Intestinal parasitic infection in Bhil tribe of Rajasthan, India

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Abstract A total of 224 Bhil tribal individuals (115 males and 109 females) of different age groups inhabiting tribal rural areas of Udaipur district of Rajasthan, India were investigated for the prevalence of intestinal parasitic (protozoan and helminths) infections. Fresh stool samples of these tribal subjects were examined microscopically by direct wet smear with saline and 1 % Lugol's iodine and formaline ether concentration. Of these 116 (51.78 %) were found to be infected with diverse species of intestinal parasites. Male individuals showed relatively higher (56.52 %) prevalence of infection as compared to their counterparts (46.78 %). Out of 116 infected tribal subjects, 53 (23.66 %), 33 (14.73 %) and 30 (13.39 %) were infected with protozoan, helminths and mixed (protozoan + helminths) parasitic infections, respectively. Maximum number of parasitic infections occurred in the age group of 6–10 years (69.23 %) in both sexes. Among the intestinal parasites, *Entamoeba histolytica* was the commonest (14.73 %) followed by *Entamoeba coli* (8.92 %), *Taenia solium* (5.35 %), *Ascaris lumbricoides* (4.46 %), *Hymenolepis nana* (2.23 %), *Ancylostoma duodenale* (0.89 %), *Strongyloides stercoralis* (0.89 %), *Trichuris trichiura* (0.44 %) and *Hymenolepis diminuta* (0.44 %). Data pertaining to distribution of parasite species in different age groups, and variation in

prevalence of their infection in relation to age and sex were also analysed statistically and found to be significant. Possible causes for variation in prevalence of protozoan and helminthic infection are discussed.

Keywords Bhil tribe · Helminths · Intestinal parasites · Prevalence · Protozoan · Rajasthan · India

Introduction

Intestinal protozoan and helminthic infestations are the major public health problem in several developing countries including India. Risk factor for this high prevalence being low levels of sanitation, lack of safe water supply, poor hygiene, low socio-economic status, age group and impoverished health services. Some of the common intestinal parasites such as *Entamoeba histolytica*, *Giardia lamblia*, *Ascaris lumbricoides* (round worm), *Ancylostoma duodenale* (hook worm), *Trichuris trichiura* (whip worm) and *Enterobius vermicularis* are responsible for considerable morbidity in young and adult population (Koneman et al. 1997). Most of the population chronically affected with these intestinal parasites and are responsible to increased risk for iron-deficiency anaemia, nutritional anaemia, protein-energy malnutrition, growth deficits in children, low pregnancy weight gain and intrauterine growth retardation followed by low birth weight (Stephenson 1994; Sackey et al. 2003; Rodriguez-Morales et al. 2006).

In India, a wide range (11–90 %) of prevalence of these intestinal parasites has been reported from different geographical provinces and populations (Sethi et al. 2000; Saifi and Wajihullah 2001; Fernandez et al. 2002; Rao et al. 2003; Singh et al. 2004; Khurana et al. 2005; Dambhare et al. 2010; Sehgal et al. 2010; Marothi and Singh 2011;

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Table 1 Distribution of the protozoan and helminthic infection in tribals ($n = 224$) of rural tribal subjects areas of Udaipur district of Rajasthan (India)

Parasitic infection	No. of stool sample					
	Examined			Positive		
	M	F	Total	M	F	Total
Protozoan (A)	115	109	224	22 (19.13)	31 (28.44)	53 (23.66)
Helminth (B)	115	109	224	25 (21.73)	8 (7.33)	33 (14.73)
Mixed infection (A + B)	115	109	224	18 (15.65)	12 (11.00)	30 (13.39)
Total	115	109	224	65 (56.52)	51 (46.78)	116 (51.78)

Figures in parentheses indicate percentage

M males; F females

Bisht et al. 2011). However, studies on these parasitic infections in the tribal population are still too scanty (Farook et al. 2002; Rao et al. 2002, 2003; ICMR 2003). Although, from Rajasthan, only a few reports are available (Tamboli and Sharma 1979; Choubisa and Choubisa 1992, 2006; Choubisa 2009). The reports on the prevalence of intestinal parasitic infections in relation to age and sex are still warranted, especially in tribal population. Therefore, the present pilot study was undertaken to determine the prevalence of different species of protozoan and helminth parasitic infections in most primitive Bhil tribal individuals, who are socio-economically very poor and backward and are living in remote, hilly and inaccessible areas.

Material and methods

A cross-sectional survey (October 2010–September 2011) was carried out in the tribal rural areas/villages of Udaipur district of Rajasthan, India for the evidence and prevalence of intestinal parasitic infection. In these areas primitive Bhil tribal individuals are living, which are socio-economically very poor and backward.

Morning fresh faecal samples from 224 Bhil tribal subjects (115 males and 109 females) below the age of 60 years in rural areas were collected in dry, clean and leak proof glass vials labelled with name and identification number. Simultaneously a record was also prepared for their address, age, sex, education, sanitation, habits, medical history etc. These samples were processed for wet-film preparation using 1 % Lugol's iodine and formalin-ether concentration techniques (Paniker 2002) for the identification and evidence of eggs, cysts, trophozoites and larvae of intestinal parasites.

