Introduction:

Intestinal parasitic infestation represents a large and serious medical and public health problem in developing countries. Risk factors for this high prevalence being low levels of sanitation, lack of safe water supply, poor hygiene, low socio economic status and impoverished health services. Protozoa such as Entamoeba histolytica, Entamoeba coli and Giardia intestinalis and Helminths such as Ascaris lumbricoides, Ancylostoma duodanale, Taenia species. Trichuris trichiuria and Enterobius vermicularis are some of the common intestinal parasites responsible for considerable morbidity in young and adult population.

Stool culture is a test to identify pathogens in patients with a suspected infection of the digestive tract. A sample of the patient's faeces is placed in a special medium where pathogens are then grown. The pathogens that grow in the culture are identified using a microscope and biochemical tests. Stool, also called faeces, is usually thought of as nothing but waste-something to quickly flush away. But bowel movements can provide doctors with valuable information as to what's wrong when we have problem in the stomach, intestines, or another part of the gastrointestinal system.

The genus Entamoeba contains many species, six of which (Entamoeba histolytica, Entamoeba dispar, Entamoeba moshkovskii, Entamoeba polecki, Entamoeba coli and Entamoeba hartmanni) reside in the human intestinal lumen. Entamoeba histolytica is the only species definitely associated with pathological sequelae in humans; the others are considered non-pathogenic (Clark and Diamond, 1991; Garcia and Bruckner, 1997).

Entamoeba histolytica is the causative agent of amebiasis and is globally considered a leading parasitic cause of human mortality (Haque et al., 2003;
Clinical features of amebiasis due to *E. histolytica* range from asymptomatic colonization to amoebic dysentery and invasive extra intestinal amebiasis, which is manifested most commonly in the form of liver abscesses. Approximately 50 million people have invasive disease, resulting in 100,000 deaths per year (Haque and Petri, 2006; WHO, 1997).

Although the parasite has a worldwide distribution, high prevalence rates of more than 10% of the population have been reported from various developing countries (Stanley, 2003). *Entamoeba histolytica*-related diarrheal illnesses have recently been reported to have a negative impact on the growth of children (Mondal et al., 2006).

*E. histolytica* is capable of invading the intestinal mucosa and may spread to other extraintestinal organs, mainly the liver and rarely the lung, brain and kidney. Thus *E. histolytica* is unique among the intestinal amebae, because it is able to invade tissue and clinical presentation may range from an asymptomatic infection to a disseminated fatal disease. Incubation period may vary from a few days to months depending on the area of endemicity (Ravdin, 1995).

*Giardia lamblia* is the most common protozoan isolated from the gastrointestinal tract (Eckmann and Gillin, 2001). Worldwide incidence is believed to range from 20% to 60% (Tripathi, et al., 1999). The incidence rate is 2-7% in industrialized nations (Upcroft and Upcroft, 2001). Patients with giardiasis typically present with diarrhea, vague abdominal discomfort, nausea and distention together with mild weight loss and lassitude.

The absence of these symptoms may result in a low clinical index of suspicion for the diagnosis. Giardiasis is diagnosed by signs and symptoms, as well as the presence of giardia cysts and trophozoites in the stool. Stool examination can be unreliable, as organisms may be excreted at irregular
Stool Examination

intervals which can produce a false negative test result (Beers and Berkow, 1999).

*Taenia solium* is a cestode species this causes taeniasis and cysticercosis in humans. Taeniasis refers to the intestinal infection with the adult stage of the tapeworm, which is acquired by eating undercooked pork contaminated with cysticerci (larval stage). On the other hand, cysticercosis refers to infection of various tissues with the larval stage of the tapeworm (cysticercus/cysticerci), which is acquired by ingestion of parasite eggs released from taeniasis carriers.

