

MODULE

# ***Intestinal Parasitosis***

For the Ethiopian Health Center Team



**Ethiopia Public Health  
Training Initiative**

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In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center,  
the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education

2008



Funded under USAID Cooperative Agreement No. 663-A-00-00-0358-00.

Produced in collaboration with the Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education.

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## **ACKNOWLEDGEMENT**

The work of drafting and revision of the first edition of this module on Intestinal Parasitosis for the “Health Center Team” was shared by many persons. We are very grateful to all faculties who have spent their precious time and energy for revising this draft module and making constructive comments for improvement. Copies of the draft document were circulated to all EPHTI-member Universities and we would like to express our sincere thanks and appreciation to those staff who took their time for commenting and enriching it. Furthermore, we are very much indebted to Drs. Daniel Fekade and Teshale seboxa of AAUMF and Dr. Micheal Deming from CDC, Dr. Patrick Lammie and Dr. Mark Eberhardt who critically reviewed and enriched the module to its final version as national and international reviewers, respectively. Their expert comments were really valuable and constructive, and we have tried to incorporate most of the suggestions given. Additionally, we would like to acknowledge Mr Asamnew Abayneh and Mr Haregewoin Merkebu, who were contributors to the First Edition of this Module

Last but not least is the continuous guidance and support of the Carter Center to the preparation of this module, covering all costs related to module preparation workshops. Therefore, we are very much grateful to the Carter Center, the USAID country office in Addis Ababa and the EPHTI Office in Addis Ababa, without their generous support the revision and production of this final printed module wouldn't have been possible.

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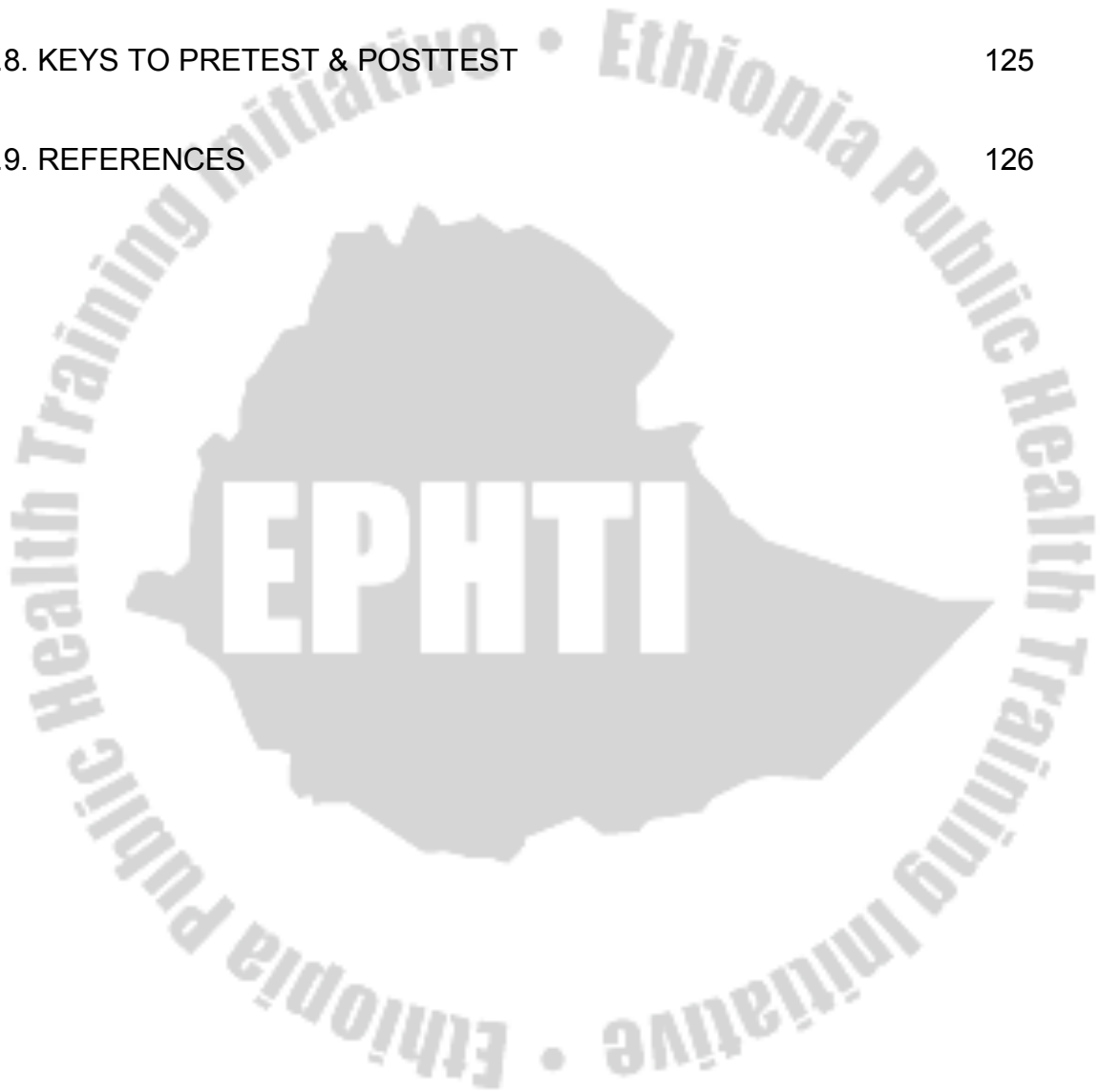
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# PART ONE

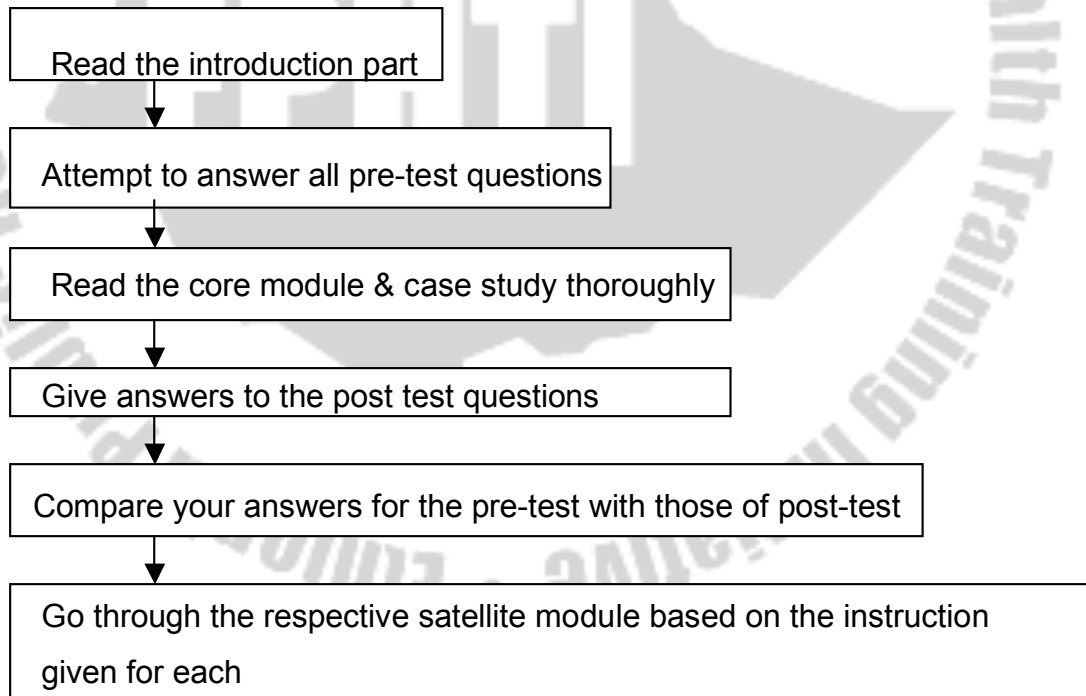
## INTRODUCTION

### 1. Introduction

#### 1.1. Purpose and uses of the Module

This Module is prepared mainly for health officer, public health nurse, environmental health, and medical laboratory technology students, to equip them with the basic knowledge and skill on how to diagnose, manage and prevent intestinal parasites. The module is divided into two parts: core and satellite modules. The core Module provides basic knowledge and skill to all categories of students of the health center team. The satellite modules on the other hand focus on the roles and specific activities of a given category of students.

Figure I: Directions for using the module



## PART TWO

### CORE MODULE

#### 2.1. Pre-test

Instruction - choose the correct answer and write on your answer sheet

1. Which of the following is an intestinal protozoa?
  - a) Entamoeba histolytica
  - b) Ascaris lumbricoides
  - c) Hymenolepis nana
  - d) Schistosoma mansoni
  
2. What is the most common route of transmission for intestinal protozoa?
  - a) Ingestion of cyst with contaminated food
  - b) Insect bite
  - c) Eating raw meat
  - d) Skin penetration
  
3. Which of the following methods doesn't help for prevention & control of intestinal protozoa?
  - a) Safe water supply
  - b) Health education
  - c) Proper disposal of human excreta
  - d) Mass screening & treatment
  
4. Among intestinal protozoa, which one is commonly found in HIV/AIDS patients?
  - a) Cryptosporidium parvum
  - b) Giardia intestinalis (=lamblia)
  - c) Entamoeba histolytica
  - d) None of the above
  
5. The infective stage of Giardia intestinalis is
  - a) Cyst
  - b) Trophozoite

- c) Both
- d) None of the above

6. Which of the following disease (s) is/are caused by nematodes entering the host through skin penetration?

- a) Enterobiasis
- b) Strongyloidiasis
- c) Hook worm infection
- d) A and B
- e) B and C

7. Which of the following intestinal nematodes are capable of autoinfection?

- a) *S. stercoralis*
- b) *T. trichuira*
- c) *E. vermicularis*
- d) A and C
- e) All of the above

8. Which of the following common nematode infections has worldwide distribution?

- a) Enterobiasis
- b) Ascariasis
- c) Trichuriasis
- d) Hook worm Infection

9. Which of the following nematode infections can be diagnosed by the recovery of larvae from fresh stool?

- a) Ascariasis
- b) Trichuriasis
- c) Strongyloidiasis
- d) Enterobiasis

10. Which of the following combinations are the best preventive methods for all intestinal nematodes?

- a) Good personal hygiene and proper excreta disposal

- b) Chlorination of domestic water
- c) Using night soil as fertilizer and wearing shoes
- d) None of the above

11. Which of the following trematodes are epidemiologically important in Ethiopia?

- a) *S. mansoni*
- b) *S. hematobium*
- c) *S. japonicum*
- d) a and b

12. Schistosomiasis is transmitted by

- a) Ingestion of uncooked cray fish
- b) Contact with snail during swimming
- c) Skin penetration by cercariae during swimming
- d) Drinking unboiled water containing *Schistosoma* eggs

13. Which of the following symptoms may characterize acute schistosomiasis?

- a) Diarrhea
- b) abdominal cramps
- c) Tenesmus
- d) all

14. Unique characteristic of *S. mansoni* egg on microscopic examination is the presence of

- a) Lateral spine
- b) terminal spine
- c) Operculum
- d) rudimentary spine

15. Which of the following methods are effective for the prevention of schistosomiasis?

- a) Proper disposal of human waste
- b) Snail eradication
- c) Boiling drinking water
- d) a & b
- e) All

16. The following cestodes are transmitted by eating raw meat or fish except

- a) *Taenia saginata*
- b) *Taenia solium*

- c) Hymenolepis nana
- d) Diphylobothrium latum

17. Which of the following cestodes are more common in our country?

- a) Taenia solium
- b) Taenia saginata
- c) Hymenolepis nana
- d) D. latum
- e) b & c

18. All of the following are features of cestode infections except:

- a) Cough
- b) Abdominal cramp
- c) Diarrhea
- d) Anorexia

19. Which of the following drugs can effectively treat tapeworm infection?

- a) Piperazine
- b) Niclosamide
- c) Mebendazole
- d) Metronidazole
- e) b & c

20. Which of the following is not the appropriate preventive or control measure for tapeworm infection?

- a) Cooking meat above 56 °C
- b) Practicing personal hygiene
- c) Encouraging use of excreta for soil fertilization
- d) Freezing meat at 10 °C for 24 - 48 hrs



## **2.2. Significance and brief description of intestinal parasitosis**

Intestinal parasitosis refers to a group of diseases caused by one or more species of protozoa, cestodes, trematodes and nematodes. These parasites are responsible for the major share of morbidity and mortality in those communities where there is over-crowding, poor environmental sanitation and personal hygienic practices, which make them a great concern for the developing countries. The prevalence of different parasites differ between immunocompetent and immunodeficient individuals. Globally, in immunocompetent individuals ascaris stands first with a prevalence of 600 million/year followed by schistosomiasis (300 million/year) and amebiasis (40 – 50million/year). In immunodeficient individuals, on the other hand, cryptosporidiosis is the commonest intestinal parasite known to occur. In Ethiopia, intestinal parasitic diseases are among the ten top causes of morbidity nationwide. Most of the intestinal parasites are more common and their manifestations are more severe in children than adults. Infection in children is also associated with malnutrition, growth retardation and poor school performance.

Besides the health impact, intestinal parasites have significant socioeconomic impact in terms of absence from work, diagnostic and treatment expenses. Therefore, it is essential that the health center team be equipped with the basic knowledge and skills to enable them to diagnose and treat common causes of intestinal parasitosis and design appropriate preventive and control strategies. In this module, emphasis is given mainly to intestinal parasites of public health importance either because of their high prevalence and/or associated morbidity and mortality. It is to be noted that early diagnosis, proper treatment and efficient preventive measures to control the spread of these parasites will improve the health of the community in general and the individuals in particular.

### **2.3. Learning objectives**

After going through this core module, the student will be able to:-

- 2.3.1. Identify the common intestinal parasites
- 2.3.2. Describe the life cycle of the parasites
- 2.3.3. Describe the mode of transmission of the parasites
- 2.3.4. Understand the clinical features of the parasites
- 2.3.5. Diagnose and treat common intestinal parasites
- 2.3.6. Outline the prevention and control measures.

### **2.4. Case Study**

Ato Gemechu Chala is a 30-yr old man originally from Tulu Gudo, one of the islands in Lake Zway, but currently a daily laborer in Zeway Plantation Farm. He visited the nearby health post run by a primary health care worker for recurrent abdominal pain and bloody diarrhea of three months duration. The pain is intermittent and crampy in nature involving the lower abdomen, and the diarrhea is small in volume and associated with tenesmus, which repeatedly subsided by itself. Ato Gemechu's family moved to Zway two years back and he has been serving as canal worker for the last one year. The family usually bathe and wash their clothing in Lake Zway. After obtaining this history the primary health worker referred the patient to Zway Health Center telling him that his condition could be serious and needs further evaluation. On arrival to the health center, the history was thoroughly revisited by the health officer. The patient gave an additional history of similar illness in two of his children who were treated with unidentified drugs in the nearby health post, but still experiencing the same problems at different times. On physical examination, the health officer found a febrile patient with slightly pale conjunctiva & mild lower abdominal tenderness. Then, the health officer requested direct stool microscopy which was initially reported as negative, and the patient was appointed to come after two days. On the second visit, the stool microscopy revealed ova of *S.mansoni* for which the patient was given 3 tablets of Praziquantel and advised to bring his sick kids and to reduce contact with water. Later that week, a team of professionals was deployed from the health center to the patient's village. The team was composed of a public health nurse (leader of the team), a sanitarian and a laboratory technician, all having a high spirit of teamwork. On arrival to the village, members of the team

shared tasks among themselves. The public health nurse tried to search for sick people and found some individuals with variable degree of abdominal complaints and she advised them to get medical care at Zway Health Center. The sanitarian moved around the village and observed a site for open field defecation as there were no latrines. Additionally, the sanitarian realized the absence of tap water facilities in the village. On further investigation, he found snails in the water at the bank of the lake. The laboratory technician collected stool samples from some of the sick individuals and the team returned to the health center. After return, the team reported to the health center head (the health officer) and arranged a short meeting to discuss on the findings. Finally, the staff of the health center agreed that the condition is serious and needs immediate attention. Therefore, it was decided to deploy another team after a week for detailed investigation of the disease in the village.

## **2.5. Intestinal nematodes**

All nematodes are characterized by their elongated, cylindrical, and unsegmented bodies. The sexes are separate, the males typically being smaller than females. More than a million people worldwide are infected with one or more species of intestinal nematodes. These parasites are most common in regions with poor sanitation, particularly in developing tropical and sub tropical countries. Although nematode infections are not usually fatal, they contribute to malnutrition and diminished work capacity. Because most of the helminthic parasites do not self replicate, the acquisition of a heavy burden of adult worms requires repeated exposure to the parasite in its infective stage (larva or egg) or auto-reinfection must occur.

### **2.5.1 Ascariasis**

#### **Definition**

Ascariasis is an infection by the nematode Ascaris lumbricoides. It is the most common helminthic parasite of humans.

#### **Etiology**

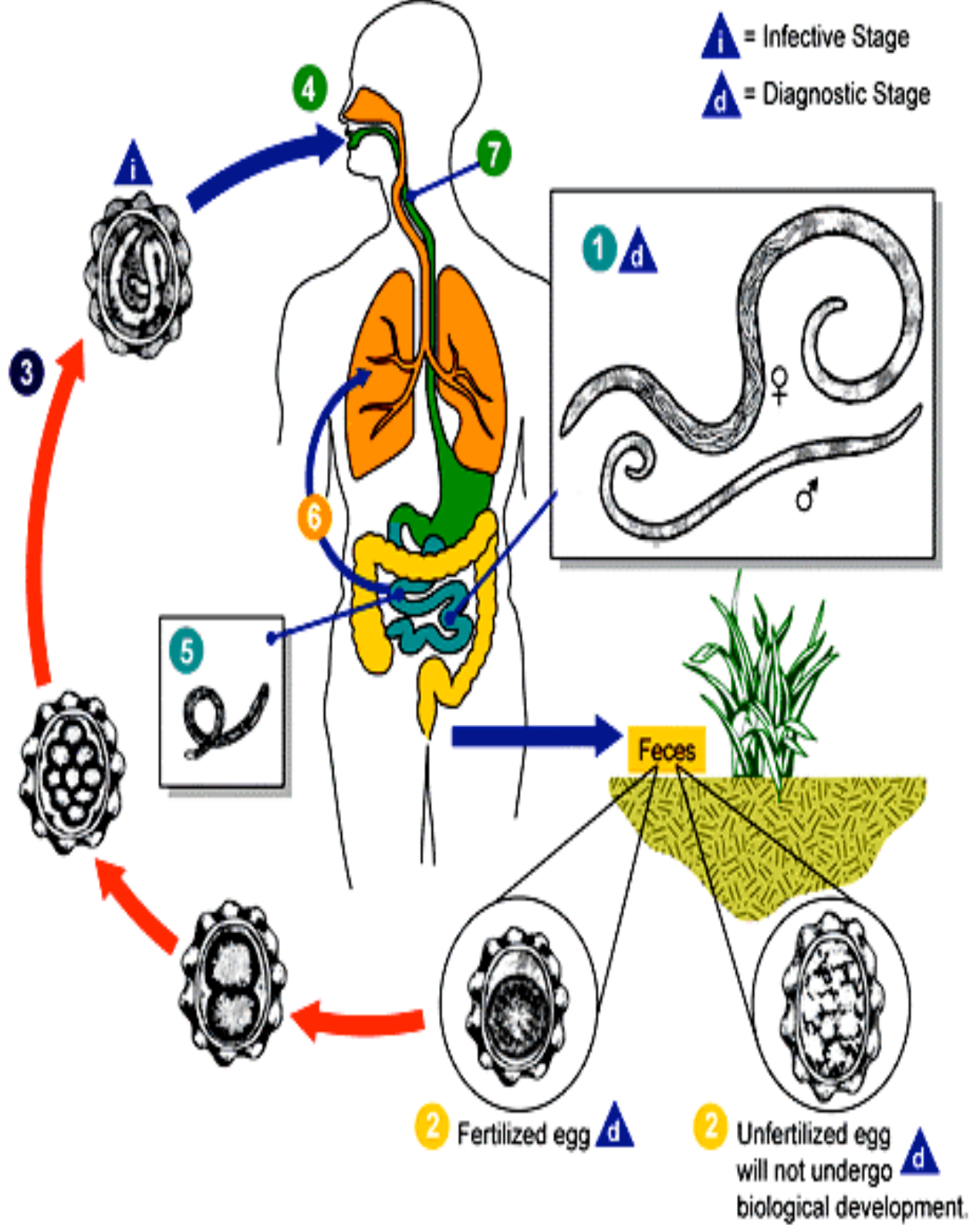
Ascariasis is the largest intestinal nematode. The females are between 20 – 35 cm in length, while the males vary between 15 and 30cm. The female lays about 200,000 eggs per day.

## **Epidemiology**

Ascariasis has a worldwide distribution and it is particularly common in regions with poor sanitation. Man may acquire ascariasis by the ingestion of eggs in contaminated foods or rarely drinks. More frequently eggs containing embryos reach the mouth directly from the soil via dirty hands. Hence, children are infected more often than adults.



Figure II: The life cycle of *Ascaris lumbricoides*



Source: CDC

### **Clinical features**

Most infections are asymptomatic. However, in heavier infections abdominal pain or discomfort, nausea, vomiting, anorexia and passage of adult worms via anus or mouth may occur.

During the lung phase, about 9 - 12 days after ingestion of the eggs, the individual may occasionally present with dry cough, chest pain, fever, wheezing, shortness of breath and blood streaked sputum associated with increased eosinophils in the circulation. This condition is called *eosinophilic pneumonitis*. Heavy infestation competes for nutrients and contributes to malnutrition in children.

### **Diagnosis**

Depends on the microscopic demonstration of eggs in the stool or recovery of an adult worm in the stool or after passing through the mouth or nose

### **Treatment**

#### **Mebendazole**

Adults and children >10 kg = 100 mg po bid for 3 days

Children < 10 kg = 50 mg po bid for 3 days

#### **Albendazole**

Adult and children >10 kg = 400 mg po single dose or for 3 days in heavy infections

Children < 10 kg = 200 mg po single dose or for 3 days in heavy infections

**Pyrantel pamoate** 10 mg/kg up to a maximum of 1gm po once

**Piperazine** citrate 75mg/kg po once to a maximum of 3.5 gm for adults and children over 12 years; and a maximum of 2.5 gm for children between 2 – 12 years.

