasitic infections among migrant construction workers and their households as 36.9%. As prevalence specifically among Indian construction workers is lacking, but overall prevalence reported from various studies is similar. Jeevitha et. with special attention to both intestinal protozoa and helminthes documented a high prevalence (75.7%) of intestinal parasites in the dwellers from south Chennai, India.[24] Tripathi et.al showed   prevalence of 40.7% in their study.[14] In our study 34.6% of infected participants were in the age group of 21 to 30 years. More females were infected with 51.6% females infected in compared to 47.4% males. 41.4% of the infected were illiterate and 56.4% of the infected received only primary school education. 45.9% of the infected were occupied in the work of digging soil and carrying mud. 83.5% of the infected recived   income of < Rs.5000/month. 98.5% of the infected workers consumed municipal tap water without prior boiling or filtering. General personal hygiene of 78.9% of the infected was careless and almost all both infected and uninfected did not use toilets and went for open filed defecation. 5.3% of the infected workers skipped hand washing before consuming food. 6.8% of the infected workers never used footwear and 39.8% used footwear only occasionally.73.7% of the infected participants had unclean and long untrimmed nails. Kotian et.al also had similar finding and showed that intestinal parasitic infection was directly related to poor personal hygiene, poor socioeconomic conditions and other factors. It has been shown that most endemic transmission of enteric infections among communities in developing countries is not primarily via water, but instead through other routes such as contaminated food, hands, and clothing. In their study, it was observed that prevalence of intestinal parasitic infection was seen more among females (17.07%) then the males (8.33%) which was explained as, women in their area were engaged

in handling of livestock and in field work too other than household work.[26] Tripathi et. Al in their study showed literacy rate of head of family was 85% and 1.67% in rural and urban school children respectively. 49.33% used cloth filter and 41.66% used plain water for drinking in rural area while 15% used cloth filter and 34.66% used plain water for drinking in urban area. 7.33% of children from rural area and 3.0% children from urban area used open field for defecation. Dirty untrimmed nails were found in 86.23% of rural and 28.66% of urban school children.In our study the commonest protozoan parasite found among positive monoinfected respondents *E,histolytica/dispar* followed by *Giardia intestinalis* and among the helminths *Hymenolepis nana* was the commonest parasite causing monoinfection with *strongyloides* as the second commonest helminth causing monoinfection. In study by Jeevitha et. *E. histolytica* was found to be predominant with 56 (21.8%) positive cases followed by *Giardia intestinalis* with 37 (14.4%) positive cases. In the case of helminthes, *Ascaris lumbricoides* was predominant with 16 (6.2%) positive cases followed by *Trichuris trichiura* with 3 (1.1%) positive cases. Finally, the metazoal parasite *Hymenolepis nana* was found predominant with 7 (2.7%) positive cases. Tripathi et.al from Bhopal reported *Giardia intestinalis* as the commonest protozoa found (43.44%). Among helminths, *Ascaris lumbricoides* was predominantly detected (9.84%). In a study by Kattula et.al for STH presence of untrimmed long dirty nails, not washing hands before eating, usage of a designated area for defaecation, pig rearing and having domestic animals were not significantly associated with an increased risk of hookworm infection. [25] Washing hands with soap and water after defaecation had a protective effect, as people who never washed hands with soap and water had odds of 1.84 (95% CI 1.27–2.67, P = 0.001) for hookworm infection, which remained statistically significant even after adjusting for other variables in the multivariate model. This finding was very similar to our finding with only handwashing was independent predictor having Odds Ratio of 3.6 with Confidence Interval 1.00 – 13.00.

5. Conclusion

Screening for intestinal parasitic infections among migrant construction is very important due to high prevalence among this group. De worming as prevention is not completely reaching this group. Also with more prevalence of protozoan parasites primary prevention strategies as education, safe drinking water , proper use of toilets , use of footwear, and above all proper hand washing with soap and water are more important for migrant workers and their families.

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