**Materials and Methods**

15 Stool samples were collected from each ward of North Indore city in polythene bags from nearby open fields and road sides in hours of the day. The samples were immediately brought to the laboratory and were examine same day. Stool samples were examined microscopically following diagnostic procedures given in standard text on parasitology by Chatterjee (1981). Following method used for examination of stool samples.

1). **Direct smear method:**

(I). **Unstained Preparation:**

A small portion of faeces was taken on a glass slide and was mixed well with few drops of normal saline (0.9%) to make a emulsion. A cover slip was then gently put over it which spread the emulsion and made a smear. It was examined under the microscope for the presence of cysts of parasitic amoebae, flagellates, ciliates and eggs, larvae and fragments of helminths.

(II). **Stained Preparation:**

Lugol’s iodine solution was used as stain to study the number characteristics of cysts of amoebic and flagellated protozoa. For this
preparation a drop of iodine was added to the saline emulsion of faeces before putting the cover slip. Lugol’s iodine solution was prepared as follows:

10 gm. of KI was dissolved in 100 ml of distilled water then 5gm. of iodine crystals (powdered) were added slowly and mixed well. The solution was filtered and kept in amber coloured bottle.

2). Concentration method:

Stool samples showing the positive results were subjected to further processing to observe the maximum number of cysts and eggs of intestinal parasites. Some samples which were negative to direct smear method were also subjected to concentration method. For concentration of cysts and eggs, Lane’s direct centrifugal floatation technique was used. About 2 gm. of emulsion was then centrifuged at 1000 rpm for two minutes. The supernatant fluid was discarded and using standard salt solution the tube was filled upto 3/4th and whole mixture was vigorously shaken. The tube was filled upto the brim with angina this was centrifuged at 1000 rpm for 2 minutes. After centrifugation the cover slip was gently lifted off and examined under light microscope for the presence of cysts of intestinal amoebae and flagellates and eggs of helminths.

Observation:

In the present study, stool samples were examined for protozoal and helminthic infection of the population in North Indore city. Results of stool examination are shown.

Stool examination by the above procedures reveals that three species of protozoans, namely *Entamoeba histolytic*, *Entamoeba coli* and *Giardia intestinalis* and five species of helminthic parasites, namely *Ascaris lumbricoides*, *Teania species*, *Ancylostoma duodenale*, *Trichura trichuris* and *Entrobius vermicularis* were recorded from the stool samples in deferent wards.
Study of protozoan parasite:

1. *Entamoeba histolytica*:

   In the present study *E. histolytica* infection was recorded in all wards of the North Indore city. Of the 480 samples collected from 32 wards, 103 samples were found infected with this parasite. Its overall infection was 21.46 percent. Maximum incidence was recorded in ward no. 44 (53.33%) followed by ward no. 34 (46.67%), ward no. 39 (40%) and Ward no. 17, ward no. 22, ward no. 35 and ward no. 42 (33.33% each). Least incidence was observed in the stool samples of ward no. 15, ward no. 25, ward no. 30 and ward no. 36 (6.67% each).

2. *Entamoeba coli*:

   Its overall incidence was 22.92 percent. Maximum incidence of this parasite was observed in ward no. 36 and ward no. 39 (46.67% each) followed by ward no. 34 (40%) and ward no. 21, ward no. 24, ward no. 38, ward no. 41 and ward no. 44 (33.33% each). Lowest infection was recorded in ward no. 27, ward no. 29 and ward no. 31 (6.67%) followed by ward no. 04, ward no. 14 , ward no. 15, ward no. 16, ward no. 18 and ward no. 26 (13.33% each).

3. *Giardia intestinalis*:

   Incidence of *G. intestinalis* was heist among all intestinal parasites (protozoal and helminthic) recorded in the population of North Indore city. Its overall incidence in the study area was 31.04 percent. Maximum incidence of this parasite was observed in the stool samples of ward no. 38 (53.33%) followed by ward no. 22, ward no. 31, ward no. 41 and ward no. 44 (46.67% each). Least incidence of *Giardia intestinalis* was recorded in stool samples of ward no. 24, ward no. 25 and ward no. 34 (13.33% each).