**Levamisole** 120 – 150 mg po once

## 2.5.2. Trichuriasis (whip worm infection)

### Definition

Trichuriasis is an infection of the human intestinal tract, caused by the nematode Trichuris trichuira (whip worm).

### Epidemiology

The distribution of trichuriasis is worldwide, being most abundant in the warm moist regions of the world. The parasite commonly occurs together with *Ascaris lumbricoides* and likewise mainly affects children. In Ethiopia it is found in 90% of 50 communities in the central and northern plateaus with a mean prevalence of 49%. (3) Infection results from the ingestion of eggs in contaminated soil. Transmission may occur through the medium of food or water or directly from the hands of individuals. Children may be heavily infected and constitute important reservoirs.

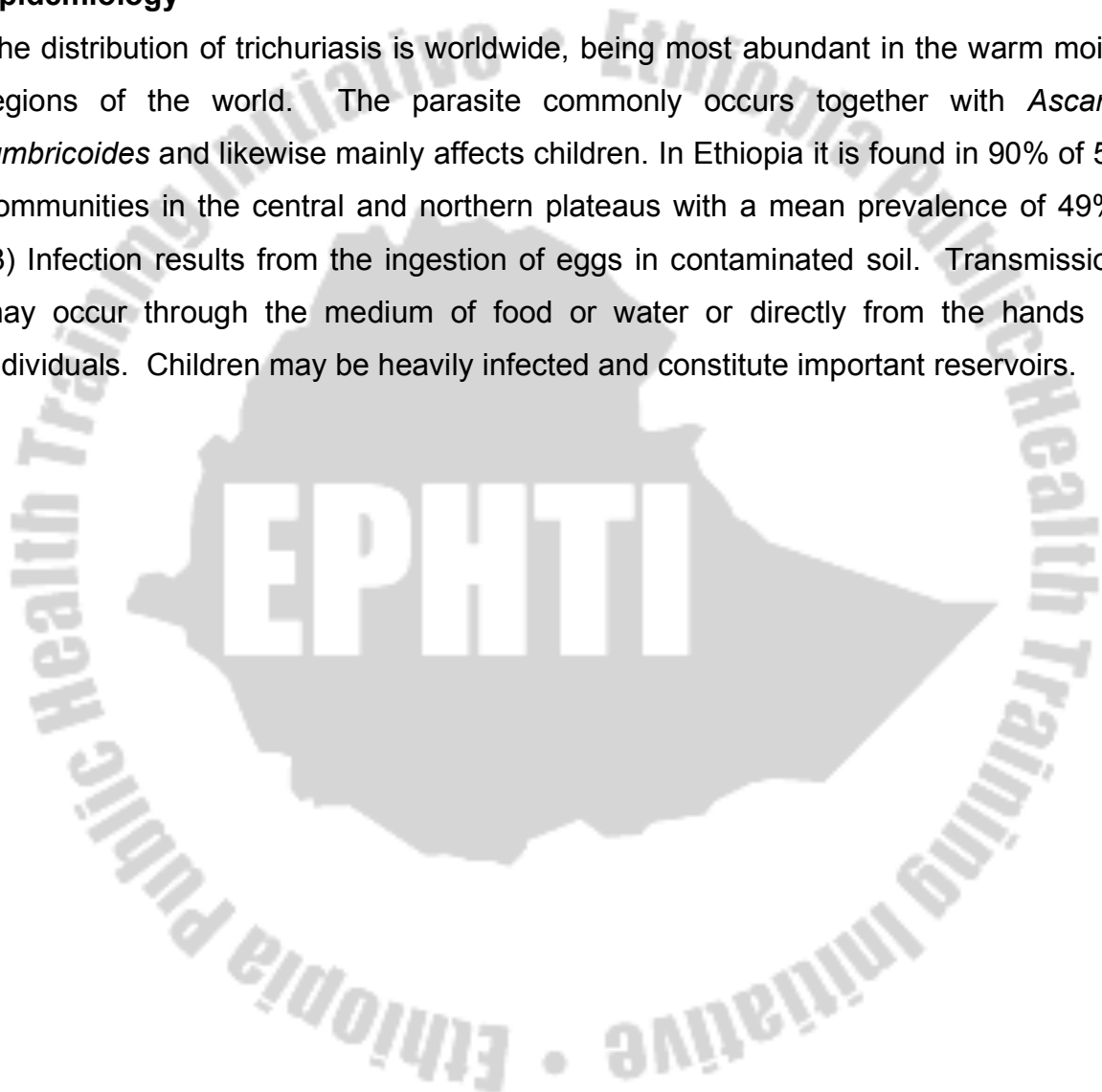
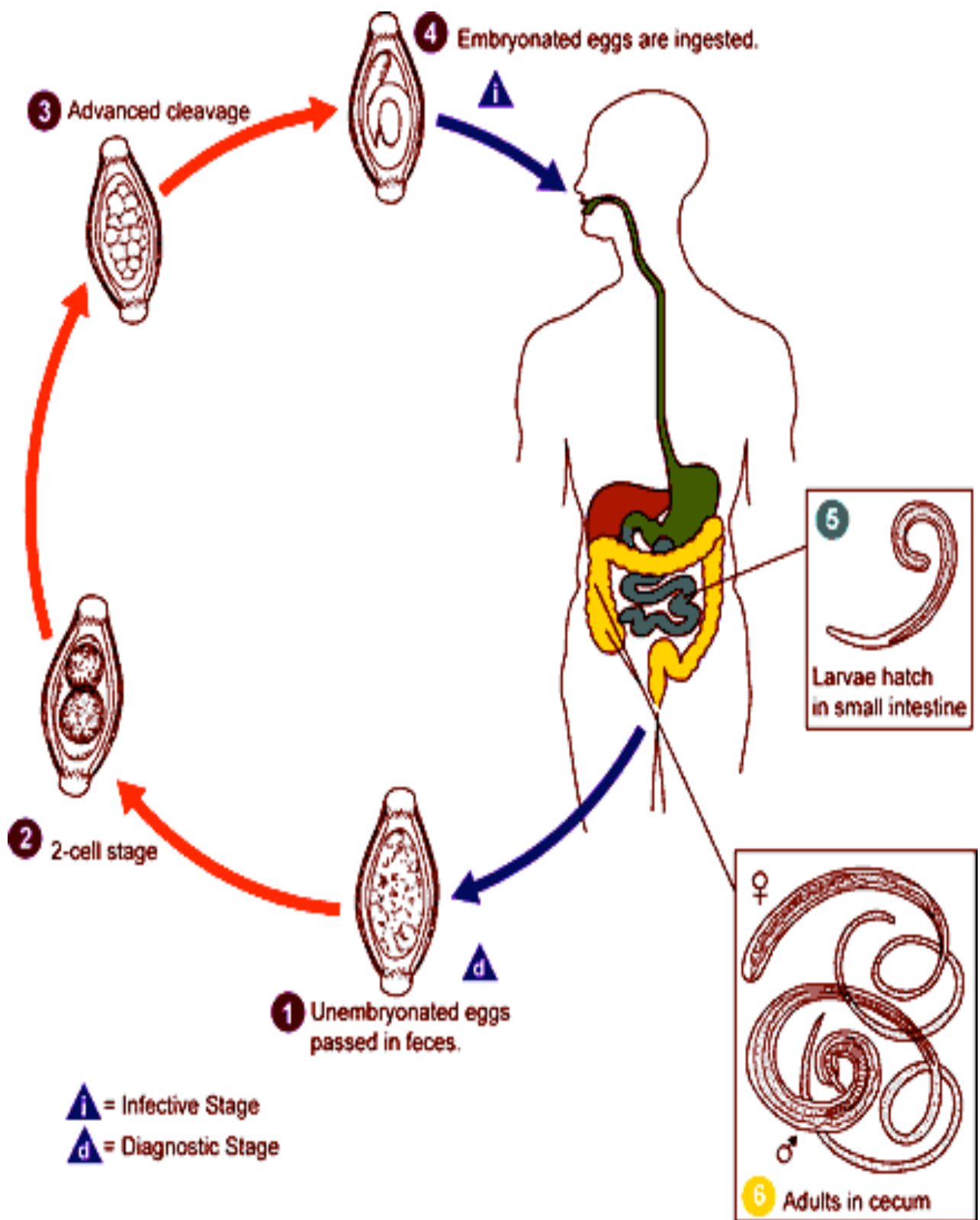




Figure III: The life cycle of *Trichuris trichiura*



Source: CDC



## **Clinical features**

Trichuriasis is asymptomatic in most persons. However, children tend to acquire heavier infection and some may experience anorexia, nausea and abdominal pain. Occasionally it causes bloody or mucoid diarrhea in young infants. Heavy and chronic infections may cause rectal prolapse. Moderately heavy whip worm burdens also contribute to growth retardation.

## **Diagnosis**

Depends on microscopic detection of the characteristic lemon shaped egg of the parasite in the stool

## **Treatment**

- Mebendazole

Adults and children >10 kg = 100 mg po bid for 3 days

Children < 10 kg = 50 mg po bid for 3 days

- Albendazole

Adults and children >10 kg = 400 mg po daily for 3 days

Children <10 kg = 200 mg po daily for 3 days

## **2.5.3 Hook Worm Infection**

### **Etiology**

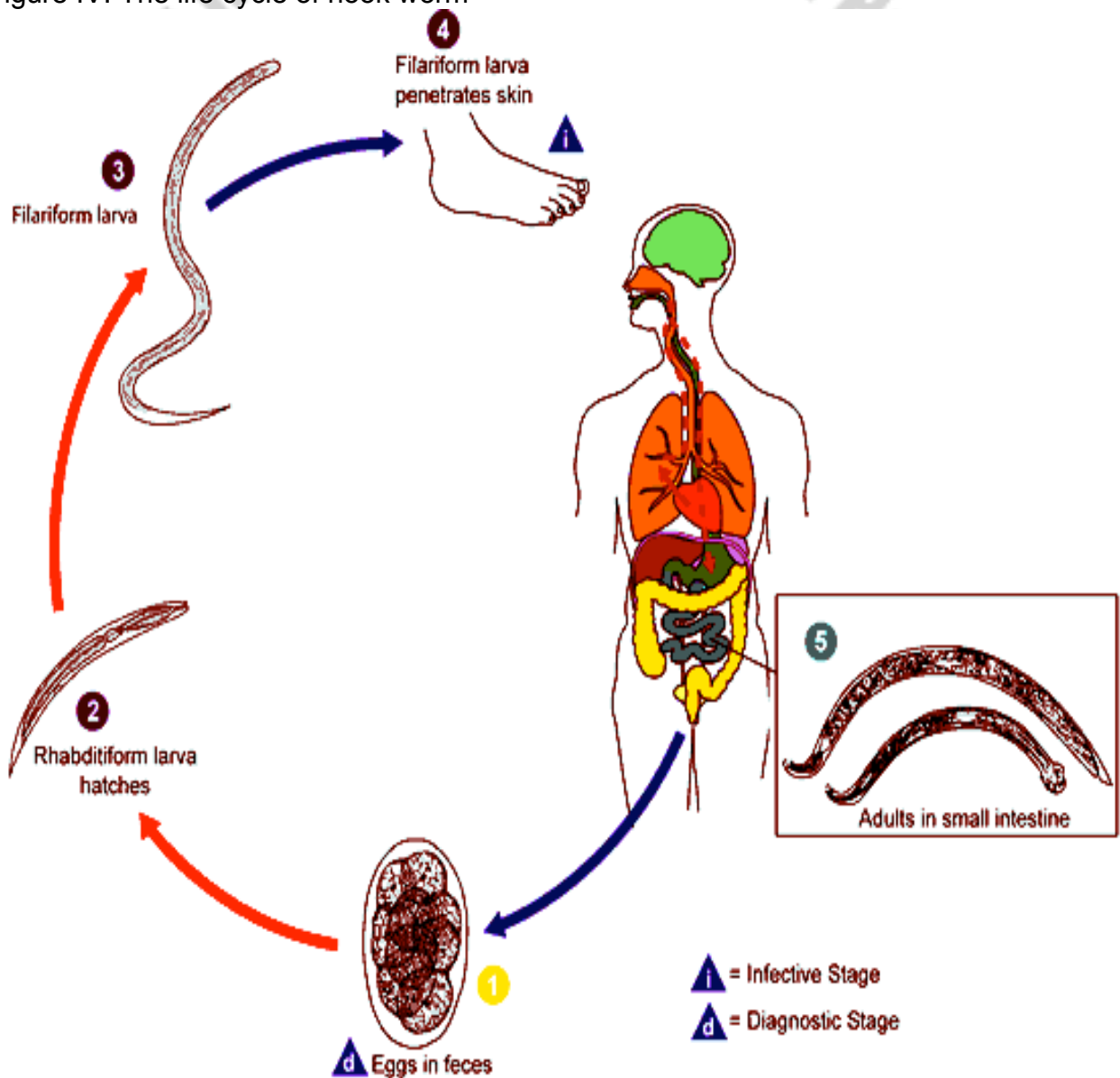
Hook worm infection is caused by one of the two hook worm species; namely Ancylostoma duodenale and Necator americanus. Adult hook worms, which are about 1cm long, use buccal teeth or cutting plates to attach to the small bowel mucosa and ingest blood and intestinal fluid (0.2 ml /day per Ancylostoma adult) and cause large volume blood loss from intestinal bleeding. One fourth of the world's population is infected with one of the two hookworm species. Hookworm disease develops from a combination of factors such as heavy worm burden, prolonged duration of infection and an inadequate iron intake, and it is characterized by iron deficiency anemia and occasionally hypoproteinemia.

### **Epidemiology**

Hookworm infection is wide spread and is one of the most important helminthic infections of man. It occurs in nearly all subtropical and tropical countries. The distribution of the two species overlap and both are present in many regions of the

world. In Ethiopia, *Necator americanus* is more common than *Ancylostoma duodenale*, and hookworm infections are most prevalent in communities located between 800 and 1200m altitude. Infection rates ranged between 7% and 67% among 10 school populations in the lowlands of Gondar Region and at community level rates ranged from 4% to 75% among 16 villages in west Abaya (3). In most areas, older children have the greatest incidence and intensity of hookworm infection. In rural areas where fields are fertilized with night soil, older working adults may also be heavily infected.

Figure IV: The life cycle of hook worm



Source: CDC

**N.B.** The period from skin penetration to appearance of eggs in the feces is about 4-6 weeks

### **Clinical Features**

Most hookworm infections are asymptomatic. However, infective larvae may provoke itching rash at the site of skin penetration. Moreover, larvae migrating through the lungs occasionally cause mild transient pneumonitis in the early intestinal phase. Infected persons may develop epigastric pain, diarrhea and other abdominal symptoms. However, the major consequence of chronic hookworm infection is blood loss resulting in iron deficiency, which in marginally nourished individuals may manifest with anemia and hypoproteinemia.

### **Diagnosis**

- Microscopic recovery of the typical eggs
- Concentration techniques may be required to detect light infections

### **Treatment-**

Mebendazole, albendazole or Pyrantel pamoate: similar to ascariasis

Dietary therapy: supplementation of oral iron preparations for iron deficiency anemia, plus proteins & vitamins.

## **2.5.4 Enterobiasis**

### **Definition**

Enterobiasis is an infection of the human intestinal tract by Enterobius vermicularis (the pinworm)

### **Etiology and Life Cycle**

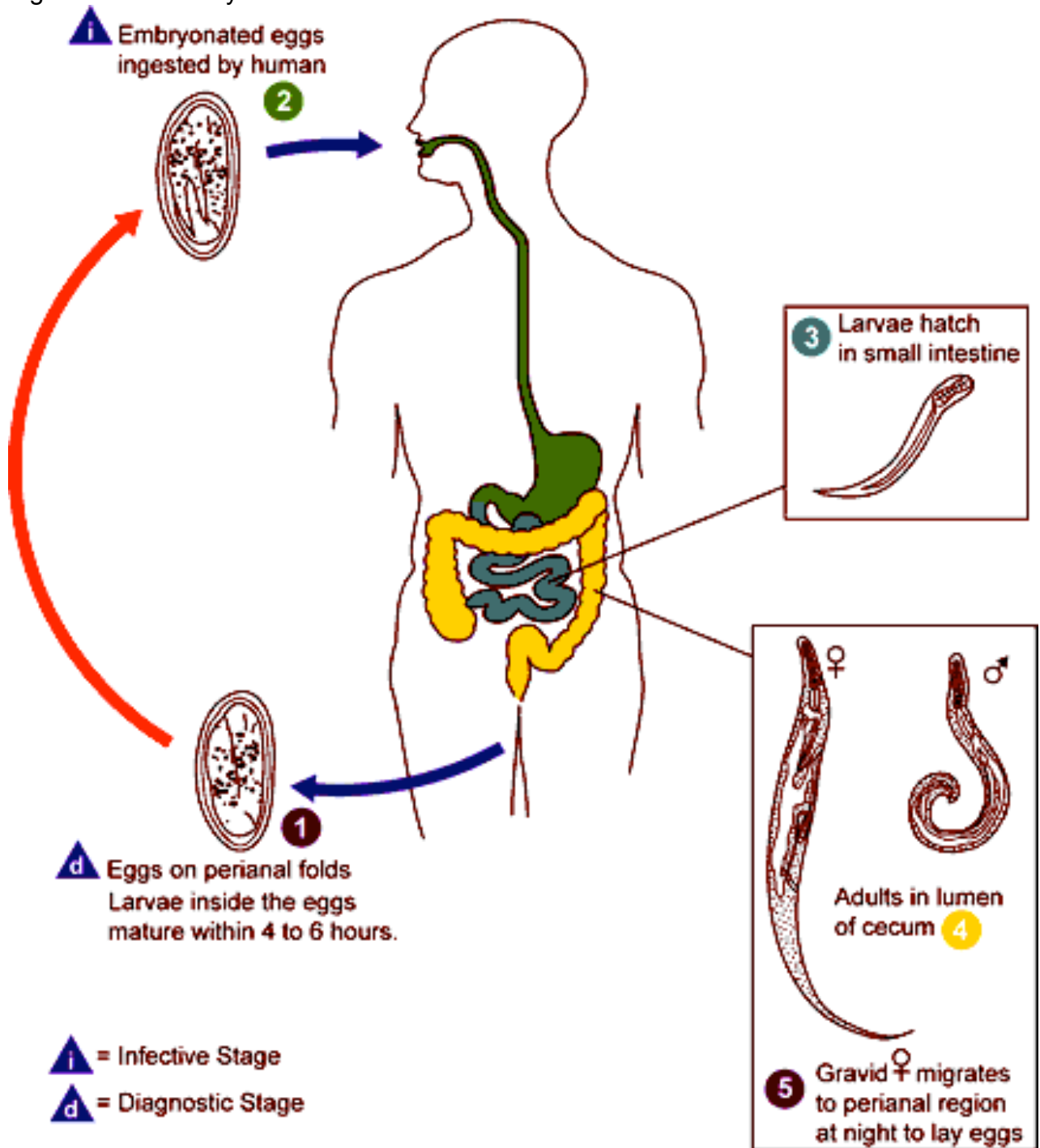
Enterobius vermicularis is a spindle shaped parasite of man and attaches to the mucosa of the lower ileum, caecum and ascending colon. Pinworm eggs are infective shortly after being excreted. After ingestion, the eggs hatch in the upper intestine and liberate larvae which migrate to the region of the ileum. Copulation (mating) of the worms takes place in the lower small intestine, and then the females migrate to the caecum or lower bowel and pass through the anus where upon contact with the air they shower their sticky eggs on the perianal skin.

## **Epidemiology**

Enterobiasis is a worldwide disease infecting mostly children. In Ethiopia past surveys have reported low prevalence of *E. vermicularis*. In Gondar area 5% of school children were found to contain *E. vermicularis* eggs under their nails, but only 0.5% of them shed eggs in the stool (3). Infections occur by ingestion of the eggs that reach the mouth on soiled hands or in contaminated food or drink. The intense perianal itching is an important factor in autoinfection and maintenance of the primary reservoir. Because of the predominance of person-to-person transmission, autoinfection through the perianal-fecal-oral route and through egg contamination of blankets and clothing, enterobiasis is more common in some families and institutions (orphanages, boarding schools, asylums, and refugee camps) where people live under crowded conditions.



Figure V: The life cycle of *Enterobius vermicularis*



Source: CDC

### Clinical features

Most pinworm infections are asymptomatic. The most common symptom when present is intense perianal itching. It is worse at night and may lead to excoriation

and bacterial superinfection. Heavy infections may manifest with abdominal pain, anorexia and weight loss.

### **Diagnosis**

Eggs are not typically found in the stool because they are released on the perineum. Therefore, eggs deposited in the perianal region are detected from perianal swab or by the application of clear cellulose tape to the perianal region in the morning. The tape is then transferred to slide to be seen under a microscope.

### **Treatment**

1. Drugs of choice:

- Mebendazole

Adult and children >10 kg = 100 mg po once then repeat same dose in 2 weeks

Children < 10 kg = 50 mg po once then repeat same dose in 2 weeks OR

- Albendazole

Adult and children >10 kg = 400 mg po single dose then repeat same dose in 2 weeks

Children < 10 kg = 200 mg po single dose then repeat same dose in 2 weeks

2. Alternatives:

Pyrantel pamoate 11mg/kg po maximum 1.0 gram single dose then repeat same dose in 2 weeks

- Warm tap water enema may help
- Family members should be treated to decrease potential source of reinfection

### **2.5.5 Strongyloidiasis**

#### **Definition**

Strongyloidiasis is an infection by the nematode Strongyloides stercoralis, which is usually embedded in the mucosa and sub mucosa of the small intestine of man.

#### **Etiology and Life Cycle**

The adult parasite is small in size, the female measuring about 2.2mm in length. The mature female lies buried in the mucosa and sub mucosa of the intestine where it liberates eggs. The eggs hatch to produce the rhabditiform larvae that are passed in

the stool. The rhabditiform larvae may undergo further development in either of two ways:

- (1) As **free living adult** under suitable conditions of moisture and temperature or
- (2) As **infective filariform larvae** under unfavorable conditions.