The protocol for this study was approved from the Chairman, Ethical Committee of R.N.T. medical college, Udaipur, Rajasthan. The approval was on the agreement that patient anonymity must be maintained, good

laboratory quality control ensured and that every finding would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the I.C.M.R. guidelines for human experimentation in biomedical research. Before the sample collection consent was obtained from each tribal subject.

Results

Out of 224 faecal samples from 115 male and 109 female Bhil tribal individuals, 116 (51.78 %) were found to be infected or positive with different species of intestinal protozoan and helminth parasites (Table 1). The prevalence rate was found to be 56.52 % in males and 46.78 % in females. In the present study nine species of these parasites were detected and identified (Figs. 1–7). Of these parasites, two were protozoan and seven helminths (Table 2). Maximum (23.66 %) infection was of protozoan parasites as compared to helminths (14.73 %). Tribal subjects below five years age showed minimum number of parasite species infection (Table 2). With increasing age different species of parasites were observed in tribal subjects. The highest prevalence rate (69.23 %) was found in 6–10 year old subjects and the lowest (39.39 %) in 16–20 years age group individuals (Table 3). But pattern of prevalence of infection in different age groups was found to be non-linear (Fig. 8).

In the present study *E. histolytica*, *E. coli* and *A. lumbricoides* parasites were common and found in subjects of all age groups. The maximum incidence (14.73 %) of infection was of *E. histolytica* followed by *E. coli* (8.92 %), *T. solium* (5.35 %), *A. lumbricoides* (4.46 %), *H. nana* (2.23 %), *A. duodenale* (0.89 %), *S. stercoralis* (0.98 %), *Hymenolepis diminuta* (0.44 %) and *T. trichiura* (0.44 %). Mixed infection (13.39 %) was also observed in tribal subjects and which was mostly of protozoan and helminth species. Data pertaining to distribution and prevalence of parasitic infection in relation to age and sex were also found to be statistically significant.

Discussion

In the present study, no family members of the positive cases of protozoan and helminth parasitic infections were investigated for the evidence of these parasites. In this study, 51.78 % of the healthy tribal subjects revealed positive result for intestinal parasites and nine species (Table 2) of parasites were detected. The prevalence and diversity of intestinal protozoan and helminth parasitic infections are known to vary greatly from place to place and from population to population (Choubisa and Choubisa

Figs. 1–7 Cysts and eggs of diverse species of intestinal parasites of Bhil tribal subjects ($\times 400$). **1** *Entamoeba coli*, **2** *Taenia solium*, **3** *Hymenolepis nana*, **4** *H. diminuta*, **5** *Ancylostoma duodenale*, **6** *Strongyloides stercoralis*, **7** *Trichuris trichiura*

2006). However, from different provinces of India, 24–91 % prevalence of these parasitic infections has been reported (Singh et al. 1991, 2004; Fernandez et al. 2002; Rao et al. 2002; Shubha and Fatima 2011; Bisht et al. 2011). Below 24 % incidence of parasitic infection has also been reported from rural and urban areas of Chandigarh (Khurana et al. 2005), Central India (Dambhare et al. 2010)

and Madhya Pradesh (Marothi and Singh 2011). From some other countries, a highly variable prevalence (3–85 %) of intestinal parasitosis has also been observed and reported (Cross and Basaca-Sevilla 1984; Ryan et al. 1988; Jiang 1988; Kam 1994). Earlier, from the state of Rajasthan, 5.2–43.6 % incidences of diverse species of intestinal parasitic infections have been reported (Paul

Table 2 Distribution of the protozoan and helminth parasites in different age groups

Parasites	Age groups (years)					Total
	0–5	6–10	11–15	16–20	>20	
(A) Protozoan						
<i>E. coli</i>	3	4	8	3	15	33 (14.73)
<i>E. histolytica</i>	2	3	7	1	7	20 (8.92)
(B) Helminths						
(i) Cestodes						
<i>T. solium</i> (Tape worm)	1	2	4	1	4	12 (5.35)
<i>H. nana</i> (Dwarf tape worm)	–	2	3	–	–	5 (2.23)
<i>H. diminuta</i> (Dwarf tape worm)	–	–	–	–	1	1 (0.44)
(ii) Nematodes						
<i>A. lumbricoides</i> (Round worm)	1	4	2	2	1	10 (4.46)
<i>A. duodenale</i> (Hook worm)	–	–	2	–	–	2 (0.89)
<i>T. trichiura</i> (Whip worm)	–	–	–	1	–	1 (0.44)
<i>S. stercoralis</i> (Thread worm)	–	–	–	1	1	2 (0.89)
(C) Mixed infection (A + B)	3	3	12	4	8	30 (13.39)
Total	10 (8.62)	18 (15.51)	38 (32.75)	13 (11.20)	37 (31.89)	116 (51.78)