Study of helminthic parasite:
4. Ascaris lumbricoides:

Fertilized eggs of *A. lumbricoides* were observed in 47 stool samples collected from 32 wards of North Indore city. Maximum incidence of this parasite was recorded in ward no. 34 in which 4 out of 15 samples showed the presence of fertilised eggs of *A. lumbricoides*. Other wards in which more than 6.67% infection was recorded were ward no. 07, ward no. 16, ward no. 19, ward no. 20, ward no. 21, ward no. 23, ward no. 25, ward no. 29, ward no. 31, ward no. 32, ward no. 38, ward no. 41, ward no. 42, and ward no. 44. However in ward no. 13, ward no. 15, ward no. 27, ward no. 28, ward no. 36, ward no. 37 and ward no. 39 in which none of the samples was found positive to this parasite.

5. *Teania* species:

Segments and eggs of tape worm were observed in 35 out of 480 stool samples and maximum incidence (20%) was observed in ward no. 17, ward no. 31 and ward no. 42 followed by ward no. 21, ward no. 23, ward no. 32, ward no. 35, ward no. 37, ward no. 38, ward no. 41 and ward no. 44 (13.33% each). Least affected wards were ward no. 4, ward no. 7, ward no. 18, ward no. 20, ward no. 22, ward no. 24, ward no. 25, ward no. 26, ward no. 30 and ward no. 34 in which not more than 6.67% infection was recorded. However in ward no. 13, ward no. 14, ward no. 15, ward no. 16, ward no. 19, ward no. 27, ward no. 28, ward no. 29, ward no. 33, ward no. 36, and ward no. 39 in which none of the samples was found positive to this parasite.

6. Ancylostoma duodenale:

This enteric parasite showed the lowest incidence among population in the wards on the North Indore city. Adult hook worm and their eggs were observed in 7 stool samples of the 32 wards. Maximum infection was recorded
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in ward no. 42 in which 13.33 percent infection was observed. Least affected wards were ward no. 16, ward no. 19, ward no. 20, ward no. 21, ward no. 35 and ward no. 44 (6.67% each).

7. Trichuris trichura:

Barrel shaped eggs of T. trichura were found in 23 out of 480 stool samples. Its overall incidence was 4.80 percent. Maximum infection was observed in ward no. 44 (26.67%) followed by ward no. 20, ward no. 21, ward no. 25 and ward no. 41 (13.33% each). Least affected wards were ward no. 07, ward no. 18, ward no. 19, ward no. 22, ward no. 23, ward no. 25, ward no. 31, ward no. 32 ward no. 34, ward no. 38, ward no. 39 and ward no. 42 (6.67% each). However in ward no. 4, ward no. 13, ward no. 14, ward no. 15, ward no. 16, ward no. 17, ward no. 24, ward no. 26, ward no. 27, ward no. 28, ward no. 29, ward no. 30, ward no. 33, ward no. 35, ward no. 36, and ward no. 37 in which none of the samples was found positive to this parasite.

8. Enterobius vermicularies:

Infection of E. vermicularies were maximum in ward no. 22 and ward no. 42 in which 2 out of 15 samples stool samples showed the presence of E. vermicularies eggs containing tadpole like larva. Its overall infection was 2.91 percent. Lowest incidence of infection was recorded in ward no. 19, ward no. 20, ward no. 21, ward no. 25, ward no. 31, ward no. 32, ward no. 35, ward no. 38, ward no. 39 and ward no. 41 (6.67% each).