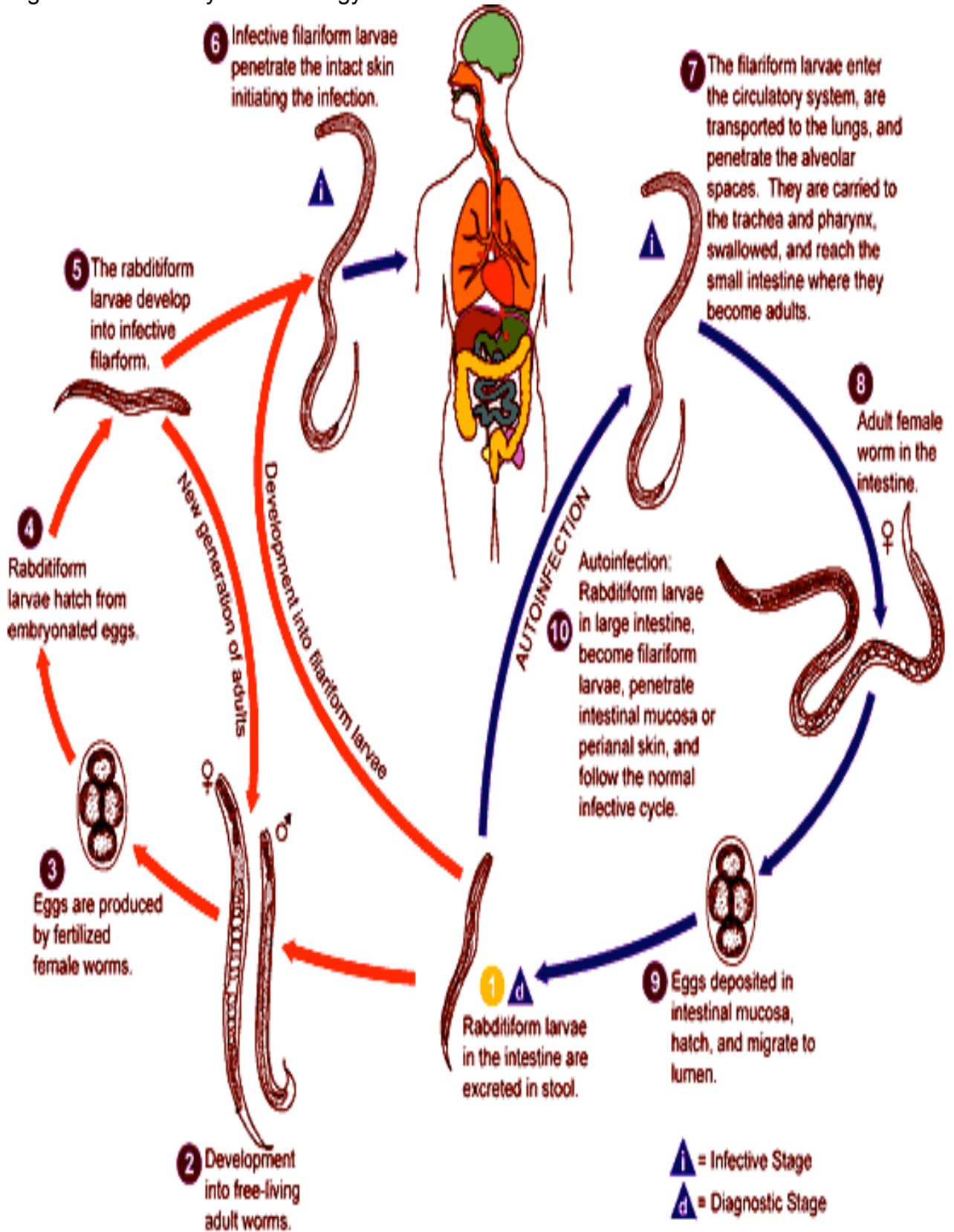
These infective larvae are capable of penetrating the skin of man. After skin penetration the filariform larvae reach the lymphatics or capillaries and are carried to the right side of the heart and pulmonary capillaries. Here they leave the capillary beds and penetrate into the alveoli of the lungs. Then most of them migrate up the respiratory passages, reach the esophagus and pass down into the stomach and intestines. The larvae mature to adult female worms in the small intestine and penetrate its mucosa. Finally mature female worms produce eggs that hatch and maintain continuity of the cycle. Besides skin penetration by infective larvae, autoinfection is commonly observed in this disease. The autoinfection cycle involves the change of rhabditiform larvae to filariform larvae within the bowel lumen and their penetration either the perianal skin or the wall of the intestine and maintain the cycle in the absence of reinfection.

### **Epidemiology**

Strongyloides stercoralis is patchily distributed in tropical areas particularly in Sub-Saharan Africa and South East Asia. Human beings usually acquire the infection by skin penetration of the infective filariform larvae. However, due to its “autoinfective” life cycle, strongyloidiasis can become permanently established in humans without the need to reinfection and a chronic clinical syndrome occurs. In such cases there is a potential for “Hyperinfection syndrome” where host immunity is reduced due to steroid or immunosuppressive drug therapy, severe malnutrition, leukemia and lymphoma, DKA, postirradiation treatment and lepromatous leprosy. In Ethiopia strongyloidiasis was found to be more common in AIDS patients than non-AIDS. The parasite is not highly prevalent in this country, but it occurs in the same geographic areas and communities as hookworm infection.



Figure IV: the life cycle of *Strongyloides stercoralis*



Source: CDC



## **Clinical Features**

### **A) Uncomplicated Strongyloidiasis**

Many patients are asymptomatic or have mild cutaneous and /or abdominal symptoms. Cutaneous manifestations include recurrent urticaria involving the buttocks and wrists, and an itchy skin lesion along the courses of larval migration. Abdominal symptoms include epigastric pain which resembles peptic ulcer disease, nausea, diarrhea and mild intestinal bleeding. The migration of larvae through the lungs may cause cough & occasionally severe respiratory symptoms. In HIV patients the clinical courses is protracted, but complication is uncommon for unknown reasons.

### **B) Disseminated Strongyloidiasis (hyperinfection syndrome)**

In this case, the larva may invade not only the intestinal and the lung tissues, but also the central nervous system, liver and kidneys. Patients may have severe and often bloody diarrhea, bowel inflammation with multiple microperforations, bacterial peritonitis and paralytic ileus, gram-negative sepsis, hemoptysis, pleural effusion and hypoxia, and encephalitis and bacterial meningitis.

## **Diagnosis**

In uncomplicated strongyloidiasis, the finding of rhabditiform larvae in feces is diagnostic. Single stool examination detects only about one third of infections. Therefore, serial stool examination or use of concentration techniques should be employed to improve the sensitivity of stool diagnosis. In hyperinfection syndrome, on the other hand, the larvae are easy to find in the stool or other body fluids (pleural, peritoneal, or bronchoalveolar lavage samples).

## **Treatment**

Even in the asymptomatic state, strongyloidiasis must be treated because of its potential for fatal hyper infection.

### **Asymptomatic or uncomplicated cases:**

Drug of choice: Ivermectin 200µg/kg/d po (or 6 mg po/d) for 3 days

Alternatives:

- Thiabendazole 25mg/kg bid maximum of 3 gm/d for two days OR

- Albendazole 15 mg/kg twice a day maximum of 400 mg daily for three days repeat same dose after 7 days.

Complicated cases (hyperinfection syndrome):

Drug of choice: Ivermectin 200µg/kg/d po (or 6 mg po/d) for 3 days

Alternatives:

Thiabendazole for five to seven days or albendazole for two weeks.

Supportive therapy: it is also important to manage complications such as gram-negative sepsis, pneumonia or meningitis.

### **2.5.6 Prevention and control of intestinal nematodes**

1. Health education
2. Sanitary disposal of feces in latrines and avoid use of night soil as fertilizer
3. Improve personal and food hygiene practices
4. Improve standard of living conditions
5. Concurrent disinfections of human excreta
6. Investigation of contact and source of infection
7. Treatment of the infected cases

## 2.6. Intestinal protozoa infections

Intestinal protozoal diseases are caused by unicellular microorganisms which invade the wall of the intestine such as amebiasis, giardiasis, cryptosporidiosis and isosporidiosis.

### 2.6.1. Amoebiasis

#### Etiology

Amoebiasis is caused by *Entamoeba histolytica*, the only pathogenic entamoeba species. It has two morphologic forms: trophozoite and cyst. The trophozoite form is the motile & invading stage of the parasite that usually lives as a commensal in the human large intestine where it multiplies by asexual binary fission and eventually differentiates into cyst forms. The cyst form is inactive, non motile, non-invading stage of the parasite, and it is responsible for the transmission of the disease to others through fecal-oral route.

#### Pathogenesis

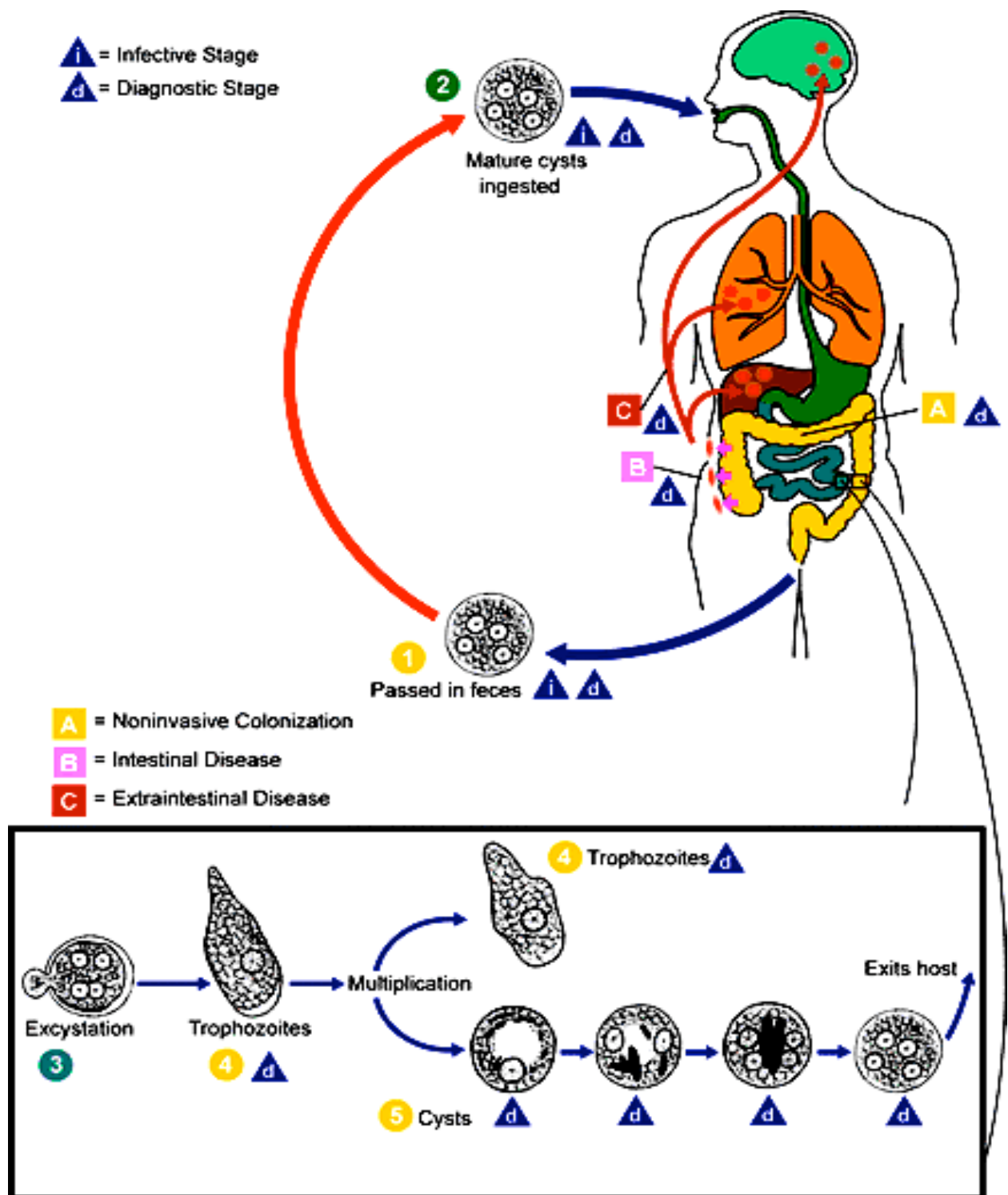
Amoebiasis is acquired by ingestion of infectious cyst through water or undercooked food contaminated by human feces. After ingestion of the cyst, which is resistant to gastric acids and enzymes, excystation occurs in the ileocecal area of the intestine to form trophozoites. The trophozoites are larger in size and actively motile organisms. According to the “bind-lyse-eat” model, the trophozoites bind to the large intestine and invade the wall releasing amebapores and phospholipidases, causing ulceration of the mucous membrane (called flask shaped ulcers), and sometimes large vessels may be eroded and severe intestinal hemorrhage result. Rarely intestinal infection results in the formation of a mass lesion in the bowel called amoeboma. However, this may be an oversimplistic. Invasion also appears to depend on cytoskeleton motility, the secretion of proteases that degrade the extracellular matrix and antibody. The host inflammatory response, including the production of cytokines and inflammatory mediators, accompanied by influx of neutrophils, are also important in the pathogenesis of invasive amebiasis. Encystation occurs in the large intestine especially when the environment becomes unacceptable for continued trophozoite multiplication, for example, amoeba over population, P<sup>H</sup> change, too much or too little food supply and too much or too little O<sub>2</sub>. The cysts are excreted in the stool and transmitted via the fecaloral route

causing new infections in others. However, such infections don't occur following the ingestion of trophozoites, because they undergo rapid degeneration and die on exposure to the outside environment and the low P<sup>H</sup> of the normal gastric contents.



**Figure V: Life cycle of *E. histolytica***

*E. histolytica* requires a single host to complete its cycle



Source: CDC

## **Epidemiology**

Amoebiasis occurs in as many as 10% of the world's population. It is considered the third leading cause of parasite related mortality, next to malaria and Schistosomiasis (1). There are between 40 and 50 million cases of symptomatic amebiasis per year, resulting in 40,000 – 110,000 deaths worldwide (2). In Ethiopia intestinal amebiasis is one of the most commonly reported parasites. In a survey of 1850 school children in 50 predominantly rural school populations in the Ethiopian highlands, *E. histolytica* was reported in 94% of the communities with the mean infection rate of 19% (range 3 – 19%). It is also one of the most common parasites in HIV infected individuals with a prevalence of 25% in one study (3). It is endemic in many parts of tropical and subtropical Africa, especially in areas with low socioeconomic status and sanitary standards. The mode of transmission of infection includes hand to mouth contamination, ingestion of contaminated food and water and sexually in persons practicing unprotected anal sex. Flies and cockroaches may serve as vectors for deposition of cysts on human food. Humans are the only reservoir and source of infection.

## **Clinical Features**

About 90% of infections are asymptomatic; and in the remaining 10% it may produce a spectrum of clinical syndromes ranging from dysentery to abscess of the liver & other organs.

The clinical features of amebiasis depends on two major factors, these are:

1. The location(s) of the parasite in the host, and
2. The extent of tissue invasion

In endemic areas most intestinal infections are asymptomatic. However, clinical presentations may include lower abdominal pain, diarrhea, and low grade fever. Patient with full blown amebic dysentery may pass stool 10 - 12 times per day. More fulminant intestinal infections commonly present with severe abdominal pain, bloody mucoid diarrhea, tenesmus and high grade fever.

**Diagnosis:** Microscopic examination of stool is standard diagnostic procedure. In acute amebiasis, the trophozoite are found in a fresh dysenteric stool. The cyst, on the other hand, is found in a formed or semi formed stool. The later does not indicate the presence of acute amebiasis, but helps to know cyst - passers with the potential risk of transmitting the disease to others.

## **Treatment**

Adults: Metronidazole 500 mg TID for 7 – 10 days or

Tinidazole 2 gm daily for 3 days

Children: Metronidazole 20 – 25 mg/kg daily in 3 divided doses for 7 - 10days or

Tinidazole 50 mg/kg maximum of 2 gm daily for 3 days

## **2.6.2. Giardiasis**

### **Etiology**

Giardiasis is caused by *Giardia intestinalis*, which is the only pathogenic intestinal flagellate known to infect humans. It has two morphological forms, namely trophozoite and cyst. The trophozoite is actively motile and invading stage of the parasite, and lives on the villi of the small intestine. The cyst is inactive, non-motile and non-invading stage of the parasite, and responsible for the transmission of the disease to others through the fecal-oral route.

### **Pathogenesis**

Giardiasis is acquired by ingestion of infective cyst with contaminated food, drink, finger, etc. Following ingestion, the cysts excyst in the duodenum to form trophozoites (flagellate forms). The trophozoite attaches to the intestinal wall by sucking disc for nourishment and multiplies by binary fission. When the environment becomes unfavorable the trophozoites encyst in the large intestines. These cysts are passed in the feces and may remain viable for as long as 3 months in cold fresh water, but do not tolerate heating and desiccation. Trophozoites usually disintegrate and die quickly on exposure to the external environment.

### **Epidemiology**

Giardiasis is one of the most common parasitic infections having a worldwide distribution and occurring both in developed & developing nations. In Africa, Asia and Latin America about 200 million cases have been estimated to occur annually. In Ethiopia surveys across all regions of the country show giardiasis prevalence to be around 10% in the 1970s and early 1980s and it is more common in children than in adults (3). The infections may occur in one of the following three epidemiological patterns, i.e.

- Endemic as in the tropics, where fecal-oral transmission is common,



- Sporadic as in travelers or
- Epidemic as water borne or institutional out breaks.

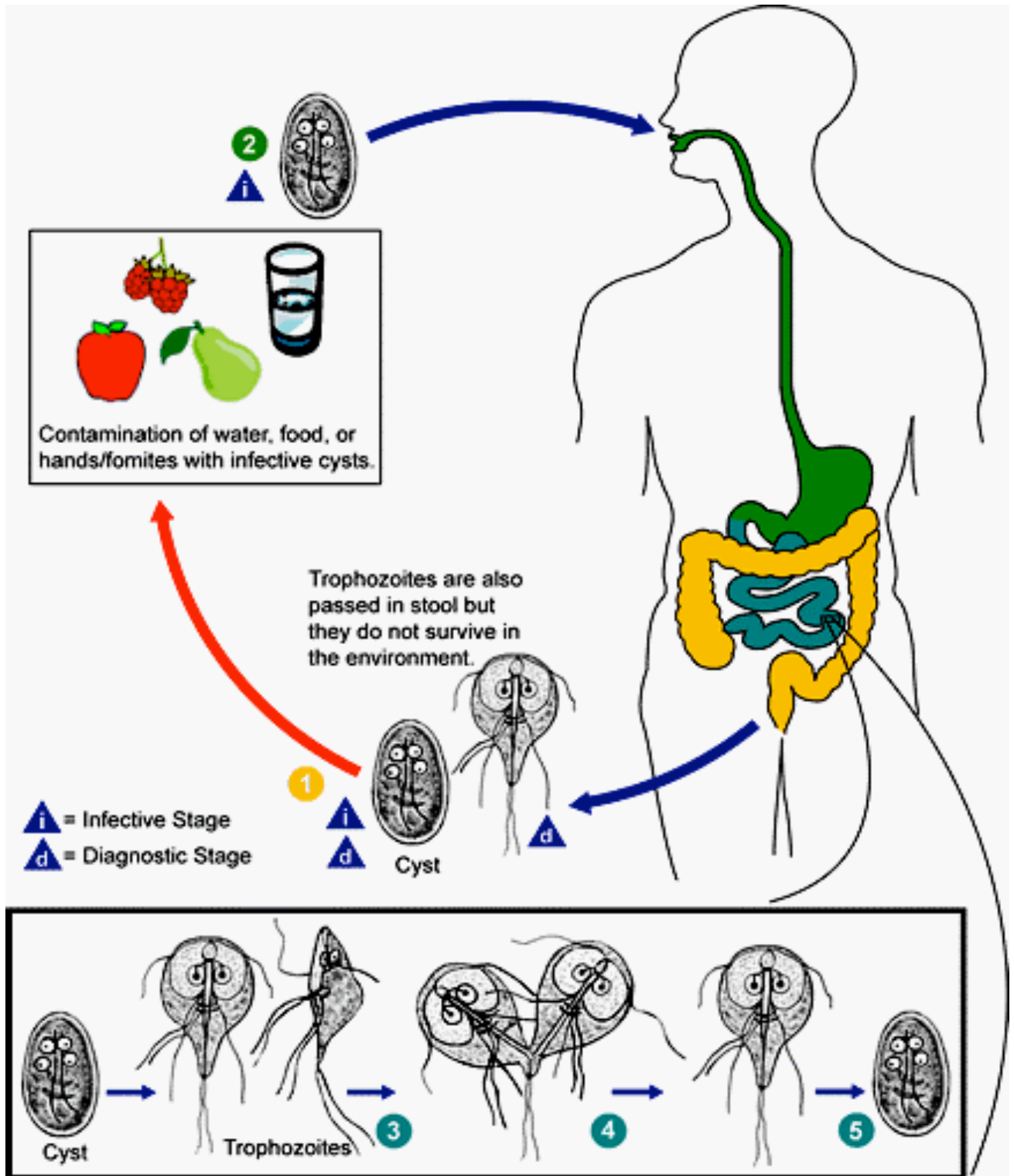
In endemic areas, children, particularly those that are malnourished are more frequently infected than adults. The water borne route is the main way of transmission though food borne transmission can also occur. Ingestion of as few as 10 cysts is sufficient to cause infection in humans.





Figure VIII: Life cycle of *Giardia intestinalis*

*G. intestinalis* requires a single host to complete its cycle



Source: CDC

## **Clinical features**

Most infections are asymptomatic, but patients may present with transient, recurrent or chronic symptoms. In symptomatic cases the major manifestations are diarrhea, bloating, belching, nausea, vomiting, abdominal cramps, anorexia and flatulence. In severe cases, steatorrhea (malabsorption of fat) can occur.

## **Diagnosis**

Macroscopically the stool is usually offensive, bulky, pale, non-bloody, mucoid (fatty) or watery.

Finding the trophozoite and/or the cyst form during microscopic examination of stool is diagnostic.

## **Treatment**

Drugs of choice

Adult dose:

- Metronidazole 500 mg po TID for 5 days or 2gm daily for 3 days OR
- Tinidazole 2 gm single dose OR
- Albendazole 400 mg/day for 5 days

Children:

- Metronidazole 15 mg/kg/day in 3 divided doses for 5 days or 40 mg/kg/day for 3 days
- or
- Tinidazole 50 mg/kg (maximum 2 gm) single dose

Alternatives:

- Furazolidone 100 mg four times a day for 7 - 10 days
- Paromomycin 50 mg/kg to maximum of 500 mg po tid for 7 days is safe to use for symptomatic pregnant mothers.