Figures in parentheses indicate percentage. Analysis of variance (ANOVA) score between different age groups was found to be significant (p value 0.03; <0.05)

Table 3 Age and sex wise distribution of positive cases of protozoan and helminthic infection

Age (years)	No. of sample tested			No. of positive cases (single infection)			No. of positive cases (double infection)			Total
	M	F	Total	M	F	Total (A)	M	F	Total (B)	
0–5	12	11	23	3 (25.00)	4 (36.36)	7 (30.43)	1 (8.33)	2 (18.18)	3 (13.04)	10 (43.47)
6–10	17	9	26	8 (7.05)	7 (77.77)	15 (57.69)	3 (17.64)	0 (0.00)	3 (11.53)	18 (69.23)
11–15	35	36	71	15 (42.85)	11 (30.55)	26 (36.61)	7 (20.00)	5 (13.88)	12 (16.90)	38 (53.52)
16–20	20	13	33	6 (30.0)	3 (23.07)	9 (27.27)	3 (15.00)	1 (7.69)	4 (12.12)	13 (39.39)
>20	31	40	71	15 (48.38)	14 (37.5)	29 (40.84)	4 (12.90)	4 (10.00)	8 (11.26)	37 (52.11)
Total	115	109	224	47 (40.86)	39 (35.77)	86 (38.39)	18 (15.65)	12 (11.00)	30 (13.39)	116 (51.78)

Figures in parentheses indicate percentage

On ANOVA score there is no significant variation between male, female and total cases, but there is significant variation (p value 0.03; <0.05) between different age groups among male, female and total subjects in single infection

Correlation coefficient between single and double infection is poor ($r = 0.27$)

et al. 1982; Choubisa and Choubisa 1992, 2006). Studies on intestinal parasitosis in different ethnic groups of tribals are very limited in India. However, few studies conducted by R.M.R.C., Jabalpur revealed that parasitic infection is widely prevalent in 75 % of Abhujmaria, 57.8 % of Baiga and 6.7 % Kamar primitive tribes of Madhya Pradesh (Annual Report 1993). Other studies conducted in children and adolescents of Gond tribal community of Jabalpur (M.P.) also revealed a high incidence (48–59.5 %) of worm infections (Rao et al. 2002, 2003). From Orissa, 31.9 % prevalence of intestinal parasitic infections in Bondo primitive tribe followed by 41.1 % in Kondha, 44.6 % in Bondo and 44.9 % in Didayi tribe have also been observed and reported (ICMR 2003).

In these tribes, hook worm (*A. duodenale*) infestation was most common and its prevalence rate varied between

14–21 %. In the present study prevalence rate of intestinal parasitosis was found relatively higher (51.78 %) and *E. histolytica* parasitic infection (14.37 %) was most common in Bhil tribal subjects. Other studies conducted in different communities revealed different species, which were found more prevalent (Farook et al. 2002; Rao et al. 2002, 2003; Fernandez et al. 2002; Dambhare et al. 2010; Marothi and Singh 2011). From these studies, it is clear that prevalence and diversity of intestinal parasitic infections vary greatly and the maximum of both these indices occurs in the lower age group. Such variation could be correlated with different degrees of poverty, hygiene, sanitation facilities and health care or education, urbanization, which provide favourable environments for the transmission of these intestinal parasites. Infact these factors accelerate the exposure rate of parasitic infection. The high incidence of these pathogens

Fig. 8 Showing non-linear presentation of percentage of infection in relation to various age groups

in the lower age group is highly associated with the lack of awareness pertaining to hygiene and sanitation, both of which can be expected to provide maximum chances of protozoan and helminthic exposure in contaminated surroundings. In the present study male individuals showed relatively higher (56.52 %) incidence of parasitosis as compared to their counterparts (46.78 %). This is probably due to their frequent migratory behaviour, which provides greater chances of parasitic exposure. Such findings have also been observed in other geographical areas (Agi 1995; Koroosh 1997; Sethi et al. 2000; Rao et al. 2003), but in other studies (Ali et al. 1999; Yong et al. 2000; Marothi and Singh 2011) females showed a relatively higher incidence of intestinal parasitic infections. The others reported similar rate in both sexes (Patel 1986; Hedge and Patel 1986). This may be related to the daily activity of the subjects rather than sex.

To conclude, intestinal parasitosis are more prevalent in tribal individuals of Rajasthan, responsible for chronic morbidity in the form of nutritional and iron-deficiency anaemia. Indeed, these tribal individuals are economically very poor, lack health education and live in unhygienic conditions where proper sanitation facilities are also wanting. Therefore, to observe these pathogenic burdens, as well as to improve the tribal health, the above mentioned determinants/factors should be considered, while preparing the future plan for the tribal health. Although, the present study is at pilot level, nevertheless, the findings reported here in shall not only significantly add to existing knowledge of intestinal parasitosis but also serve as an index of the tribal community's progress towards effective sanitation and health education.

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