Results and Discussion:

In the present study on stool samples collected from wards on North Indore city maximum incidence of G. intestinalis was recorded. It is a common parasitic inhabitant of the upper small intestine of man and can cause diarrhoeic disorder with mild steatorrhoea.
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Infection of this parasite in the population indicates consumption of food or drinking water contaminated with cysts of *Giardia intestinalis* by the population. Maximum incidence of *G. intestinalis* was recorded in ward no. 38 followed by ward no. 22, ward no. 31, ward no. 41 and ward no. 44 in these wards sanitary conditions are very poor and during rainy season people are bound to use contaminated drinking water as there is no proper drainage of rainy water. Aher and Kulkarni (2011) reported that the maximum incidence of *Giardia intestinalis* (13.5%) followed by *E. histolytica* (3.9%) and *E. coli* (1.9%) while studying stool samples in Ahmednagar district of Maharashtra, India.

Total parasitic incidence in wards of North Indore city in ward no. 44 (24.67%) followed by ward no. 42 (20.83%), ward no. 38 (20%) and ward no. 21 and ward no. 41 (18.33% each).

Lake of heath education may be major cause of outbreak of this parasitic infection in these wards. It is interesting to note that in ward no. 44 and ward no. 42 people have access to safe drinking water even though maximum incidence of parasitic infection was observed in the stool samples collected from these wards. Lowest incidence of intestinal parasite was observed in ward no. 15 (5.83%) followed by ward no. 27 (6.67%) and ward no. 28 (7.5%). Incidence of *E. coli* infection was second in order of dominance of parasitic infection of stool samples of wards.

It is non-pathogenic protozoan parasite inhabiting large intestine of human being and is more commonly in the dysenteric stool. Cysts of *E. coli* are resistant to drying as compared to *E. histolytica* which accounts for high incidence of infection this parasite. In the present study, author has recorded approximately 22.92 percent infection in the stool samples with maximum incidence in the ward no. 36 and ward no. 39 followed by ward no. 34, ward no. 21, ward no. 24, ward no. 38, ward no. 41 and ward no. 44. Another species
of *Entamoeba* i.e. *Entamoeba histolytica* was also recorded in wards of the North Indore city. It also inhabit large intestine of man but unlike *E. coli* it is a pathogenic protozoal parasite causing amoebiasis in man. Prasad *et al.* (2000) reported that the maximum incidence of *Giardia intestinalis* (7.7%) followed by *E. histolytica* and *E. coli* (3.8% each) while studying of Enteric Pathogens in HIV-positive Patients with Diarrhoea in Northern India. In the present study approx 21.46 percent of the stool samples showed the presence of *E. histolytica*. Maximum incidence of this parasite was observed in ward no. 36 and ward no. 39 followed by ward no. 34, ward no. 21, ward no. 24, ward no. 38, ward no. 41 and ward no. 44 which is also confirmed by the epidemiological survey as maximum cases of amoebiasis were reported in these wards. Faecal contamination of drinking water, vegetables and food are primary responsible for the transmission of cysts of *E. histolytica* to man. Eating of uncooked vegetables and fruits grown by using infected human faeces as manure by the people is also responsible for spread of the disease. In these wards road-side defecation is commonly seen. Cysts present in the faeces can contaminate drinking water and ultimately affect the population consuming such as water. In the North Indore city it is also commonly seen that people do not cover the food-stuff which may be infected by house-flies by carrying cysts from faeces to food-stuff.