Treatment of family members may be indicated to prevent reinfection.

### **2.6.3. Cryptosporidiosis**

#### **Etiology**

Cryptosporidiosis is a disease caused most commonly by *cryptosporidium parvum*, a coccidian protozoa of human & domestic animals or *cryptosporidium hominis*, a parasite strictly of humans.

### **Pathogenesis and life cycle**

Cryptosporidiosis is acquired by ingestion of contaminated food or water containing infective oocysts excreted in the feces and excyst to liberate sporozoites. The sporozoites enter the epithelial cells of the small intestine where they multiply by schizogony (Merogony) and develop to Merozoites, which are subsequently liberated and infect new cells. However, some Merozoites may change into male and female gametes that can be fertilized into Zygotes. The Zygotes mature into oocyst within the intestinal cells, and are then excreted in the feces. These oocysts are infectious immediately after excretion. The oocysts also infect animals, and transmission from animals to man is also common.

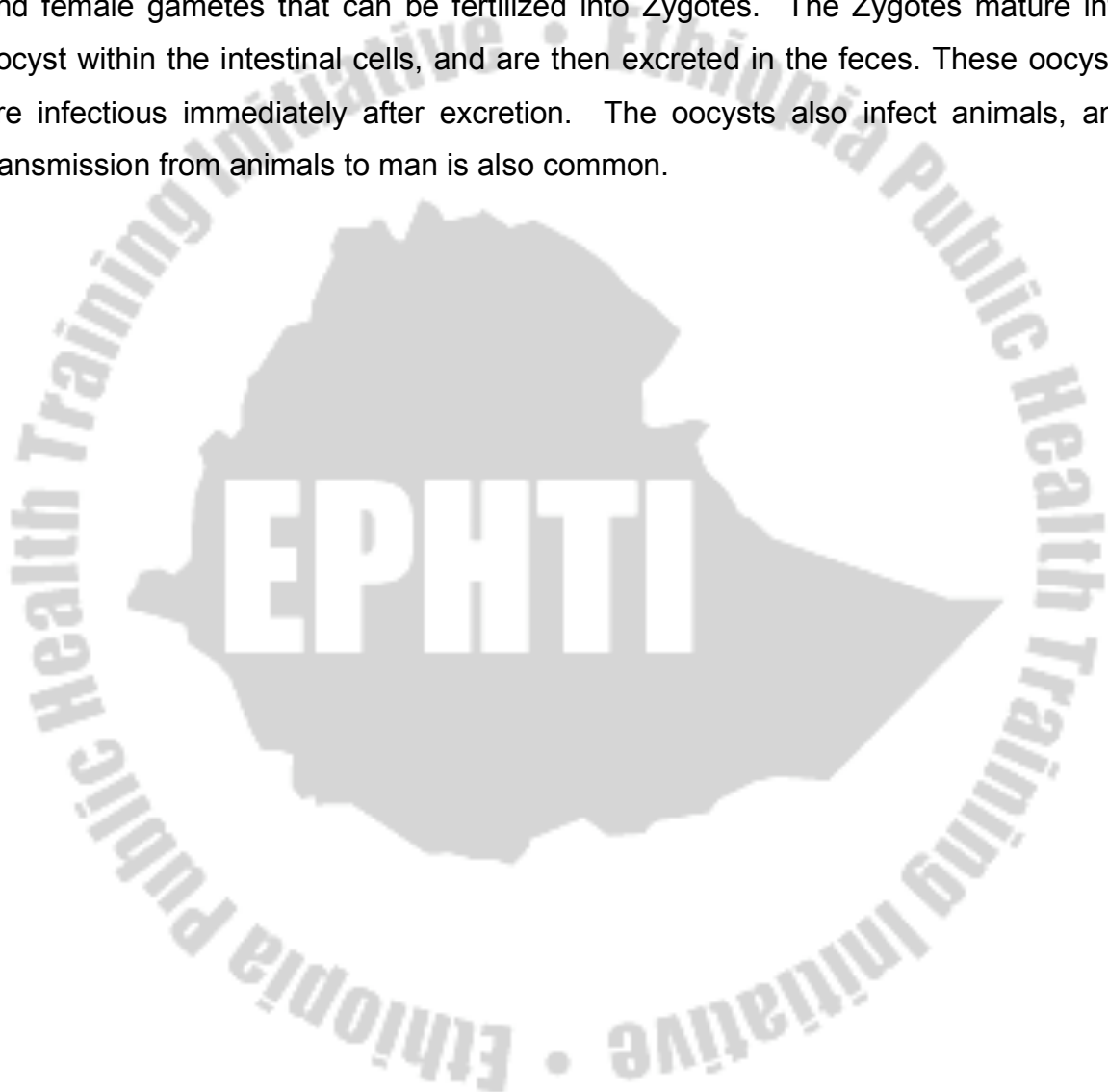
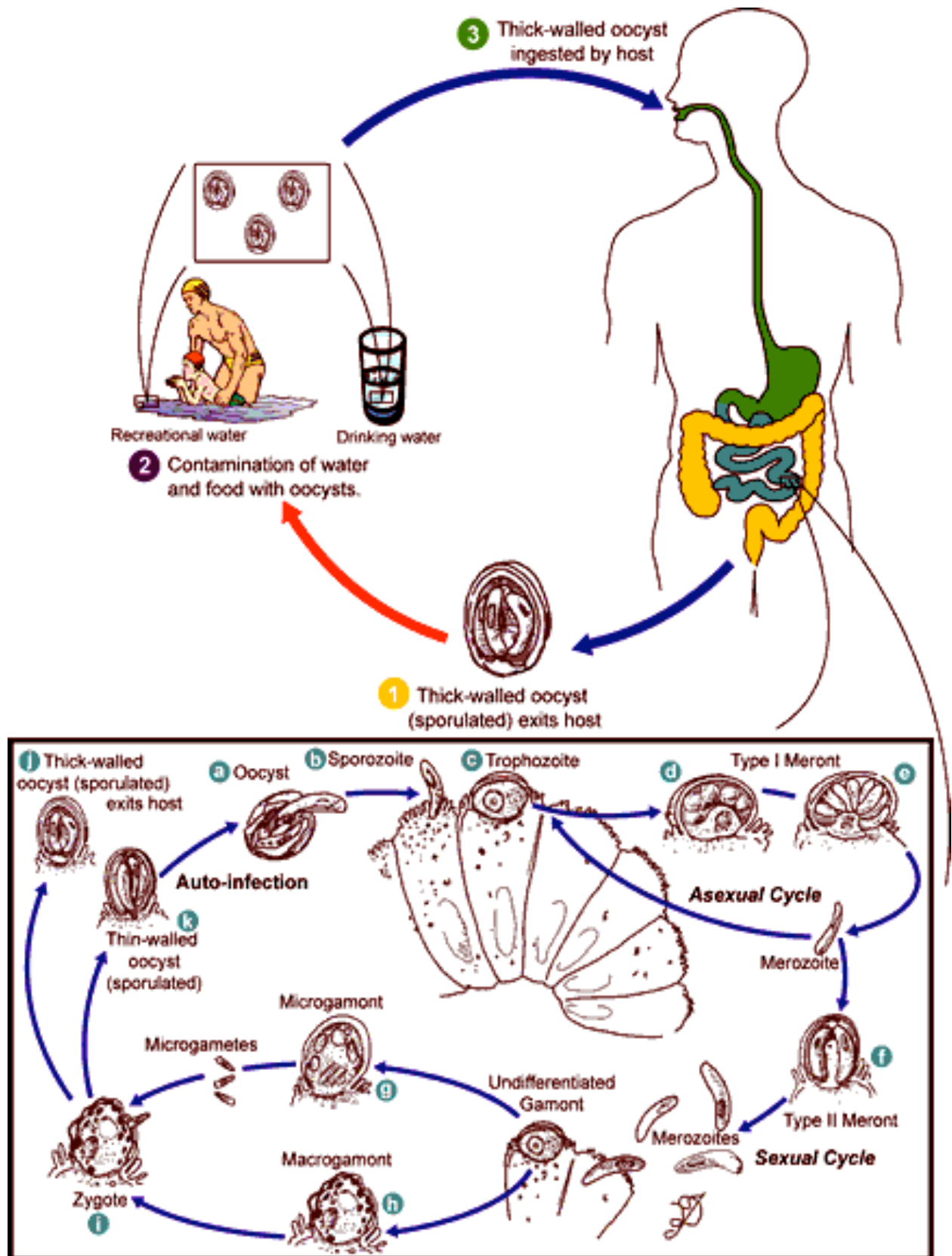


Figure IX: The life cycle of *Cryptosporidium parvum*



Source: CDC

## **Epidemiology**

Cryptosporidiosis has a world wide distribution. In developing countries its prevalence is significantly high. Infection is acquired by the fecal-oral route, and water borne transmission usually leads to larger outbreaks of the disease. Cryptosporidium is known to cause diarrheal diseases in immunocompetent people and shown to be especially common among persons with AIDS or other forms of immunodeficiency.

## **Clinical Features**

The illness is usually symptomatic, but self limited. Major symptoms such as acute or chronic profuse watery diarrhea and abdominal pain commonly occur in children under the age of five years and immunocompromized patients, especially those with HIV/AIDS. Frequent exposure is associated with development of immunity, and this reduces symptoms in infected individuals.

## **Diagnosis**

Microscopic Examination: Detection of oocysts in the stool using modified acid fast staining technique. Identification is enhanced by evaluation of multiple stool samples collected on several days.

## **Treatment**

At present no specific treatment. Paromomycin is found to be partially effective for some patients with HIV. Thus, it is the agent most commonly recommended for the treatment of cryptosporidium in HIV patients, in addition to adequate fluid & electrolyte replacement. However, HIV related cryptosporidiosis often improves following the initiation of antiretroviral treatment.

### **2.6.4. Isosporidiosis**

#### **Etiology**

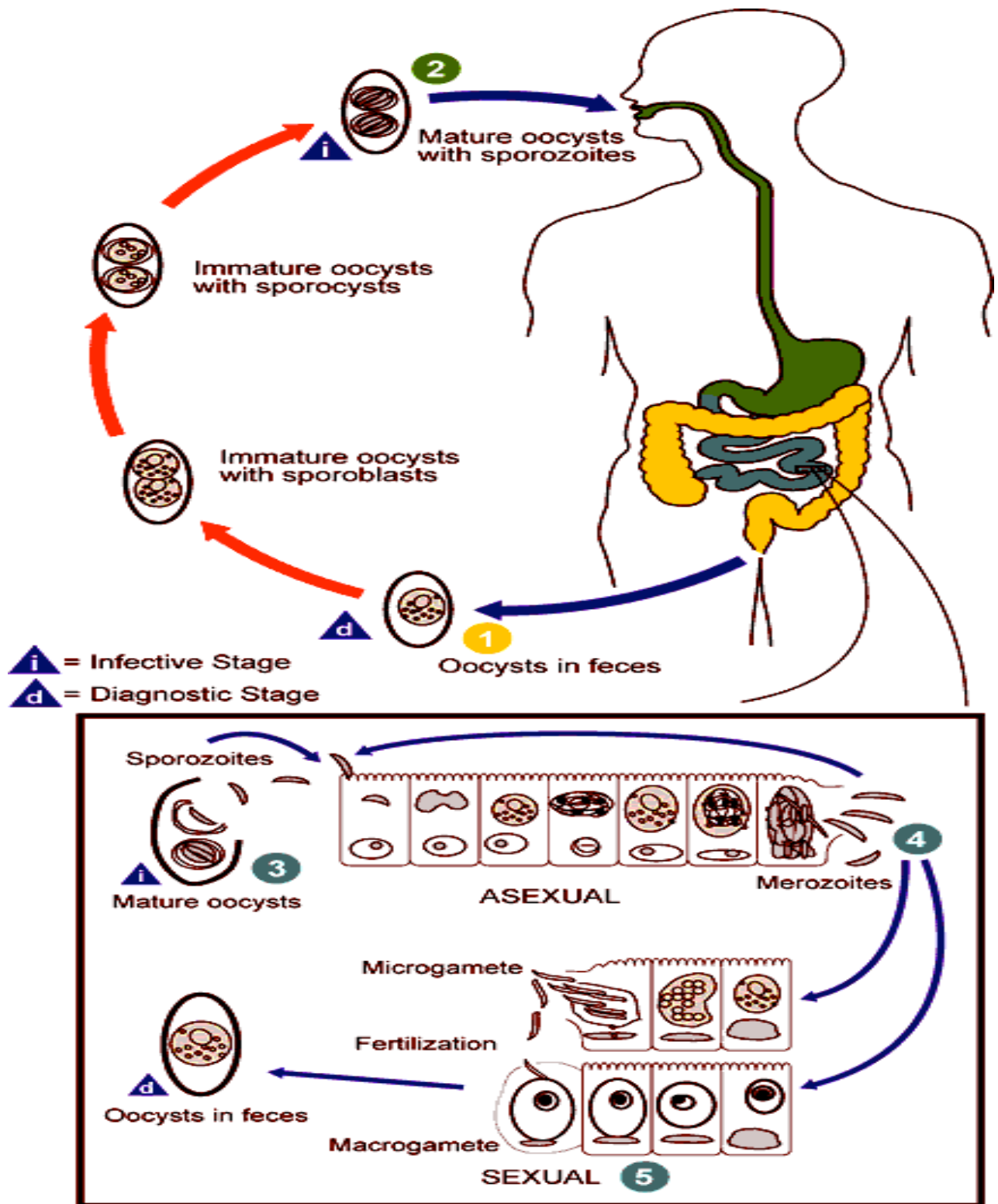
Isosporidiosis is a disease caused by Isospora belli, a strictly human parasite.

Pathogenesis and life cycle

The pathogenesis and life cycle of *Isospora belli* are similar to that of *Cryptosporidium parvum*, except that oocyst maturation occurs in the external environment after sporulation before it becomes infective.



Figure X: The life cycle of *Isospora belli*



Source: CDC



## **Epidemiology**

Isospora belli is widely distributed in the tropical and subtropical countries.

Infection is acquired by consumption of infective oocysts through fecal-oral route.

## **Clinical Features**

Acute infection begins abruptly with fever, abdominal pain and diarrhea. It is usually self limited, but its manifestations resemble that of cryptosporidiosis (with chronic, profuse diarrhea) in patients with immunodeficiency such as HIV/AIDS

## **Diagnosis**

Detection of oocysts in stool samples by modified acid fast staining is diagnostic.

## **Treatment**

Unlike cryptosporidiosis this disease responds well to drug treatment. Effective drugs include:-

1. Trimethoprim Sulphamethoxazole (TMP-SMX)  
Adult dose: 2 SS tabs QID for 10 days then bid for 3 weeks  
or
2. Pyrimethamine  
Adult dose: 50 – 75 mg/day for patients intolerant of sulfonamide

### **2.6.5. Prevention & control for intestinal protozoa infection**

1. Health education
2. Avoid eating uncooked fruit and vegetables
3. Adequate and safe water supply
4. Hand washing after defecation and before eating
5. Sanitary disposal of human excreta
6. Improvement of standard of living
7. Early case detection and treatment



## 2.7. Intestinal trematodes (flukes)

Trematodes are parasites which commonly infect human intestine, biliary tree, lung and venules of the genitourinary tract or intestine. Trematodes can be

- **Tissue (organ) dwelling trematodes** include species like *Fasciola hepatica* and *Fasciolopsis buski* that infect lung, intestine and biliary tree

- **Blood dwelling trematodes** include *Schistosoma* species that reside in venules

- Trematodes have three morphologic stages

- 1) The egg (ova) – the excretory stage
- 2) Larvae (*Miracidium*, *metacercariae*, *cercariae*)- the infective stage
- 3) Adult worms.

Among trematode diseases, intestinal schistosomiasis is the most common disease in Ethiopia and it is discussed below.

### 2.7.1. Schistosomiasis

#### Definition -

Schistosomiasis is a trematode disease caused by different species of *Schistosoma*.

#### Etiology

Four species of *Schistosoma* namely – *Schistosoma mansoni*, *S. japonicum*, *S. makongi* & *S. intercalatum* are responsible for intestinal schistosomiasis and *S. haematobium* for urinary schistosomiasis. In this country *S. mansoni* causes intestinal disease, while *S. hematobium* causes genitourinary schistosomiasis.

#### Pathogenesis

- Infection occurs during body contact with water contaminated with infective cercariae. A number of factors govern the disease manifestations. These factors include duration and intensity of infection, host genetics, concurrent infection, and location of egg deposition.

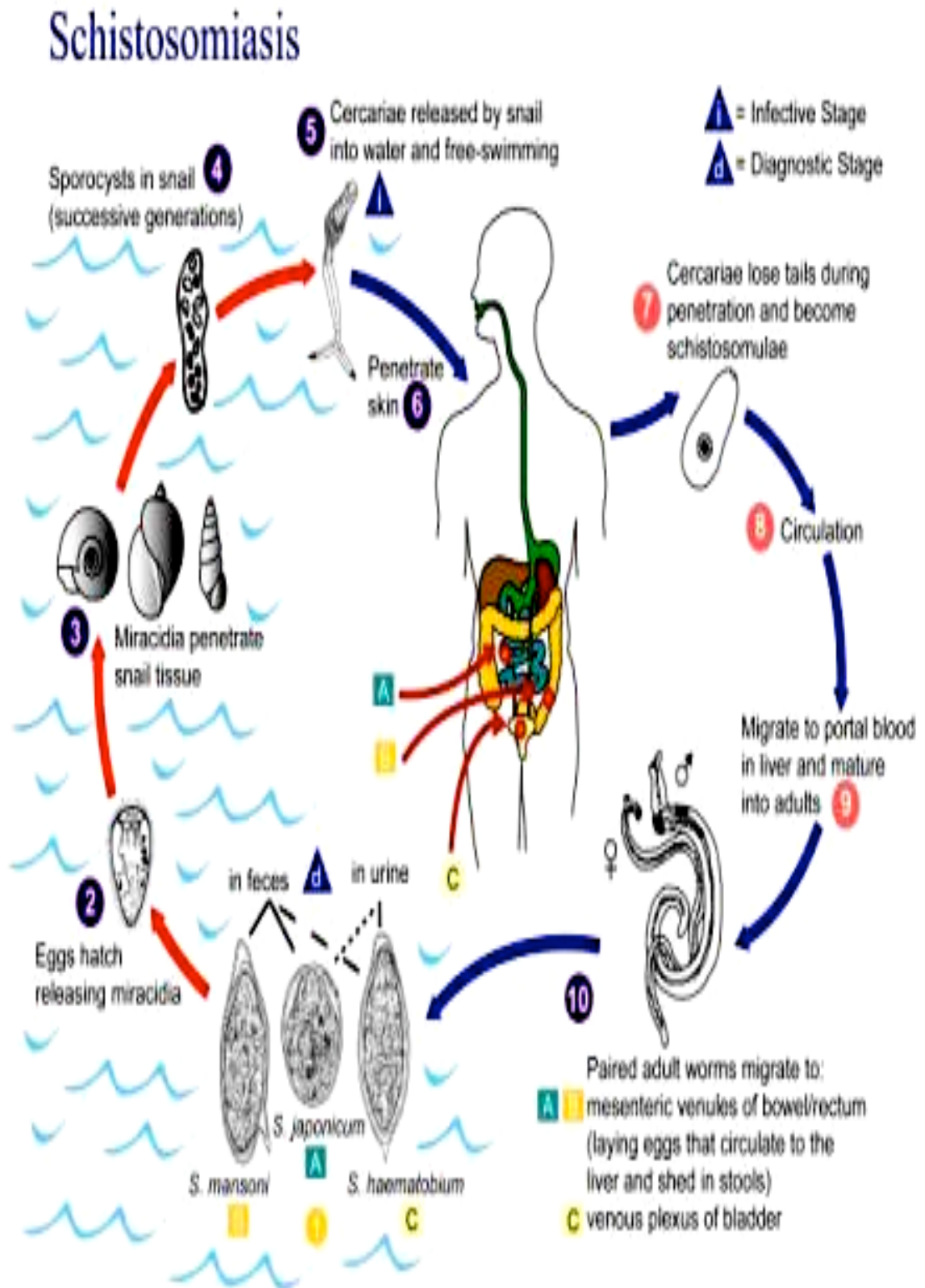
- Allergic reaction to the schistosomule or eggs is responsible for the acute manifestations, while inflammatory and fibrotic responses to eggs are responsible for chronic manifestations.

- Tissue reaction to retained eggs, which follows sensitization to egg antigens, is circumoval granuloma. It results from combined humeral and cell mediated attack on the egg, and it is characteristically composed of epitheloid, giant cells, lymphocytes

and eosinophils arranged in a concentric circle around the egg. The cellular components of granuloma diminish with time or disappear following chemotherapy.



Figure XI: Life cycle of schistosomiasis



Source: CDC

## **Epidemiology**

There are a number of reservoir hosts capable of carrying schistosoma species, especially in the case of *S. japonicum*. Snails are intermediate hosts in which the asexual stage (larval stage) develops. Snails are more likely found in stagnant than rapidly flowing water. The snail species are specific to each *Schistosoma* species i.e. *Biomphalaria* for *S. mansoni*, *Onchomelania* for *S. japonicum* and *Bulinus* for *S. hematobium*. *S. mansoni* is scattered in Africa, S.America, the Caribbean and parts of Arabia. *S. mansoni* and *S. hematobium* are the species endemic in Ethiopia. *S. mansoni* is reported from all regions with altitude between 1000 and 2000 meters but comparatively more prevalent in the northern areas like Tigray (Adwa), Wollo (Bati, Kemissie, and Dessie), Gojjam (Jiga, Bahir Dar), Jimma and Agaro. *S. hematobium* distribution on the other hand is limited to the low lands of Ethiopia with altitudes between 300 and 700 meters above sea level. Endemic areas include the swampy flood plains of the Awash and Wabe Shebele valleys and the intermittently flowing stream in Kurmuk, at the Ethio-Sudan border. Areas with irrigation projects have the highest risk of infection.

## **Clinical manifestation**

- Patients with schistosomiasis may have different clinical features based on host factors, site of infection (intestinal, urinary) parasite load and duration of infection.

The manifestations occur in 4 stages:

- Stage one (stage of invasion): Patients may have itching sensation at the site of skin penetration by cercariae (called swimmers' itch). It occurs in travelers to endemic areas and is rare in indigenous people
- Stage two (acute schistosomiasis): Patients may have diarrhea, abdominal cramp, tenesmus, fever and chills. .
- Stage three and four (Chronic or hepatosplenic schistosomiasis): Patients with *S. mansoni* may present with complications like periportal fibrosis with portal hypertension (causing abdominal swelling (ascites), splenomegaly, and upper GI bleeding from varices) intestinal stricture and polyps. Chronic manifestations of *S. hematobium* include obstructive uropathy from fleshy masses in the bladder (pseudopapillomas) with the resulting hydroureter & hydronephrosis and occasionally followed by uremia. Moreover, *S. hematobium* is known to cause

bladder calcification, genital involvement (urethral papillomatosis of men and boys and sterility of women) and cor-pulmonale.

### **Diagnosis**

- It is essential to have a high index of suspicion for patients coming from endemic areas.
- Confirmation of the diagnosis is by detection of ova using direct microscopic examination of stool or rectal biopsy specimen in the case of S. mansoni and urine sediment in S. hematobium. The egg of S. mansoni is characterized by lateral spine, while that of S. hematobium by a terminal spine.

### **Treatment**

Praziquantel is the drug of choice for both S. mansoni and S. hematobium. Additionally, Oxaminoquine is effective against S. mansoni and Metrifonate is effective for S. hematobium. All these drugs are safe and effective. Doses are given below:

S. mansoni

Praziquantel – 40 mg/kg as a single dose or in two divided doses given 4 hours apart

Oxaminoquine 15 mg/kg bid for two days

S. hematobium

Praziquantel – same dose as above

Metrifonate – 22.5 – 30 mg/kg divided into 3 doses and given weekly for 3 weeks

### **Prevention and control measures**

Environmental sanitation (avoidance of pollution of surface water)

- ▶ Provision of latrine and sanitary waste disposal
- ▶ Prevention of human contact with infected water
- ▶ Provision of safe and adequate water
- ▶ Protective clothing when contact is unavoidable
- ▶ Health education to reduce contact with infected water bodies

Elimination of the disease in the human reservoir by chemotherapy

- ▶ Case finding and treatment and mass (community) treatment in selected population

Snail control

- ▶ Physical control-alteration of habitat, e.g. Clearing aquatic vegetation, drainage of stagnant water sources etc
- ▶ Chemical control (molluscicides) niclosamide, Cuso<sub>4</sub>, Yurimin, Frescon, or “Endod “ (*phytholacca dedocandra*)
- ▶ Biological control - growing fish or other snails that feed on vector snails
- ▶ Community participation

## 2.8. Intestinal Cestodes

### General Description

Cestodes (tape worms) are segmented worms that cause disease in humans and other animals. T. saginata and H.nana are the two most important human cestodes in Ethiopia. Depending on whether human beings are the definitive or the intermediate host or both, cestodes can be grouped into three:-

- Man is the definitive host for Taenia saginata, Diphyllobothrium latum and Hymenolepis nana and the adult worms live in the human gut.
- Man is the intermediate host for Echinococcus granulosus and E. multilocularis and the larval stage of these cestodes is present in the human tissues.
- Man may be either definitive or intermediate host for Taenia solium, and this cestode can cause both intestinal and somatic infections in humans.

Since the module is intended to deal with intestinal parasitosis, the discussion focuses on those tape worms that cause intestinal infection.

### 2.8.1. Taeniasis

#### Definition:

A disease caused by Taenia species, namely Taenia saginata and T. solium.

Etiology and pathogenesis

Infestation by Taenia species requires one intermediate host where the embryo develops into an infective larval stage. Cattle and pigs are intermediate hosts for T.saginata and T.solium respectively.

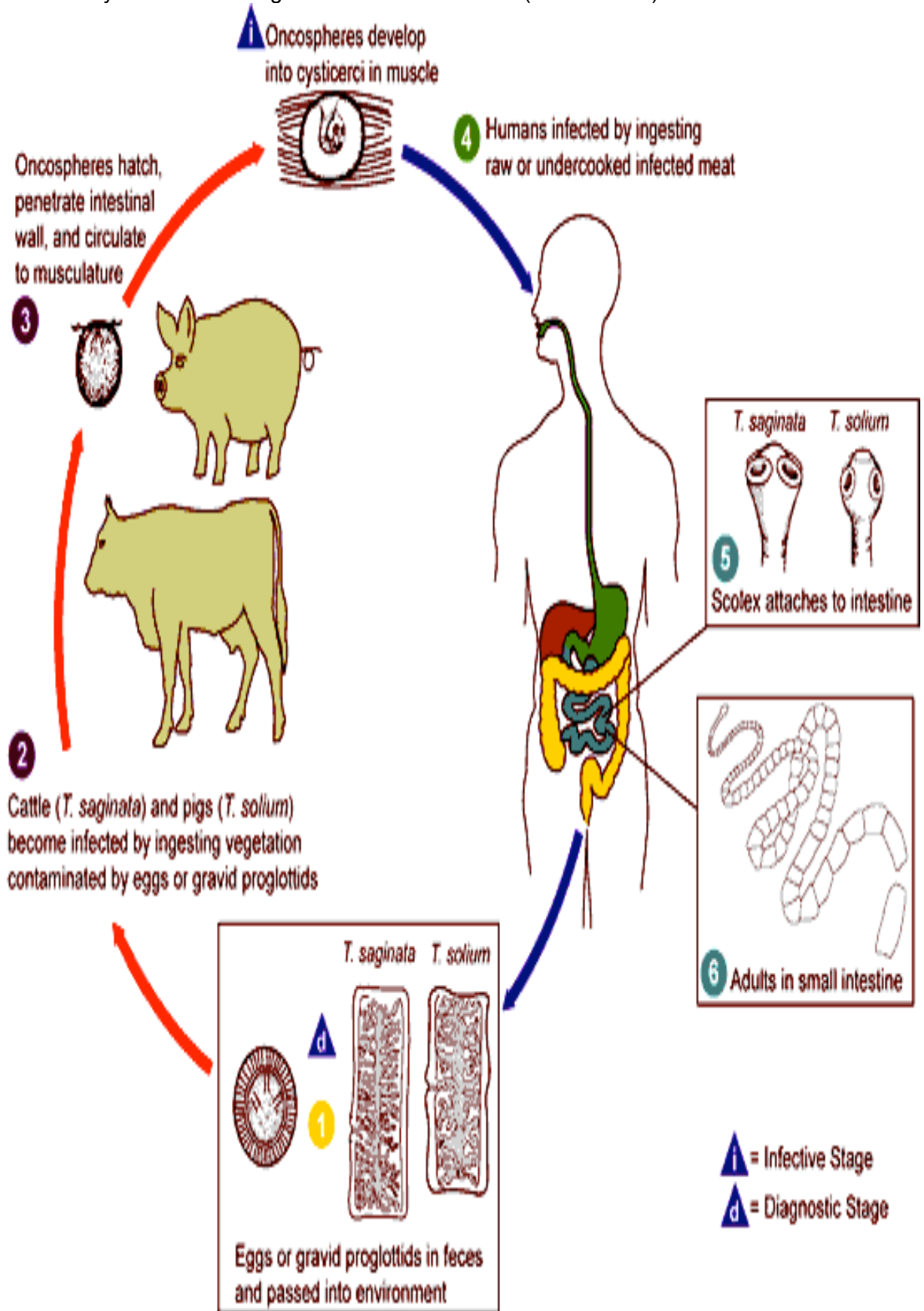
Adult worms of T.saginata can be 3 -10 meters long and T.solium up to 3 m long. Both species reside in the upper jejunum, attached to it with a scolex. A single Taenia may have as many as 1000 proglottids forming a chain structure or strobila. The gravid proglottids (egg-filled segments) migrate out of the anus or are

discharged in the feces by detaching from the adult tapeworm. Cattle (intermediate host for *T.saginata*) and pigs (intermediate host for *T. Solium*) become infected by ingesting eggs at pasture or in the case of pigs direct consumption of feces containing proglottids. The larval stage in cattle or pig muscle is known as a *cysticercus*. Humans become infected after eating uncooked or undercooked beef or pork containing cysticerci. After ingestion, the cysticerci attach to the intestinal mucosa and develop into adult worms.





Figure XII: Life cycle of *Taenia saginata* and *Taenia solium* (summarized)



Source: CDC



## **Epidemiology**

T.saginata occurs wherever raw or uncooked beef is eaten and there is sub-standard excreta disposal particularly in Ethiopia, the Eastern Mediterranean and parts of Russia. T.saginata infection is highly prevalent in Ethiopia due to the widespread custom of eating raw beef and the habit of defecating in the open grazing fields. Taenia infections in Ethiopia are underreported missing many infections owing to the tradition of self treatment using modern or traditional plant medicines such as Kosso (*Hagenia abyssinica*), enkoko (*Embelia shimperi*) or metere (*Glinus lotoides*). T.saginata accounted for 3% of the outpatient visits in Zeway Health center, 3.7% of the 246 hospital inpatients in Addis, 2.5% of the residents of a small town in highland Gojjam, 1% of the population near Lake Tana and 28% of elementary school students in a town of Asendabo, in Jimma Zone. T. solium on the other hand is endemic in many parts of the world where pork or pork products are eaten, but its existence in Ethiopia is uncertain. (3)

Taeniasis is highly associated with poor sanitary condition in general and inappropriate human excreta disposal in particular. There is no direct person to person transmission of the infections, except in T.solium where human infection occurs by ingesting viable eggs in infected food or from contaminated fingers and result in cysticercoids (somatic infection), sometimes with neurologic involvement, and neurocysticercosis is a common cause of epilepsy.

## **Clinical manifestation**

Human intestinal tapeworm infections are usually asymptomatic although it may result in mild to moderate abdominal symptoms, such as vague abdominal pain or discomfort, change of appetite, vomiting or diarrhea. Additionally, the person may notice motile proglottids in the perianal area or observe them during the passage of stool.

**Diagnosis** depends on:-

1. Identification of proglottid segments recovered from patient's cloths or passed in feces
2. Detection of eggs in feces using direct microscopic examination. The eggs are rarely seen on direct microscopic examination of the stool. Thus, repeated stool examination and concentration techniques are recommended.

## Treatment

1. Praziquantel is the drug of choice for the treatment of Taenia. A single dose of praziquantel 10 mg/kg body weight is effective.
2. If praziquantel is not available niclosamide can be substituted. Adult dose: Niclosamide 2 gm given orally in two divided doses 1 hour apart.

### 2.8.2. Hymenolepiasis nana

#### Etiology and pathogenesis

*Hymenolepis nana* (*dwarf tapeworm*) is a common human parasite and the smallest tapeworm known to infect humans. Transmission is by ingesting eggs in food or drink or from contaminated hands. The eggs are infective by the time they are passed in feces. Internal autoinfection also occurs.

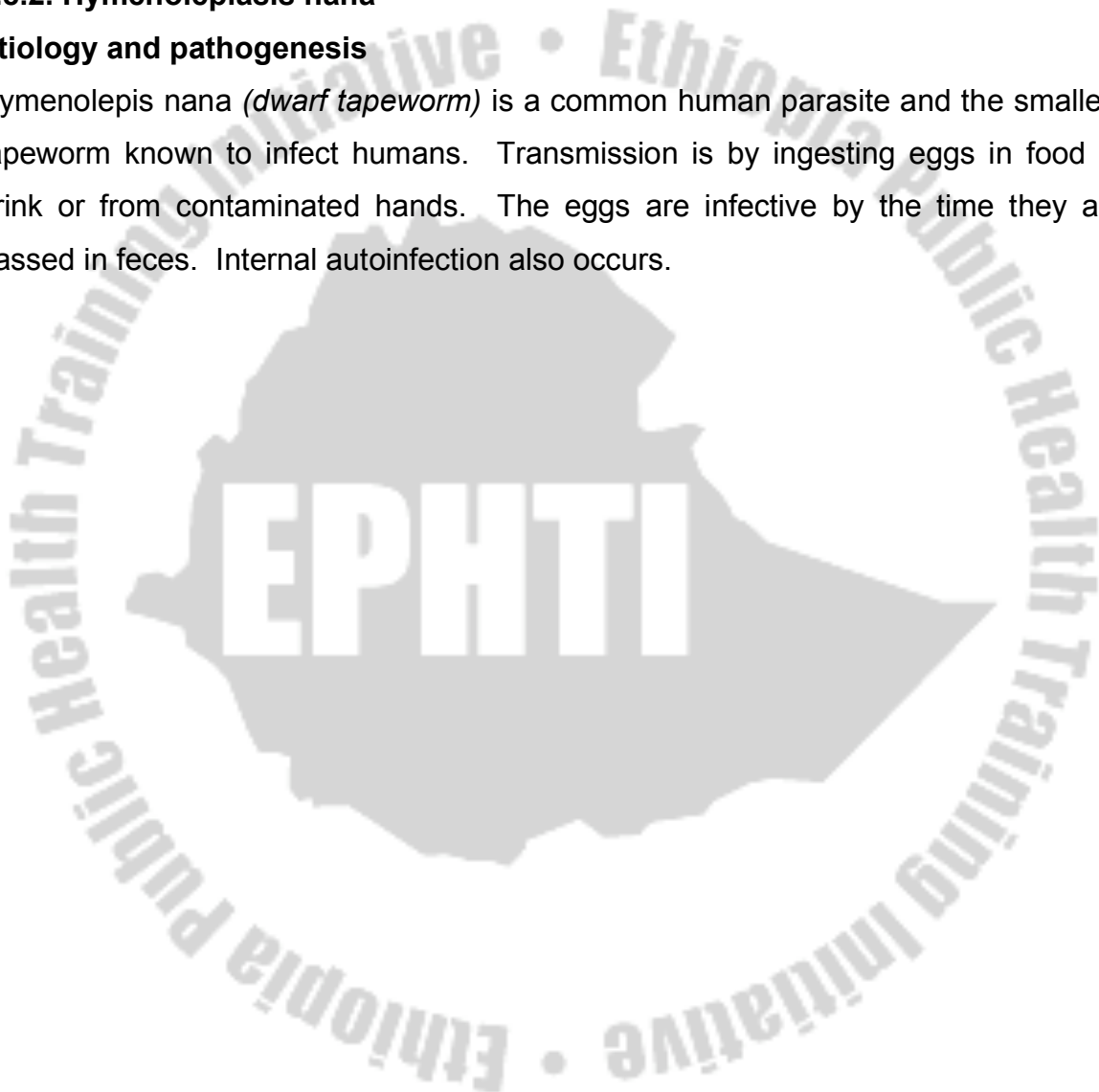
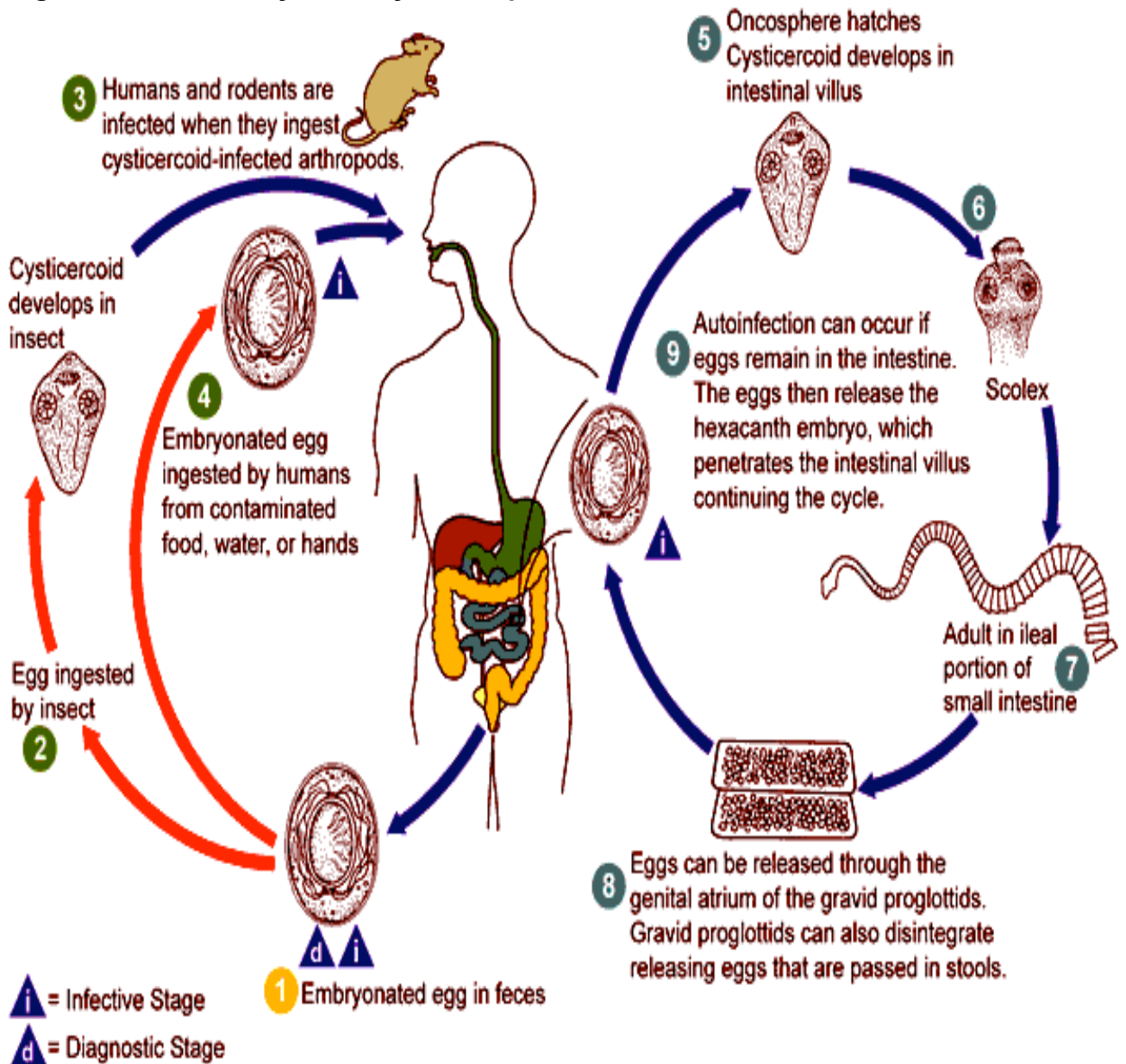


Figure XIII: The life cycle of *Hymenolopis nana*



Source: CDC

**Epidemiology:** - *Hymenolepis nana* is widely distributed in countries with warm climates including those of Africa, South America, Mediterranean Region, and South East Asia. The disease is common in Ethiopia. The highest recorded prevalence (61%) was reported for school children in Kemise in south Wollo. Among students in 50 communities in central and northern highlands of Ethiopia, 78% had positive cases with a mean prevalence of 12 % (3). Children are more commonly infected than adults. Susceptibility to intestinal tapeworm infection is universal. However, *Hymenolepis nana* infection is more common among institutionalized children. Disseminated infection with *H.nana* occurs in immune deficient and malnourished children. No apparent resistance follows most intestinal tapeworm infections.

**Clinical Features:** Although many worms can be found in a host due to internal autoinfection, symptoms are rarely serious except in children and include:

- Worms may cause abdominal pain and diarrhea
- Toxins released from the worms can cause allergic reactions
- Severe and sometimes disseminated infections can occur in malnourished or immunosuppressed persons.

**Diagnosis:** Detection of eggs of the parasite in feces by direct microscopic examination is diagnostic

**Treatment**

- Niclosamide
  - Adult dose: 2 gm/d for 5 days
  - Children - under 2 years: 500 mg/day for 5 days
  - 2 – 8 years: 1 gm/day for 5 days
  - Over 8 years 1.5 gm/day for 5 days

- Praziquantel 25 mg/kg once

**Prevention and Control measures for intestinal cestodes**

- Educate the public to prevent contamination of soil, animals and human foods
- Inspecting meats and discarding those containing cysticerci.
- Heating the meat (at 56 °C) or freezing at (8 to 15 °C )
- Early case detection and treatment.
- Promote sanitary disposal of human excreta and avoid using untreated human feces for fertilization

## 2.9. Post-test

**Instruction** - choose the correct answer and write on your answer sheet

1. Which of the following is an intestinal protozoa?
  - a) Entamoeba histolytica
  - b) Ascaris lumbricoides
  - c) Hymenolepis nana
  - d) Schistosoma mansoni
  
2. What is the most common route of transmission for intestinal protozoa?
  - a) Ingestion of cyst with contaminated food
  - b) Insect bite
  - c) Eating raw meat
  - d) Skin penetration
  
3. Which of the following methods doesn't help for prevention & control of intestinal protozoa?
  - a) Safe water supply
  - b) Health education
  - c) Proper disposal of human excreta
  - d) Mass screening & treatment
  
4. Among intestinal protozoa, which one is commonly found in HIV/AIDS patients?
  - a) Cryptosporidium parvum
  - b) Giardia intestinalis (=lamblia)
  - c) Entamoeba histolytica
  - d) None of the above
  
5. The infective stage of Giardia intestinalis is
  - a) Cyst
  - b) Trophozoite
  - c) Both
  - d) None of the above

6. Which of the following disease (s) is/are caused by nematodes entering the host through skin penetration?

- a) Enterobiasis
- b) Strongyloidiasis
- c) Hook worm infection
- d) a and b
- e) b and c

7. Which of the following intestinal nematodes are capable of autoinfection?

- a) *S. stercoralis*
- b) *T. trichuira*
- c) *E. vermicularis*
- d) a and c
- e) All of the above

8. Which of the following common nematode infections has worldwide distribution?

- a) Enterobiasis
- b) Ascariasis
- c) Trichuriasis
- d) Hook worm Infection

9. Which of the following nematode infections can be diagnosed by the recovery of larvae from fresh stool?

- a) Ascariasis
- b) Trichuriasis
- c) Strongyloidiasis
- d) Enterobiasis

10. Which of the following combinations are the best preventive methods for all intestinal nematodes?

- a) Good personal hygiene and proper excreta disposal
- b) Chlorination of domestic water
- c) Using night soil as fertilizer and wearing shoes
- d) None of the above

11. Which of the following trematodes are epidemiologically important in Ethiopia?
- a. *S. mansoni*
  - b) *S. hematobium*
  - c. *S. japonicum*
  - d) a and b
12. Schistosomiasis is transmitted by
- a) Ingestion of uncooked cray fish
  - b) Contact with snail during swimming
  - c) Skin penetration by cercariae during swimming
  - d) Drinking unboiled water containing *Schistosoma* eggs
13. Which of the following symptoms may characterize acute schistosomiasis?
- a) Diarrhea
  - b) abdominal cramps
  - c) Tenesmus
  - d) all
14. Unique characteristic of *S. mansoni* egg on microscopic examination is the presence of
- a) Lateral spine
  - b) terminal spine
  - c) Operculum
  - d) rudimentary spine
15. Which of the following methods are effective for the prevention of schistosomiasis?
- a) Proper disposal of human waste
  - b) Snail eradication
  - c) Boiling drinking water
  - d) a and b
  - e) All
16. The following cestodes are transmitted by eating raw meat or fish except
- a) *Taenia saginata*
  - b) *Taenia solium*
  - c) *Hymenolepis nana*
  - d) *Diphyllobothrium latum*
17. Which of the following cestodes are more common in our country?
- a) *Taenia solium*



- b) Taenia saginata
- c) Hymenolepis nana
- d) D. latum
- e) b and c

18. All of the following are features of cestode infections except:

- a) Cough
- b) Abdominal cramp
- c) Diarrhea
- d) Anorexia

19. Which of the following drugs can effectively treat tapeworm infection?

- a) Piperazine
- b) Niclosamide
- c) Mebendazole
- d) Metronidazole
- e) b and c

20. Which of the following is not the appropriate preventive or control measure for tapeworm infection?

- a) Cooking meat above 56 °C
- b) Practicing personal hygiene
- c) Encouraging use of excreta for soil fertilization
- d) Freezing meat at 10 °C for 24 - 48 hrs



## 2.10. Keys to pretest & post test

1. a
2. a
3. d
4. a
5. a
6. e
7. d
8. b
9. c
10. a
11. d
12. c
13. d
14. a
15. d
16. c
17. e
18. a
19. e
20. c

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1. Harrison principles of internal medicine, 14<sup>th</sup> Ed
2. G.V.Gill and N.J.Beeching: lecture note on tropical medicine, 5<sup>th</sup> Ed, pp153
3. Birhane Y.et al, Epidemiology and Ecology of Health and Disease, 1<sup>st</sup> Ed, pp 521
4. British National Formulary, 2006

# **PART THREE**

## **SATELLITE MODULE ON INTESTINAL PARASITOSIS FOR HEALTH OFFICER STUDENTS**

### **3.1. Introduction**

Health officers are mid-level health workers who are closely involved in health promotion, disease prevention and treatment. Therefore, it is necessary for this group of health workers to acquire adequate knowledge of prevention and management of intestinal infections. They are supposed to be equipped with sufficient skill on diagnosis, treatment and the design of preventive and control measures for intestinal parasitosis. This satellite module is thus designed for the health officers, focusing on major areas of diagnosis, treatment, preventive & control methods.