In the present study among helminthic parasite infection maximum incidence of *Ascaris lumbricoides* was observed followed by *Taenia sp.*, *Trichuris trichiura*, *Enterobius vermicularis*, *Ancylostoma duodenale*. Parameshwarappa *et al.* (2012) also reported maximum incidence of *Ascaris lumbricoides* followed by *Taenia species*, *T. trichiura*, *E. vermicularis* and *Strongyliodes stercoralis* while studying stool samples in Rajpur of Gulbarga district. They found that incidence of infection was maximum among the population of lower income group.
Author in the present study has also found that wards who do not have access to safe drinking water and having poor health and hygienic conditions were worst affected with parasitic infection. Presence of *A. lumbricoides* eggs in the stool shows unhygienic habits of the peoples. Infection of this nematode is caused by swallowing Ascaris eggs with raw vegetables cultivated on a soil fertilized by infected human excreta. *Enterobius vermicularis* infection was also seen in most of the wards except ward no. 04, ward no. 07, ward no. 13, ward no. 14, ward no. 15, ward no. 16, ward no. 18, ward no. 23, ward no. 24, ward no. 26, ward no. 27, ward no. 28, ward no. 29, ward no. 30, ward no. 33, ward no. 34, ward no. 36, ward no. 37 and ward no. 44. It inhabit caecum and vermiform appendix of man generally children. Infection of this parasite is caused by ingestion of eggs of this parasite. When this parasite lays eggs it causes intense itching which induces patient to scratch the affected part and thereby carrying the eggs on their finger. Handling food by such infected hands contaminates the food and when such a food is consumed it causes infection. Infection may also occur directly anus to mouth in children, a common habit in children of taking hand to mouth.

Lake of health education is the major cause of intestinal infection in the population. Eggs and segments of *Taenia solium and saginata* were also found in the stool samples of the peoples of North Indore city. Man is the definitive host for *Taenia*. Human beings get infected with *Taenia* either by drinking contaminated water or eating improperly cooked/uncooked pork or beef. Man may be reinfected due to unclean and unhygienic person habits. Adult worm of *Taenia* when found in the intestine of man may cause abdominal pain and disorders. Faecal contamination of food and water cause infection of *Trichuris trichiura* (whipworm) also. In the present study except ward no. 4, ward no. 13, ward no. 14, ward no. 15, ward no. 16, ward no. 17, ward no. 24, ward no. 26, ward no. 27, ward no. 28, ward no. 29, ward no. 30, ward no. 33, ward no. 35,
ward no. 36, and ward no. 37 infection of *T. trichiura* was observed in all the wards. Maximum incidence was recorded in ward no. 44, where 26.66 percent stool samples were positive to *T. trichiura* infection. It causes trichuriasis. Human being gets infected by swallowing embryonated eggs with water or food. *Ancylostoma duodenale* (hook worm) infection was observed in the stool samples collected from the wards of the North Indore city. It infects human beings by penetrating the skin coming in contact of this parasite. It causes ancylostomiasis. It indicated that people do not use slippers or shoes while working in the agriculture fields and also while going for defecation in the open fields. Marothi and Singh (2011) reported that the maximum incidence of *Ascaris lumbricoides* (14.3%) followed by *E. vermicularis* (3.0%), *Taenia species*(1.3%) and *T. trichuria* (0.8%) while studying stool samples in urban region of Ujjain of Madhya Pradesh.
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<table>
<thead>
<tr>
<th>Parasites</th>
<th>Positive case</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) <em>Entamoeba histolytica</em></td>
<td>103</td>
<td>21.49%</td>
</tr>
<tr>
<td>2) <em>Entamoeba coli</em></td>
<td>110</td>
<td>22.92%</td>
</tr>
<tr>
<td>3) <em>Giardia Intestinalis</em></td>
<td>149</td>
<td>31.04%</td>
</tr>
<tr>
<td>4) <em>Ascaris lumbricoides</em></td>
<td>47</td>
<td>9.80%</td>
</tr>
<tr>
<td>5) <em>Ancylostoma duodenales</em></td>
<td>8</td>
<td>1.67%</td>
</tr>
<tr>
<td>6) <em>Taenia species</em></td>
<td>35</td>
<td>7.29%</td>
</tr>
<tr>
<td>7) <em>Trichuris trichiura</em></td>
<td>23</td>
<td>4.80%</td>
</tr>
<tr>
<td>8) <em>Enterobius vermicularis</em></td>
<td>14</td>
<td>2.92%</td>
</tr>
</tbody>
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![Stool Examination of north Indore city](chart.png)