#### **3.1.1. Purpose of the Module**

This satellite module is prepared for health officer students. It gives more emphasis to those areas that were not covered in detail by the core module.

#### **3.1.2. Instructions for use of this module**

- After completion of the core module attempt to answer pretest questions under section 3.3 and write the answers on a piece of paper.
- Go through the rest of this satellite module
- Refer to the core module whenever necessary
- Answer post test questions
- Finally compare the results of the pretest and posttest questions with the keys given.

### **3.2. Learning objectives**

After going through this satellite module the student will be able to:

- Discuss the clinical features of each intestinal parasite.
- Explain the treatment of choice and the alternatives for each intestinal parasite.
- Describe the prevention and control measures for common intestinal parasites.

### **3.3. Pretest questions**

1. Which of the protozoan infections are highly associated with HIV/AIDS?
2. Compare amoebic and bacillary dysentery
3. Write the case management of strongyloidiasis
4. What are the possible presentations of ascariasis?
5. List the common cestodes causing human infections and describe their routes of transmission
6. List preventive and control measures for schistosomiasis

### **3.4. Intestinal protozoa infections**

#### **3.4.1. Amoebiasis**

Definition: see core module

Etiology: see core module

Epidemiology: see core module

#### **Clinical features**

About 90% of infections are asymptomatic and the remaining 10% produce a spectrum of clinical syndromes ranging from dysentery to abscess of liver and other organs that depends on two major factors:

- The location (s) of the parasite in the host
- The extent of tissue invasion.

#### **3.4.1.1 Intestinal amoebiasis**

The clinical spectrum depends on the time course of the disease, the age and susceptibility of the host and probably differences in the degree of virulence of amoeba strains.

### **a) Asymptomatic carriers**

In endemic areas up to 90% of intestinal infections are in the form of asymptomatic carriers. In general, they pass small numbers of cyst in their feces. Cyst excretion could be transient, intermittent or may persist for several months.

Factors responsible for asymptomatic carrier states include

1. Low virulence of parasite strain
2. Low inoculum size
3. intact immunity of the patient

### **b) Symptomatic intestinal amebiasis**

Presentations include acute recto-colitis, fulminant necrotizing colitis (toxic mega colon) amoeboma, amebic appendicitis and painless rectal bleeding.

#### **I - Acute recto-colitis:**

Usually present as non-toxic dysenteric syndrome. Constitutional symptoms are not prominent. The onset is gradual. Only 40% of patients have mild low-grade fever.

Patients will have intense abdominal pain; initially pass loose watery stool which later becomes bloody and mucoid associated with tenesmus. When a higher segment of the colon is involved the diarrhea may be non-bloody.

Children usually have fever  $> 38^{\circ}\text{C}$ , anorexia, irritability, vomiting, severe abdominal pain and dehydration. Secondary bacterial infection may occur on top of the classic flask-shaped amebic ulcer.

#### **II- Fulminant necrotizing colitis**

Severe, life-threatening and rapidly progressive presentation is more common in malnourished children, immuno compromised, in the elderly and patients taking steroids.

Frequent (over 20 times in 24hrs), bloody, foul smelling diarrhea, generalized abdominal pain, and intense rectal tenesmus, fever  $> 40^{\circ}\text{C}$  with nausea and vomiting may occur. The patient is usually very sick and dehydrated with hypotension and prostration. Profuse rectal bleeding may occur.

Since patients with bacillary infections of the intestine also present with dysentery, it is important to know the main features of each to make a clear distinction between the two, as presented below.

### Comparisons of amebic & bacillary dysenteries

<u>Parameter</u>	<u>Amebic</u>	<u>Bacillary</u>
Onset	Gradual	Sudden
Clinical appearance	usually non-toxic in adults toxic in infants & children	often toxic
Dehydration	Common – children	Common in both
Tenesmus	Severe	moderate
Hepatomegaly	Common	Uncommon
Stool	Blood & mucus, may be semi formed	Blood & mucus, usually liquid
Fecal leukocytes	Uncommon	common
Colonic ulceration	Usually segmental	Diffuse

### III. Amoeboma

Amoeboma is a localized thickening of the intestinal wall accompanied by a thin and ulcerative mucosa. It occurs in 0.5 - 1.5% of patients with invasive amoebiasis of the colon, most often in the caecum and ascending colon.

Patients present with tender palpable abdominal or rectal mass and rarely as intestinal obstruction.

#### Differential diagnosis

- Carcinoma of colon,
- Chronic idiopathic inflammatory disease like Crohn's disease
- Colonic tuberculosis.

#### Diagnosis

- Barium enema
- Biopsy
- Serology

### **3.4.1.2 Extraintestinal amoebiasis**

Trophozoites of *E.histolytica* migrate in the circulation and can reside in the liver. It can also migrate to and infect other organs such as lung, pericardium, spleen and brain. Rarely invasive amoebiasis can affect vulva, vagina, cervix and penis in a patient having anal sex.

#### **Amoebic Liver abscess**

Amoebic Liver abscess is the most common extra intestinal Amoebiasis. It occurs in all age groups, but is ten times more common in adults. Males are predominantly affected, with the male-to-female ratio of about 3:1 to 6:1 but the reason is unclear. Although liver abscess is caused by translocation of amoeba from the intestinal lumen, patients seldom have amoebic recto-colitis (9%) and amoebae are found in the stools of only 22% of cases. Liver abscesses involve the right lobe in 83% of the cases, mostly in the posterior, external and superior positions.

#### **Clinical features**

Abrupt onset of high grade fever, rigors, night sweating, right upper quadrant abdominal pain which is intense and constant, radiating to the right scapula and shoulder, aggravated by deep breathing, coughing and resting on right side.

If the abscess is on the left lobe patients may have epigastric tenderness and pain radiating to the left shoulder. There is anorexia, rapid weight loss and in about 30% of the cases dry cough, nausea, diarrhea and vomiting occur.

Physical examination reveals wasted patient with pale conjunctivae, tender enlarged liver and shallow breathing. In about 30% of cases moderate jaundice may occur.

In a third of patients, especially elderly, it may present with mild, chronic, nonspecific febrile illness and weight loss, in which case it can be wrongly diagnosed as fever of unknown origin.

#### **Differential diagnosis**

##### **I. Pyogenic liver abscess:**

It is more common in the elderly with a history of hepatobiliary disease, abdominal sepsis, appendicitis, diverticulitis or abdominal surgery.

It is more likely to present with fever, jaundice, pruritis and septic shock.

Amoebic serology is negative,

Hepatomegally and elevated diaphragm on chest x-ray are uncommon.  
In this case aspiration for microscopy or culture is indicated.

## **II. Liver neoplasm:**

Febrile and wasted patient with vague abdominal discomfort.  
Patient may have palpable liver mass, rarely with bruit.

### **Complications of amoebic liver abscess**

- Thoracic complications: -non-purulent pleural effusion commonly caused by leakage through diaphragmatic holes, rupture of liver abscess into bronchi can be accompanied by cough and expectoration of “Anchovy sauce” like sputum.
- Rupture of liver abscess into the abdominal cavity presents with signs of generalized peritonitis.
- Occasionally rupture may occur into the gallbladder, stomach, duodenum, colon or inferior vena cava.
- Rarely secondary bacterial infection of amoebic liver abscess can be suspected when patient becomes severely toxic with little response to anti amoebic treatment.

## **Diagnosis**

### **I. Intestinal amoebiasis**

- Direct Microscopy: to identify motile trophozoites with ingested RBC or cysts, in stool samples or scrapings of affected mucosa
  - False positive – White blood cells, parasites such as *E. hartmanni* and fecal debris may be confused.
  - False negative- in one third of cases
- Rectosigmoidoscopy and colonoscopy to visualize ulcers
- Serology

### **II. Amoebic liver abscess**

- WBC -  $>15,000/\text{mm}^3$  in 25%, leukemoid reaction in 5% of cases
- Liver function test – elevated alkaline phosphatase
- Chest X-ray - elevated right half of the diaphragm
- Ultrasound: space-occupying lesion detected in 75 - 95%



- Serology - reaches peak by the second or third month.
- Stool microscopy - little value.

## PROGNOSIS

- Good response to appropriate chemotherapy
- True relapses are uncommon
- Fulminant colitis - 55% of cases survive
- Amebic appendicitis – has a mortality rate of 20 %
- Amoeboma - Good prognosis, mortality rate is 16% if intestinal perforation occurs or if operation is done with incorrect diagnosis.
- Invasive amebiasis - occasionally gives fibrous intestinal stricture or chronic amebic colitis.
- Amebic liver abscess - has a mortality rate of 2% in centers with good facilities.

## TREATMENT

Amoebicides are classified into two based on the site of their action

- I. Luminal amoebicides - poorly absorbed and reach high concentration in the intestinal lumen
  - II. Tissue amoebicides - reach high concentration in the blood and tissue after administration.
- Treatment of asymptomatic cyst passers - controversial because of difficulty to differentiate pathogenic from non-pathogenic strains
  - For symptomatic cyst passers give luminal amoebicides such as:
    - Diloxanide furoate :
      - Adult- 500 mg po TID for 10 days
      - Child- 20 – 25 mg/kg daily in 3 divided doses for 10 days
    - Iodoquinol 650 mg po TID for 20 days
    - Paromomycin 50 mg/kg/d to maximum of 500 mg po TID for 7 days.
  - Invasive intestinal amoebiasis: Tissue amoebicides such as nitroimidazoles (Metronidazole or Tinidazole) are the cornerstones of management. It should be combined with luminal amoebicides
    - Metronidazole
      - Adult- 750 mg po TID for 10 days
      - Child- 15 mg/kg every 8 hours maximum of 750 mg po TID for 10 days



- Tinidazole

Adult- 1gm po BID for 3 days

Child-50 mg/kg maximum of 2 gm daily for 3 days

Tinidazole may be preferred because of short duration of treatment, fewer side effects, and equal efficacy with metronidazole.

- Perforated amebic colitis- more conservative approach by using IV antibiotics against enteric bacteria + Metronidazole
- Toxic mega colon and amebic appendicitis: Surgery + amoebicide
- Colonic amoeboma: treat with amoebicide alone
- Amoebic liver abscess

Metronidazole - 750 mg orally or intravenous tid for 10 days OR

Tinidazole 2gm/d, orally for 3 – 5 days with luminal agents

Indications for percutaneous drainage of amebic liver abscess are:

- Imminent rupture of large liver abscess.
- As complementary therapy, when drug response is slow (if no clinical response in 3-5 days)
- When pyogenic or mixed infection is suspected
- In case of false negative serology

Indications of surgical drainage are

- Rupture of liver abscess
- Imminent rupture of inaccessible liver abscess, for example, in the left lobe.
- Risk of peritoneal spillage after aspiration.

Prevention and control: See core module

### 3.4.2. Giardiasis

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

### Clinical features

**G. intestinalis** is known to be the only pathogenic intestinal flagella. Infections may be aborted, transient, recurrent or chronic.

**1. Asymptomatic /carrier state:** - more common

**2. Symptomatic:** - clinical features range from mild abdominal complaints to steatorrhoea, and malabsorption syndrome in which the diarrhea is watery, foul smelling usually non-bloody. Severe cases may present with light-colored stools with a high fat content, fat soluble vitamins deficiency, folic acid deficiency, hypoproteinemia, hypogamaglobulinemia and structural change of intestinal villi may be observed. In general giardiasis is self-limiting within 10 - 14 days; however relapses may occur particularly in those with intestinal diverticula and IgA deficiency.

**Diagnosis:** see core module

#### **Treatment**

1. Drugs of choice:

Metronidazole:

Adults – 250 – 500 mg po tid for 5 - 7 days

Children – 30 mg/kg in 3 divided doses for 5 - 7days

For refractory cases metronidazole 750 mg po tid for 03 weeks is used, after evaluation for reinfection of family members, environmental sanitation and hypogamaglobulinemia.

Tinidazole:

Adults – 2 gm po single dose

Children – 50 mg/kg maximum of 2 gm po single dose

2. Alternatives:

- Furazolidone 100 mg four times a day for 7 - 10 days
- Paromomycin 50 mg/kg to maximum of 500 mg po tid for 7 days is safe to use for symptomatic pregnant mothers.

Treatment of family members may be indicated to prevent reinfection.

Prevention and control: see core module

### **3.4.3. Cryptosporidiosis**

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

### **Clinical features**

The symptoms of the disease usually appear after an incubation period of 7 - 10 days and include watery diarrhea and abdominal pain. The illness is usually self-limiting within 1-2 weeks, but in immunocompromized patients especially those with HIV/AIDS the illness can be devastating with persistent, profuse (1 to 25 L/day) diarrhea, substantial weight loss, significant fluid and electrolyte depletion. It can also affect biliary tree, leading to a calculus, cholecystitis or sclerosing cholangitis.

**Diagnosis:** see core module

### **Treatment**

In immune competent patients no specific chemotherapy is required as it is usually self limited.

Supportive care: fluid and electrolyte replacement, anti-diarrheal agents.

In AIDS patients:

Restore immunity with HAART

If ART fails to stop diarrhea try with antidiarrheal agent as loperamide 4 mg po at initial then 2 mg at each diarrheal episode to a maximum of 16 mg daily with

- Paromomycin 50 mg/kg to maximum of 1.0 gm/d with azithromycin 10 mg/kg to maximum of 500 mg po daily OR
- Nitazoxanide 0.5- 1.0 g po BID

#### **3.4.4. Isosporidiosis**

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Diagnosis: see core module

### **Treatment**

1. Drug of choice:

Trimethoprim sulphamethoxazole (TMP-SMX): - 4/20 mg/kg to maximum of 160/800mg po QID for 10 days then BID for 03 weeks.

2. Alternative: for those patients not tolerating sulfonamides.

Pyrimethamine: - 50-75 mg orally daily for 10 days.

Ciprofloxacin 500 mg po BID for 7 days. It is not recommended in children

**Chemoprophylaxis** is necessary in AIDS patients to prevent relapses

- TMP-SMX 160/800 mg one to three times /week OR
- Sulfadoxine 500 mg and pyrimethamine 25 mg combination once a week.

### 3.4.5. Cyclosporiasis

*Cyclospora cayentanensis* potentially has a worldwide distribution.

Water borne transmission is recognized as one means of transmission.

#### Clinical features

Incubation period is 2 to 11days followed by acute onset of diarrhea, abdominal cramp, flu like symptoms, flatulence and burping. It can remit and relapse.

In some instances patients can have prolonged diarrhea, anorexia, nausea, vomiting, sustained fatigue and weight loss. It may be protracted in HIV patients.

Diagnosis: see core module

#### Treatment

TMP-SMX: 4/20 mg/kg to maximum of 160/800 mg orally twice a day for 7 days.

### 3.4.6. Microsporidiosis

Microsporidia is an obligate intracellular spore forming protozoa, which are members of distinct phylum with many genera and species.

*Enterocytozoon bienensi* & *Encephalitozoon intestinalis* are recognized to cause chronic diarrhea & wasting in AIDS patients but are rare in immuno competent hosts.

**Diagnosis:** see core module

#### Treatment

Albendazole 400 mg po BID for 3 weeks

## 3.5. Intestinal nematodes

### 3.5.1. Ascariasis

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Diagnosis: see core module

### **Clinical features**

- Most infections are asymptomatic but, abdominal pain, nausea, vomiting or diarrhea are the common presentations in symptomatic patients.
- Occasionally spontaneous worm passage via anus, mouth or nose
- Eosinophilic pneumonitis occurs during the lung phase after 9 –12 days of egg ingestion manifesting with dry cough, chest pain, fever, wheeze and crackles. Sometimes dyspnea, hemoptysis and urticaria occur.
- Life- threatening conditions:
  - Small bowel obstruction by bolus of entangled worms
  - Migration to ectopic sites can lead to biliary colic, cholecystitis, cholangitis, pancreatitis, appendicitis and intra hepatic abscess.
- Heavy infestation will compete for nourishment & contribute to malnutrition.

### **Treatment**

1. Drug of choice: Benzimidazoles:

- Mebendazole

Adult, child >10 kg – 100 mg po BID for 3 days

Child <10kg – 50 mg po BID for 3 days

- Albendazole

Adult, child >10 kg- 400 mg po single dose before food

Child <10 kg-200 mg po single dose before food

These drugs are contraindicated in pregnancy and heavy infestation, which may provoke ectopic migration.

2. Alternatives:

- Pyrantel pamoate 11mg/kg po maximum 1.0 gram single dose

- Piperazine citrate

Adults and children > 6 years- 1 sachet, repeat after 14 days

Children < 6 years - 5 ml single dose repeat after 14 days

### Management of Complications

- Partial intestinal obstruction: nasogastric tube insertion and Piperazine installation, Intravenous fluid administration.
- Complete obstruction and other acute abdomen: immediate surgery

### 3.5.2. Enterobiasis

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Diagnosis: see core module

#### Treatment

1. Drug of choice:

Benzimidazoles:

- Mebendazole

Adults and children > 10 kg – 100 mg po once then repeat same dose in 2 weeks

Children < 10 kg- 50 mg po once then repeat same dose in 2 weeks OR

- Albendazole

Adults and children > 10 kg- 400 mg po single dose then repeat same dose in 2 weeks

Children < 10 kg-200 mg po single dose then repeat same dose in 2 weeks

2. Alternatives:

Pyrantel pamoate 11mg/kg po maximum 1.0 gram single dose then repeat same dose in 2 weeks two times

- Warm tap water enema may help
- Family members should be treated to decrease potential source of reinfection

### 3.5.3. Hook worm infection

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Diagnosis: see core module

### **Treatment**

- Drug of choice: Benzimidazoles: similar to ascariasis
- Alternative : Pyrantel pamoate 11mg/kg po maximum 1.0 gram po daily for 3 days
- Dietary therapy: supplementation of iron, protein and other vitamins.

### **3.5.4. Trichuriasis**

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Diagnosis: see core module

### **Treatment**

- Drug of choice: benzimidazoles

Mebendazole

Adults and children >10 kg = 100 mg po bid for 3days

Children < 10 kg = 50 mg po bid for 3 days

Albendazole

Adults and children >10 kg = 400 mg po daily for 3 days

Children <10 kg = 200 mg po daily for 3 days

### **3.5.5. Strongyloidiasis**

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Diagnosis: see core module



## **Treatment**

1. Drug of choice: Ivermectin 200µg/kg/d po for 3days

2. Alternatives:

### **Asymptomatic or uncomplicated cases:**

- Thiabendazole 25 mg/kg bid maximum of 3 gm/d for two days OR
- albendazole 15 mg/kg twice a day maximum of 400 mg daily for three days repeat same dose after 7 days.

### **Complicated cases:**

- Thiabendazole for five to seven days or
- Albendazole for two weeks.
- It is also important to manage complications such as gram-negative sepsis, pneumonia or meningitis.

**Prevention and control of intestinal nematodes: see core module**

## **3.6. Intestinal trematodes**

### **Schistosomiasis**

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Clinical feature: see core module

Diagnosis: see core module

### **Complications:**

#### **1. Portal hypertension (hepatosplenic schistosomiasis):**

It occurs after about 10 - 15 years of prolonged exposure and infection. It's due to the development of periportal fibrosis. The liver may be enlarged although in many cases it's small, firm and nodular and the left lobe is characteristically prominent. It



manifests with ascites, esophageal varices with or without bleeding and enlarged spleen.

Patients usually do not have schistosoma eggs in feces because of previous treatment and/or attrition of adult worms without subsequent reinfection.

## **2. Pulmonary hypertension:**

It may occur due to obliteration of pulmonary arterioles by granulomatous inflammation induced by embolized and shunted schistosoma eggs. This may cause cor pulmonale.

**3. Glomerulonephritis:** this may manifest with proteinuria and rarely cause renal failure.

**4. Large intestinal polyps:** this is due to an exudative granulomatous response to focal dense deposits of schistosoma eggs. Major presentation is bloody diarrhea sometimes associated with protein losing enteropathy and anemia.

## **Treatment**

1. Drug of choice:

praziquantel 40 mg/kg single dose or divided into two doses given 4 hrs apart

2. Alternatives:

Oxaminoquine 20 mg/kg daily for 3 days

## **Prevention and control**

1. Prevention measures

- Environmental sanitation
- Health education

2. Control measures

- Snail control: chemical & biological control
- Environmental management
- Chemotherapy

Objective: reduction of intensity of infection to levels below public health importance.

It is given as

1. Selective population chemotherapy: treatment of people with schistosoma eggs in stool after examination of the entire population.
2. Mass chemotherapy: treatment of the entire population without prior stool examination based on epidemiological data, where most of the population is assumed to be infected.

3. Selective group chemotherapy: only group that has high prevalence and high intensity of infection is treated. It is a variant of selective population chemotherapy.
4. Targeted chemotherapy: treatment only to individuals who are heavily infected, to reduce contamination and risk of development of severe disease.

### 3.7. Intestinal cestodes

#### Taeniasis including hymenolepiasis

Definition: see core module

Etiology: see core module

Pathogenesis: see core module

Life cycle: see core module

Epidemiology: see core module

Clinical feature: see core module

Diagnosis: see core module

#### TREATMENT

1. Drug of choice: Praziquantel - Taeniasis: 5-10 mg/kg po single dose  
Hymenolepiasis: 25 mg/kg po single dose

2. Alternatives: Niclosamide

##### Adults

- Taeniasis : 2 gm po single dose
- Hymenolepiasis: adults 2 gm po daily for 5 days

##### Children

##### Hymenolepiasis

Under 2 years: 500 mg/day for 5 days

2 – 8 years: 1 gm/day for 5 days

Over 8 years 1.5 gm/day for 5 days

Taeniasis – the same dose is given once

### **3.8. POST TEST**

1. Which protozoan infections are highly associated with HIV/AIDS?
2. Compare amebic and bacillary dysentery
3. Write the case management of strongyloidiasis
4. What are the possible presentations of ascariasis?
5. List common cestodes causing human infections and describe their routes of transmission
6. List the preventive and control measures for intestinal schistosomiasis

### **3.9. ROLES and TASK ANALYSIS**

1. Take history, do physical examination and indicate the necessary lab investigations.
2. Confirm diagnosis by (1)
3. Treat the patient with appropriate drugs
4. Health education on the preventive methods and repeat follow up to confirm effectiveness of the drug given and possible side effects
5. Design preventive and control measures.

### 3.10. KEYS TO PRETEST and POST TEST

1. Cryptosporidiosis, isosporidiosis, cyclosporiasis, microsporidiasis
2. **Amebic dysentery:** the diarrhea is bloody or mucoid; gradual onset; toxic in infants and children, but usually non-toxic in adults; dehydration is common in children, but unusual in adults. It is associated with severe tenesmus.

**Bacillary dysentery:** the diarrhea is bloody or mucoid; has sudden onset. The patient is usually more toxic and dehydrated. It is associated with moderate tenesmus.

3. **Asymptomatic or uncomplicated cases:** Ivermectin 200 µg/kg once or Thiabendazole 25 mg/kg twice a day for two days or albendazole 15 mg/kg twice a day for three days.

**Complicated cases:** Thiabendazole for five to seven days or albendazole for two weeks. It is also important to manage complications such as gram-negative sepsis, pneumonia or meningitis.

4. Most infections are asymptomatic, but clinical presentations may include:
  - Passage of worm through anus, mouth or nose
  - Eosinophilic pneumonitis manifest with cough, chest pain, fever, wheeze and crackles on auscultation of the chest. Dyspnea, hemoptysis and urticaria may also occur.
  - Gastrointestinal complaints such as abdominal pain, nausea, vomiting or diarrhea may be seen. Signs of small bowel obstruction could also occur.
  - Biliary colic, cholecystitis, cholangitis, pancreatitis, appendicitis and intrahepatic abscess due to ectopic migration of the worm may rarely appear
  - Malnutrition is common in children

5. Ingestion of cysticerci containing raw meat, pork or raw fish for ***T. saginata***, ***T. solium***, ***D. latum*** respectively. Ingestion of ova through fecal-oral route for ***H.nana*** and ***T.solium***

6. Preventive measures: environmental sanitation and health education

Control measures: snail control; environmental management and chemotherapy

# **PART FOUR**

## **SATELLITE MODULE ON INTESTINAL PARASITOSIS FOR MEDICAL LABORATORY SCIENCE STUDENTS**

### **4.1 Introduction**

#### **4.1.1 Purpose of the module**

Laboratory science has expanded greatly in the last decade. Responsibilities of laboratory personnel have increased dramatically. This has created an urgent need for clear and concise instructional reference that responds to the expanding knowledge in the field of medical laboratory science.

Much of the general routine laboratory testing is done by laboratory personnel. For this day-to-day activity they need a quick reference, which incorporates the routine laboratory tests at their work place. The shortage of reference materials in different health facilities is a major problem in their career.

This satellite module on intestinal parasitosis is therefore, intended to solve the critical shortage of reference materials on the subject for the students and graduate laboratory technicians in health centers.

This module leads the students through the most frequently used tests and up to date methods by means of procedural steps.

This satellite module provides the specific tasks and skills that should be known by a medical laboratory personnel in a health center to diagnose intestinal parasites.

#### **4.1.2 Direction for using the satellite module**

1. Do the pretest of the core module.
2. Read the core module thoroughly and do the post tests
3. Do the pretest of satellite module for MLT.
4. Read the satellite module thoroughly
5. Do the posttest of satellite module for MLT and evaluate yourself by comparing with the answer keys given.

## 4.2. Pretest Questions

Instruction: Circle the appropriate answer(s) from the alternatives given.

1. The identification of helminthic eggs should take into account all of the following except:
  - A. Size and shape of the egg
  - B. Thickness of the shell
  - C. Number of nuclei within the eggs
  - D. Presence of spines, knobs, or opercula
  
2. The tapeworm scolex (head) with four suckers and a rostellum with no hooklets is suggestive of:
  - A. Taenia solium
  - B. Taenia saginata
  - C. Diphyllbothrium latum
  - D. Multiceps multiceps
  
3. Adhesive cellulose tape is used for laboratory diagnosis of:
  - A. Trichuris trichuira
  - B. Trichinella spiralis
  - C. Onchocerca volvulus
  - D. Enterobius vermicularis
  - E. A and C
  
4. Modified acid-fast stain is used for the diagnosis of:
  - A. Entamoeba histolytica
  - B. Concentration technique
  - C. Immune diagnosis
  - D. Culture
  
5. Which of the following technique is different from the others?
  - A. Direct saline preparation
  - B. Zinc sulphate floatation technique

- C. Brine floatation technique
- D. Zinc sulphate centrifugal floatation



**4.3. Learning objective:** after completing this satellite module, the student will be able to:

- Collect the right specimens for the identification of different parasites
- Demonstrate the different laboratory techniques for microscopic identification of intestinal parasites.
- Identify intestinal parasites at different stages of development.

#### **4.4. Intestinal parasitosis**

Definition: refer to the core module

Epidemiology: refer to the core module

Etiology & pathogenesis: refer to the core module in each section

##### **4.4.1. Laboratory diagnosis of intestinal parasites (general)**

###### **4.4.1.1. Collection and handling of stool Specimen**

The specimen containers should be leak-proof, clean, dry and free from traces of disinfectant and not contaminated with urine or feces. A large teaspoon amount of feces is adequate for about 10 ml of a fluid specimen. The stool specimen must arrive in the laboratory soon after they are collected. If delay is necessary, use appropriate type of preservative. Several specimen collections on alternate days may be required to detect parasites that are excreted intermittently.

###### **4.4.1.2. Types of stool examination**

**I. Macroscopic examination:** Stool specimen should be examined with the naked eye and reported pertaining to its:-

- Color
- Consistency i.e. whether formed, semi formed, unformed, or watery
- Presence of blood, mucus and/or pus. Blood and mucus may be found in feces from patients with amoebic dysentery, intestinal schistosomiasis, bacillary dysentery or severe *T. trichuria* infection. Pus can be found in fecal specimen from patients with bacillary dysentery. It can be found in amoebic dysentery but in less amount .
- Whether it contains worms, E.g. *A. lumbricoides* (large round worms), *E. vermicularis* (pin worms) or Tape worm segments (proglottids) of *T. solium* and *T. saginata*



- Pathological odor: offensive, non offensive
- Pale colored and fatty stool specimen can be found in giardiasis and other infections associated with malabsorption.

## II. Microscopic examination

The detection and identification of species of parasites requires microscopic examination of specimens.

### 1. Direct microscopy

#### 1.1 Direct microscopic examination of stool specimen with physiological saline and Dobell's Iodine solutions.

Routine microscopic examination of stool specimen with physiological saline and Dobell's iodine solution helps to detect and identify the stages of most parasites.

#### Materials and solutions

- Wooden applicator sticks
- Microscopic slides
- Cover slips
- Dropping bottles containing physiological saline (0.85% w/ v) and Dobell's Iodine solutions
- Microscope
- Pasteur pipette

#### Procedure

1. Place a drop of physiological saline (0.85% w/v) in the center of the left half of the slide and place a drop of Dobell's Iodine solution in the center of the right half of the slide.
2. With an applicator stick, pick up a small portion of the feces (Approximately 2 mg, which is about the size of a match head) and put on the drop of saline. Add a similar portion of stool sample to the drop of iodine.
3. Mix the feces with the drops to form homogeneous suspensions.
4. Cover each suspension with cover slip by holding the cover slip at an angle of 30° touching the edge of the suspension and gently lowering the cover slip onto the slide so that air bubbles are not introduced.

5. Examine the saline preparations using the 10x objective for motile forms, cyst and oocyst of intestinal protozoa and for any ova or larva of helminthes.
6. Examine the iodine solution preparation using 40x objective to identify the cyst stages of protozoa. The iodine will stain the nuclei and the glycogen mass of the cyst.



## 1.2. Modified Ziehl-Neelsen technique (Acid-fast stain)

Modified Ziehl-Neelsen staining of fecal smear helps to detect oocysts of cryptosporidium, cyclospora and isospora belli.

### Materials and reagents –

- Carbol fuchsin stain
- 0.25 % Malachite green (or Methylene blue)
- 1% acid alcohol
- Slides
- Oil immersion
- Microscope

### Procedure

1. Prepare a thin fecal smear on a slide, then air dry.
2. Fix the smear with methanol for 2 - 3 minutes.
3. Stain the smear with cold carbol fuchsin for 5 - 10 minutes.
4. Wash off the stain with clean tap water
5. Decolorize with 1% acid alcohol for 10 - 15 sec. until color ceases to flow out of the smear
6. Rinse in tap water and counter stain with 0.5% malachite green (or methylene blue) for 30 sec.
7. Wash off the stain with tap water
8. Stand the slide on a draining rack for the smear to dry
9. Add a drop of oil immersion on to the smear
10. Examine the smear microscopically using 100x objective to detect and identify oocyst.

### 4.4.2. Concentration method for fecal specimens

The concentration and the separation of protozoa cysts and helminthes egg from other elements of the fecal specimen can be of great advantage in diagnosis. This can be accomplished by sedimentation, flotation or combination of the two. Feces normally contain a great variety of materials most of which are lighter or denser, smaller or larger than the cysts, eggs and larvae of parasites. The concentration of

parasites in parasitological specimens is some times called the "enrichment technique" since it enables to examine greater quantity of stools in less volume. The purpose in using a concentration technique is to separate as completely as possible parasites from all other elements of the stool.

In general the concentration technique may be necessary:

1. To identify parasites which are not detected by direct saline wet mount examination in a patient with persisting symptoms of intestinal parasitic infection.
2. To detect ova of parasites which are often few in number, such as those of schistosoma or taenia species.
3. To check whether treatment has been successful or not
4. To investigate the prevalence and incidence of parasitic infections as part of epidemiological survey

The choice of concentration technique depends on:-

1. The species of parasite
2. The number of specimen to be examined
3. The equipment and time available

A direct microscopic examination of stool must always be done before preparing a concentration because motile forms of flagellates, ciliates and amoebae die during the concentration procedure.

**Concentration techniques of fecal specimen are divided into three:**

#### **4.4.2.1. Floatation technique**

Floatation technique concentrates the cysts and eggs of parasites at the top since their density is less than that of the suspending medium. The waste products, crystals, body cell, etc. have a higher specific gravity and usually sink to the bottom. The top layer can be removed and placed on a slide to be examined under the microscope.

#### **Zinc Sulfate floatation technique**

Zinc sulfate floatation technique is one of the most widely used method of concentration. It has a special merit of being suitable for routine examination of both cyst of protozoa and eggs of most helminths. Operculated eggs of trematodes and

cestodes, infertile ascaris ova and larvae of nematodes are not concentrated, because they have greater specific gravity than the suspending medium.

A zinc sulfate solution which is used for the concentration of parasite has a specific gravity (relative density) of 1.180 -1.200. Feces is emulsified in the solution and the suspension is left undisturbed for the eggs and cysts to float to the surface where they are collected on a cover glass or can be collected by Pasteur pipettes.

### **Materials & Reagents**

1. Test tubes of about 10 ml capacity
2. Zn so<sub>4</sub> solution, 33 % (w/v) (about 33 grams of Zn so<sub>4</sub> crystals in 100 ml solution), specific gravity of 1.180 - 1.200. Use a hydrometer to check the specific gravity (relative density) of the solution. Adjust with distilled water or other chemical if required.
3. Cover glass
4. Microscope slide
5. Applicator stick
6. Microscope

### **Procedure:**

1. Fill the tube about one quarter with zinc sulfate solution
2. Add an estimated 0.5 gram of feces and using a rod or sticks, emulsify the specimen in the solution
3. Fill the tube with the zinc sulfate solution and mix well
4. Stand the tube in a completely vertical position in a rack
5. Using a plastic bulb pipette or Pasteur pipettes, add further solution to ensure that the tube is filled to the rim.
6. Carefully place a completely clean (grease free) cover glass on the top of the tube, avoiding trapping any air bubbles.
7. Leave undisturbed for 30 - 45 minutes to give time for the cysts and eggs to float.

Remember: After 60 minutes, the eggs will begin to sink.

8. Carefully lift the cover glass from the tube by pulling straight upwards and place it on a slide face downwards. The eggs and cysts will be found adhering to the cover glass.

9. Examine first the entire preparation using the 10x objective and then run a drop of iodine solution under the cover glass and use the 40x objective to identify the cysts.

Other floatation methods include:

- Brine (saturated NaCl ) floatation
- Saturated sugar floatation
- ZnSO<sub>4</sub> centrifugal floatation

#### 4.4.2.2. Sedimentation techniques

In this technique **cysts and eggs of parasites are concentrated at the bottom** since they have greater density than the suspending medium. The cysts and eggs can be sedimented by natural gravity or by accelerating the process by centrifugation.

##### ➤ **Formalin - Ether centrifugal sedimentation technique**

This method is recommended as the best technique for concentrating the eggs and larvae of helminthes and moderately satisfactory for cysts of protozoa. It is most useful for detecting the eggs of schistosoma in feces. The formalin is used for fixation and preservation of the morphology of parasites. The fecal debris absorbs ether and becomes lighter than water.

Advantages of this technique include:

- It is rapid and suitable for fresh or preserved stool
- It is used for concentrating those parasites for which zinc sulfate floatation has given poor results due to excessive amounts of fats and fatty acids and for operculated ova of some trematodes and cestodes.
- The morphology of most parasites is retained for easy identification
- It will cover most intestinal parasites

#### **Materials & Reagents**

- Electrical centrifuge
- 15ml conical centrifuge tubes
- Stoppers
- Funnel
- Gauze/sieve
- Graduated cylinder /pipette/

- Beaker
- Slide
- 50% formalin solution
- Normal saline
- Applicator stick
- Cover slip
- Ether
- Lugol's iodine solution

## Procedure

1. Take about 2 g or 2 ml of stool and mix it with 10 ml of normal saline solution.
2. Filter through two layers of gauze into a centrifuge test tube
3. Centrifuge for a minute at medium speed (2000-5000 rpm). If the supernatant fluid is very cloudy wash the deposit again i.e. mix it again with 10ml of normal saline solution.
4. Centrifuge for a minute at medium speed and pour off the supernatant fluid
5. Add 10 ml of formaldehyde solution to the sediment
6. Stir or mix the suspension well and let it stand for five minutes
7. Add 3 ml of ether

Note: Ether is highly flammable and anesthetic. Therefore make sure the laboratory is well ventilated and there is no open flame in the room.

8. Stopper the tube, turn it on its side and shake vigorously for 30 seconds or a minute
9. Remove the stopper carefully and centrifuge for a minute at low speed (1500 rpm)

At this point there will be four layers in the tube:

1<sup>st</sup> layer: Ether

2<sup>nd</sup> layer: Debris

3<sup>rd</sup> layer: Formaldehyde solution

4<sup>th</sup> layer: The deposit containing different stages of the parasites (cyst, egg and /or larvae)

10. Free the layer of debris by rotating the top of a wooden applicator stick between it and the sides of the tube. Tilt the tube and pour off all the supernatant fluid. Use a cotton swab to remove any debris adhering to the side of the tube.



11. Mix the remaining fluid well with the deposit by tapping the tube gently
12. Place one drop of the deposit each at two points on a slide. Add some drops of iodine solution to one of these.
13. Place cover slip over both drops.
14. Examine microscopically the entire preparation using the 10x objective for eggs and lava of helminthes and 40 x objectives for cysts of protozoa.
15. Identify the species and stages of parasites and count the number of each parasite in the entire preparation and report the result.

**Note:** Formalin preserved specimen follows the same steps, however, the solvent used in step one is distilled water instead of normal saline solution.

Other sedimentation Techniques are

- Sedimentation in water, either by gravity or centrifugation
- Acid-ether sedimentation

#### **4.4.2.3. Kato-thick smear egg count**

##### **Materials and Reagents**

1. Applicator sticks, wooden
2. Screen (stainless steel or plastic)
3. Template (stainless steel, plastic, or card board). Templates of different sizes are known to exist:  
A hole of 9 mm on a 1mm thick template will deliver 50 mg of feces; a hole of 6 mm on a 1.5 mm thick template delivers 41.7mg; and a hole of 6.5 mm on a 0.5 mm thick template delivers 20 mg. The templates should be standardized in a country and the same size of templates should always be used to ensure repeatability (reproducibility) and comparability of prevalence and intensity data.
4. Spatula plastic
5. Microscope slides (75 x 25mm)
6. Hydrophilic cellophane, 40-50cm thick, strips 25x30 or 25 x 35mm in size
7. Flat bottom jar with lid
8. Forceps
9. Toilet paper or absorbent tissue
10. Newspaper



11. Glycerol-malachite green or glycerol-methylene blue solution (1ml of 3% aqueous malachite green or 3% methylene blue is added to 100 ml of glycerol and 100 ml of distilled water and mixed well). This solution is poured on to the cellophane strips in a jar and left for at least 24 hrs prior to use.

### Procedure

1. Place a small amount of fecal material on newspaper or scrap paper and press the small screen on top so that some of the feces are sieved through the screen and accumulated on top.
2. Scrap the flat-sided spatula across the upper surface of the screen to collect the sieved feces
3. Place template with hole on the center of a microscope slide and fill it with feces from the spatula so that the hole is completely filled. Using the side of the spatula remove excess feces from the edge of the hole
4. Remove the template carefully so that the cylinder of feces is left on the slide
5. Cover the fecal material with the pre-soaked cellophane strip. The strip must be very wet. If excess glycerol solution is present on upper surface of cellophane wipe with toilet paper. In dry climates excess glycerol will retard, but not prevent drying
6. Invert microscope slide and firmly press the fecal sample against the hydrophilic cellophane strip on another microscope slide or on a smooth hard surface such as a piece of file or on a flat table. The fecal material will be spread evenly between the microscope slide and the cellophane strip. It should be possible to read newspaper print through the smear after clearing.
7. Carefully remove the slide by gently sliding it side ways to avoid separating the cellophane strip or lifting it off. Place the slide on a bench with the cellophane upwards. Water evaporates while glycerol clears the feces.
8. For all ova except hookworm eggs, keep slide for one or more hours at ambient temperature to clear the fecal material prior to microscopic examination. To speed up clearing and examination, the slide can be placed in a 40 degree centigrade incubator or kept under direct sunlight for several minutes.
9. Ascaris and trichuris eggs will remain visible and recognizable for many months in these preparations. Hook worm eggs clear rapidly and will no

longer be visible after 30-60 minutes. In schistosoma endemic areas examine the slide preparations within 24 hours.

10. The smear should be examined systematically and the number of ova of each parasite should be counted and reported. Later on, you are required to multiply this figure by an appropriate factor to know the total number of eggs per gram of feces (selection of a factor depends on the template used, thus multiply by 20 if a 50 mg template is used, by 50 for a 20 mg template and by 24 for 342.7 mg template) with high egg counts. To maintain a rigorous approach while reducing reading time, the stool quantitative dilution technique with 0.1mg/dl NaOH may be recommended.

#### **4.4.3. Culture**

Only minority of parasitic infections are diagnosed routinely by culture technique. Relatively few of the protozoa and none of the helminthes can be cultured for laboratory identification. The only culture methods in general use are those used for the isolation of *E.histolytica*. However, others are not routinely used except for research purpose.

#### **4.4.4. Immune diagnosis: - it is based on the detection of:**

- a. Antibody in the patient's serum produced in response to a particular parasitic infection. Antibody tests do not distinguish between past and present infections, since the antibody may persist in the serum for a long time after an infection has cleared. Therefore, when these tests are used to diagnose parasitic diseases, they need to be interpreted with care.

- b. Antigen, which is excreted by parasites and can be found in the serum, urine, cerebrospinal fluid, feces or other specimens. Antigen tests provide evidence of current infection and are therefore of greater value than antibody tests in the clinical diagnosis of parasitic infections.

Immunodiagnostic techniques are required when:-

- Parasites live in the tissue of internal organ and cannot therefore easily be removed for examination.
- Parasites can be found in specimens only in certain stages of infections, E.g. In the acute stage

- Parasites are present intermittently or in too few numbers to be easily detected in the specimens.
- The technique used to detect parasites is complex or time consuming.

#### 4.4.5. Laboratory diagnosis of intestinal protozoa

##### i. Intestinal amebiasis

Examination of a fresh dysenteric fecal specimen or rectal scrap for motile amoebae

- The finding of motile amoebae (trophozoite) containing ingested red cells is diagnostic of amoebic dysentery

Examination of formed or semi formed feces for cysts.

- The finding of cysts indicates infection with either a pathogenic or non pathogenic strain of *E. histolytica*

The two separate species are

- *E. histolytica* – the invasive pathogenic species
- *E. dispar* – the non invasive non pathogenic species.

#### Technique

##### 1. Direct microscopic examination using

- a) Saline smear method for trophozoite
- b) Dobell's Iodine smear method for cyst

##### 2. Concentration technique

*E. histolytica* cysts can be concentrated by the formol-ether technique, formol detergent sedimentation technique (overnight sedimentation), or by zinc sulphate floatation technique.

##### i. *Entamoeba histolytica*

#### Morphology

**Trophozoites:** The trophozoites of *E. histolytica* range in size from 8 to 65 microns ( $\mu\text{m}$ ), with an average size of 12 to 25  $\mu\text{m}$ . The trophozoite exhibits rapid, unidirectional, progressive movement, achieved with the help of finger-like hyaline pseudopods. The single nucleus typically contains a small and central karyosome (also referred to as karyosomal chromatin). Variants of the karyosome include eccentric or fragmented karyosomal material. The peripheral chromatin is typically fine and evenly distributed around the nucleus in a perfect circle. Variations such as

uneven peripheral chromatin may also be seen. Although the karyosome and peripheral chromatin appearance may vary, most trophozoites maintain the more typical features described. The invisible nucleus in unstained preparations becomes apparent when stained. Stained preparations may reveal lightly staining fibrils located between the karyosome and the peripheral chromatin. The *E. histolytica* trophozoite contains a finely granular cytoplasm, which is often referred to as being “ground glass” in appearance. Red blood cells in the cytoplasm are considered diagnostic since *E. histolytica* is the only intestinal ameba to exhibit this characteristic. Bacteria, yeast, and other debris may also reside in the cytoplasm, but their presence, however, is not diagnostic.

**Cysts** The spherical to round cysts of *E. histolytica* are typically smaller than the trophozoites, measuring 8 to 22  $\mu\text{m}$ , with an average range of 12 to 18  $\mu\text{m}$ . The presence of a hyaline cyst wall helps in the recognition of this morphologic form. Young cysts characteristically contain unorganized chromatin material that transforms into squared or round-ended chromatoid bars in older cysts. The chromatoid bars may or may not be present in mature cysts. A diffuse glycogen mass is also usually visible in young cysts. As the cyst matures, the glycogen mass usually disappears. One to four nuclei are usually present. These nuclei appear basically the same as those of the trophozoite in all respects, but are usually smaller in size. Nuclear variations do occur, with the most common of those being eccentric (rather than the typical central) karyosomes, thin plaques of peripheral chromatin, or a clump of peripheral chromatin at one side of the nucleus that appears crescent shaped. The mature infective cyst is quadrinucleated (containing four nuclei). The cytoplasm remains fine and granular. Red blood cells, bacteria, yeast, and other debris are not found in the cyst stage.

## ii. *Giardia lamblia*

The specimen of choice for detection of *G.lamblia* trophozoite and cyst is stool. Multiple samples collected at different times are required since the cyst is excreted intermittently. The stool is usually offensive, bulky, pale, mucoid (fatty) and diarrheal without blood.

### Morphology

**Trophozoites:** The typical *Giardia lamblia* trophozoite ranges from 8 to 20  $\mu\text{m}$  in length by 5 to 16  $\mu\text{m}$  in width. The average *G. lamblia* trophozoite, however, measures 10 to 15  $\mu\text{m}$  long. The *G. lamblia* trophozoite is described as pear or teardrop in shape. The broad anterior end of the trophozoite characteristically exhibits motility that resembles a falling leaf. The trophozoite is bilaterally symmetrical, containing two ovoid to spherical nuclei, each with a large karyosome, usually centrally located. Peripheral chromatin is absent. These nuclei are best detected on permanently stained specimens. The trophozoite is supported by an axostyle made up of two axonemes. Two slightly curved rod like structures, known as median bodies sit on the axonemes posterior to the nuclei. It is important to note that there is some confusion regarding the proper name of the median bodies. Some texts refer to these structures as parabasal bodies suggesting that the two structures are different. Other texts consider median bodies and parabasal bodies as two names for the same structure. For the purposes of this text, the term median bodies are used to define these structures. Although they are sometimes difficult to detect, the typical trophozoite has four pairs of flagella. One pair of flagella originate from the anterior end, and another pair extends from the posterior end. The remaining two pairs of flagella are located laterally, extending from the axonemes in the center of the body. *The G. lamblia* trophozoite is equipped with a sucking disc. Covering one half to three quarters of the ventral surface, the sucking disc serves as the nourishment point of entry by attaching to the intestinal villi of an infected human.

**Cysts:** - The typical ovoid *G. lamblia* cyst ranges in size from 8 to 17  $\mu\text{m}$  long by 6 to 10  $\mu\text{m}$ . The colorless and smooth cyst wall is prominent and distinct from the interior of the organism. The cytoplasm is often retracted away from the cyst wall creating a clearing zone. This phenomenon is especially possible after being preserved in formalin. The immature cyst contains two nuclei and two median bodies. Four nuclei,

which may be seen in iodine wet preparations as well as on permanent stains, and four median bodies are present in the fully mature cysts. In addition, mature cysts contain twice as many interior flagellar structures.

### **Technique**

1. Direct microscopic examination
  - Saline smear for trophozoite form
  - Dobell's iodine smear for cysts
2. Formalin ether concentration technique or zinc floatation technique - suitable for cysts

### **iii. Cryptosporidium parvum**

The specimen of choice for recovery of *Cryptosporidium parvum* is from water and non-offensive stool. The oocyst may be seen using modified Ziehl-Neelson stain. In addition, formalin fixed smears stained with Giemsa may also yield the desired result.

### **Morphology**

**Oocysts:** Measuring only 4 to 6  $\mu\text{m}$ , the round cryptosporidium oocysts are often confused with yeast. Although not always visible, the mature oocyst consists of four small sporozoites surrounded by a thick cell wall. Contrary to other members of the sporozoa, such as *Isospora*, cryptosporidium oocysts do not contain sporocysts. One to six dark granules may also be seen.

**Schizonts and gametocytes:** The other morphologic forms required to complete the life cycle of cryptosporidium include schizonts containing four to eight merozoites and microgametocyte and macrogametocytes. The average size of these forms is 2 to 4  $\mu\text{m}$ . It is important to note that these morphologic forms are not routinely seen in patient samples.

**iv. Isospora belli:** The specimens of choice for the recovery of *I. belli* oocyst are fresh feces and duodenal content. The oocyst can be identified by direct saline or Dobell's Iodine stain. When required, the oocysts can be concentrated by the formol-ether technique or by the zinc sulfate floatation method. In about 50% of infected persons charcot-leyden crystals are found in the feces.



## Morphology

**Oocysts:** - The oval transparent oocyst of *Isospora belli* ranges in size from 25 to 35  $\mu\text{m}$  long by 10 to 15  $\mu\text{m}$  wide, with an average of 30 by 12  $\mu\text{m}$ . The developing sporoblast contains a small discrete nucleus and granular cytoplasm. As it matures, the young oocyst divides into two sporoblasts, each with a small discrete nucleus. Each sporoblast continues to mature and eventually becomes a sporocyst, each containing four sausage-shaped sporozoites. This stage is known as the mature oocyst. Throughout its development, the sporoblast and sporocysts are surrounded by a smooth, colorless, two-layered cell wall.

### 4.4.6. Laboratory diagnosis of cestodes

#### i. *Taenia* species

Laboratory confirmation of *T. saginata* infection is by:-

- Identifying gravid segments recovered from patient's clothing or passed in feces. The segments are usually passed singly.
- Detecting eggs in feces

#### Technique

1. Direct microscopic examination
2. Formalin- ether concentration method

A concentration technique and examination of several specimens may be necessary to detect *Taenia* eggs in feces, because the eggs are not regularly discharged from the tapeworm in the intestine. The eggs are only released when gravid segments become detached and damaged.

Egg of *Taenia saginata* or *Taenia solium*

- It is round or round to oval, measuring 33 - 43  $\mu\text{m}$  in diameter
- A thick brown radially striated wall (embryophore) surrounds the embryo
- Hooklets are present in the embryo (embryonic hooklets) careful focusing is necessary to see the three pairs of hooklets
- Sometimes a clear membrane can be seen surrounding the egg, but usually the egg shell and yolk sacs are lost when the gravid segment becomes detached and disintegrated.



**Note:** If required, the Ziehl-Neelson staining technique (as used for AFB) can be used to differentiate Taenia eggs. The embryo of *T.saginata* is acid fast (i.e. stains red), whereas that of *T.solium* is not acid fast.

- Gravid segment of Taenia saginata
  - Appears white or opaque and measures about 20 mm long by 6 mm wide when freshly passed. It is therefore longer than *T.solium* gravid segment
  - Uterus has a central stem which has more than 13 main side branches on each side; (*T.solium* has fewer than 13). The main side branches are subdivided into smaller branches
- **Gravid segment of *T.solium*** Appears grey-blue and translucent and measures about 13 mm long by 8 mm wide when freshly passed. It is therefore:-
  - shorter than a gravid segment of *T.saginata*
  - Uterus has a central stem which has up to 13 main side branches on each side; (*T.saginata* has more than 13). The main side branches are subdivided in to smaller branches.

## ii. Hymenolepis nana (common name: dwarf tapeworm)

Confirmation of *H.nana* infection is by finding the eggs of the parasites in feces  
Technique

1. Direct microscopic examination
2. Formalin - ether concentration technique

Examination of several specimens may be required to detect *H.nana* eggs. Sometimes adult worms can be found in feces.

### Morphology

**Eggs:** The somewhat round to oval egg of *Hymenolepis nana* typically measures 45 by 38  $\mu\text{m}$  in size. The centrally located hexacanth embryo is equipped with the standard three pairs of hooklets. A shell complete with polar thickenings protects the embryo. Numerous polar filaments originate from the polar thickenings, which, in addition to size, help to distinguish it from the egg of *H. diminuta*. A colorless embryophore

#### 4.4.7 Laboratory diagnosis of intestinal nematodes

##### i. Laboratory diagnosis of ascariasis is by:

- Finding ascaris eggs in feces
- Identifying adult worms expelled through the anus or mouth

##### Technique

1. Direct saline preparation
2. Concentration techniques are rarely required

##### ➤ Eggs of *ascaris lumbricoides*.

Usually fertilized eggs are found in the feces, but occasionally unfertilized eggs are passed when the worms in the intestine are mostly female.

##### Fertilized egg:

- It is yellow brown and the shell is covered by an uneven albuminous coat
- Oval or round and measure 60 x 40  $\mu\text{m}$
- Contains a central granular mass which is the unsegmented fertilized ovum

**Decorticated egg:** This term is used to describe an egg that has no albuminous coat. A decorticated egg has smooth shell and appears pale yellow or colorless

##### Unfertilized egg:

- It is darker in color and has a more granular albuminous covering than a fertilized egg.
- More elongated than a fertilized egg and measures about 90 x 45  $\mu\text{m}$
- Contains a central mass of large refractile granules

##### Adult worms are:

- Large
- Pink brown (freshly expelled) or yellow white in color
- Tail of the male is curved and has two small spicules (rod-like projections)

##### ii. *Enterobius vermicularis*: laboratory confirmation of enterobiasis is by:

- Finding *E. vermicularis* eggs in samples collected from perianal skin or recovered from clothing worn at night.
- Finding *E. vermicularis* worms in feces or during clinical examination

Eggs can be collected from skin around the anus or from clothing by applying clear adhesive tape. The eggs are detected microscopically by sticking the tape directly on a slide.

### **Clear Adhesive Tape Technique**

1. Take a strip of about 20 cm of clear cellulose or vinyl adhesive tape (e.g. cellophane tape, scotch tape), which measures about 20 mm in width.
2. Apply the clear cellophane tape to the perineal region. Remove and spread the tape on a slide, sticky side down, for microscopic examination.
3. Look for the presence of pinworm eggs.

**NB.** Because the female usually deposits her ova at night, collect the specimen early in the morning before the patient bathes or defecates.

### **Egg of *enterobius vermicularis***

- It is colorless and has a clear shell
- Oval in shape and usually flattened on one side. It measures about 55 x 30  $\mu\text{m}$
- Contain a larva.

### **E. *vermicularis* worm**

- It is small, measuring only 8 -13 mm in length and resembling a small piece of white thread (hence the name thread worm).

### **iii. *Trichuris trichuira***

Laboratory diagnosis of trichuriasis is made by:

- Finding *T. trichuira* eggs in feces by direct saline preparation

Concentration techniques are not required to detect infection because many eggs are produced by the female worms.

#### ➤ Eggs of *T. trichuira*

- It is yellow-brown and measure about 50 x 25  $\mu\text{m}$
- Has a characteristic barrel shape with a colorless protruding mucoid plug at each end
- Contains a central granular mass which is the unsegmented ovum

### **iv. Hook worms**

Laboratory diagnosis of hookworm infection is by finding hook worm eggs in feces

**Note:** Hookworm infection is usually accompanied by eosinophilia in the blood.

### Technique

1. Direct microscopy using saline smear
2. Formalin - ether concentration technique or sodium chloride floatation technique

#### ➤ Egg of Hook worm

Morphologically the eggs of *A. duodenale* and *N. americanus* are similar and the following features can be used to identify the egg of either species

- It is colorless with a thin shell which appears as a black line around the ovum
- Oval in shape measuring about 65 x 40 µm
- Contain an ovum which usually appears segmented

**v. *Strongyloides stercoralis*:** laboratory diagnosis of strongyloidiasis is by finding *S. stercoralis* larvae in feces or duodenal aspirates. Because *S. stercoralis* larvae tend to be excreted at intervals and can be few in numbers, concentration techniques should be used if infection is highly suspected.

### Technique

1. Examination of feces for *S. stercoralis* larvae using direct saline preparation and formol -ether concentration technique
2. Water immersion technique for detecting *S. stercoralis* larvae

A simple alternative method of detecting *S. stercoralis* larvae when they are few in number is to encourage their emergence from feces into water and examine the water for the motile larvae.

3. Examination of duodenal aspirate for *S. stercoralis* larvae

#### ➤ Larvae of *S. stercoralis*

- It is actively motile except in formalin preparation
- It is large, unsheathed, measuring 200 - 300 µm x 15 µm
- Show a typical rhabditiform larva with bulbed esophagus

### 4.4.8. Laboratory diagnosis of intestinal flukes

**i. *Schistosoma mansoni*:** laboratory confirmation of *S. mansoni* infection is by:

- Finding *S. mansoni* eggs in feces

- Examining a rectal biopsy for eggs when they cannot be detected in feces, especially for partially treated patients

➤ **Eggs of *S.mansoni***

- It is pale yellow-brown, large, and oval measuring about 15 x 60µm
- Has a characteristic side (lateral) spine
- Contains a fully developed miracidium



## 4.5. POST TEST

**Instruction:** Circle the appropriate answer(s) from the alternatives given.

1. The identification of helminthic eggs should take into account all of the following **except**:
  - A. Size and shape of the egg
  - B. Thickness of the shell
  - C. Number of nuclei within the eggs
  - D. Presence of spines, knobs, or opercula
  
2. The tapeworm scolex (head) with four suckers and a rostellum with no hooklets is suggestive of:
  - A. Taenia solium
  - B. Taenia saginata
  - C. Diphyllbothrium latum
  - D. Multiceps multiceps
  
3. Adhesive cellulose tape is used for laboratory diagnosis of:
  - A. Trichuris trichuira
  - B. Trichinella spiralis
  - C. Onchocerca volvulus
  - D. Enterobius vermicularis
  - E. A and C
  
4. Which of the following methods are not employed in the laboratory diagnosis of intestinal parasites?
  - A. Direct microscopy
  - B. Concentration technique
  - C. Immune diagnosis
  - D. Culture
  
5. Which of the following technique is different from the others?
  - A. Direct saline preparation

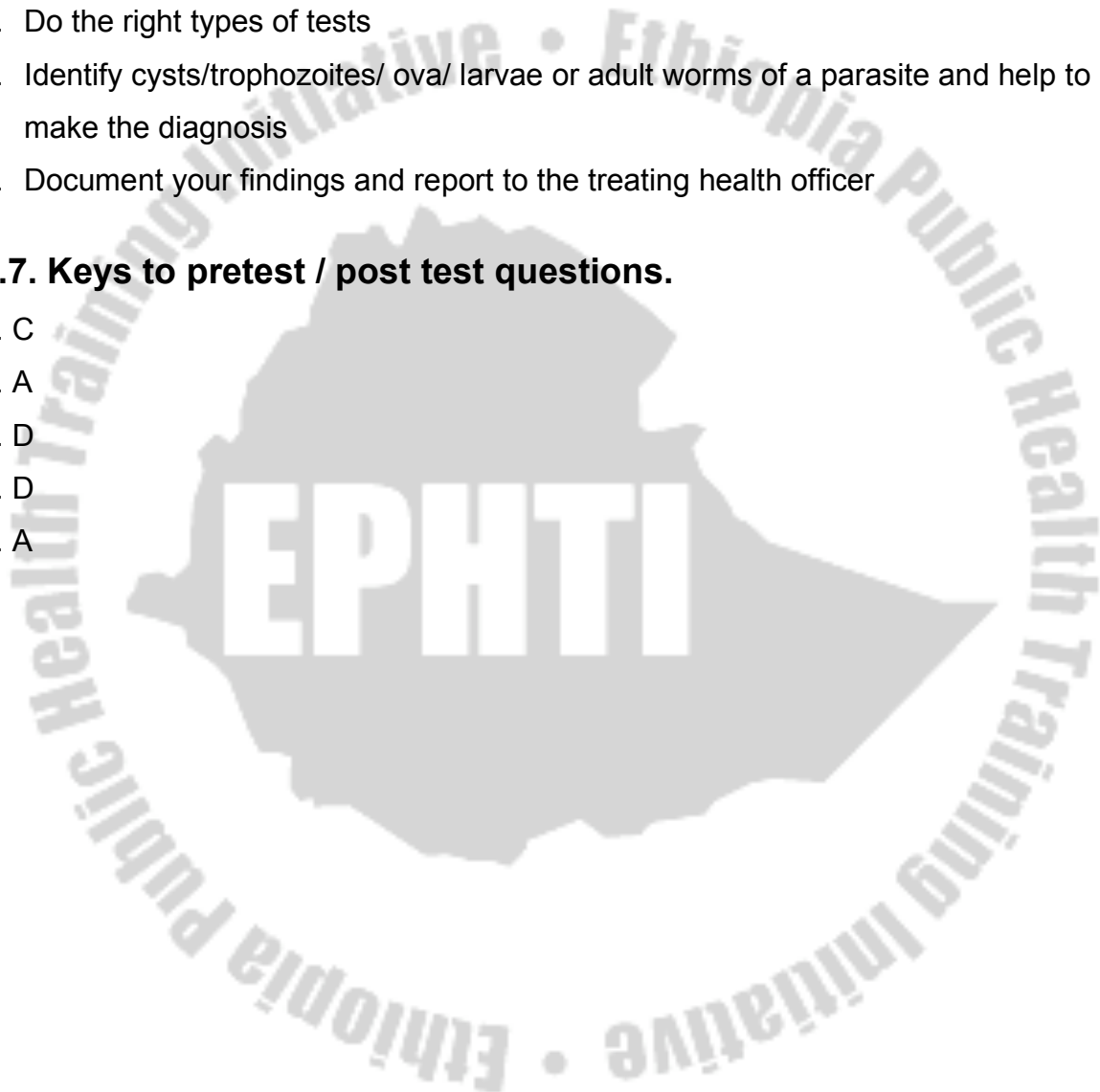
- B. Zinc sulphate floatation technique
- C. Brine floatation technique
- D. Zinc sulphate centrifugal floatation

#### **4.6. Roles & Task Analysis**

- 4. Collect the required laboratory specimen and transport (when it is necessary)
- 5. Do the right types of tests
- 6. Identify cysts/trophozoites/ ova/ larvae or adult worms of a parasite and help to make the diagnosis
- 7. Document your findings and report to the treating health officer

#### **4.7. Keys to pretest / post test questions.**

- 1. C
- 2. A
- 3. D
- 4. D
- 5. A



# **PART FIVE**

## **SATELLITE MODULE ON**

### **INTESTINAL PARASITOSIS FOR NURSE STUDENTS**

#### **5.1. Introduction**

Intestinal parasitosis is one of the most common public health problems in this country affecting all segments of the population. As long as successful disease prevention and health promotion is continuously implemented, it is hoped that the community will enjoy better health and living condition. This entails that the nurse student should be equipped with the basic knowledge of Intestinal parasitosis and the methods of prevention and control. The nurse can effectively control infestations by different strategies, such as mobilizing communities, teaching health education, case detection and management.

##### **5.1.1 Purpose and Use of This Module**

This satellite module is an easy reference developed for nurse students and graduate nurses in the service sector, with the aim of providing them with the required knowledge and skill specific to the profession about the management, prevention, and control of intestinal parasites and enable them to identify and tackle such problems of the individuals and the community at large. Moreover, the module is designed to provide a uniform and easy -to -understand reading material and hoped to reduce the shortage of such reference materials in the remote parts of this country.

##### **5.1.2 Direction for Use of the Satellite Module**

The nurse student is advised first to read the core module, which is developed for all members of the health center team, and then pass to this satellite module, which is specific to your field of training and profession

- Do the pretest to check your existing knowledge
- Read the learning objectives
- Go through the case management, methods of prevention and control
- Do the post-test to check the knowledge that you gained after reading the satellite module and compare your answer with the answer keys given at the end.



**5.2. Pre-test** Choose the correct answer and circle the letter

1. Which of the following is not a subjective data about intestinal parasitosis?
  - A. Abdominal cramps
  - B. Pale conjunctiva
  - C. Malaise
  - D. Nausea
  
2. Which of the following is not included under nursing diagnosis?
  - A. Dehydration
  - B. Abdominal pain
  - C. Potential for infection
  - D. Altered nutrition
  - E. Altered skin integrity
  
3. Which of the following information is irrelevant during the collection of specimens for the diagnosis of intestinal parasites?
  - A. Time
  - B. Quantity
  - C. Type
  - D. Place
  
4. Which of the following is neither a promotive nor a preventive measure for intestinal parasitosis?
  - A. Personal hygiene
  - B. Breast feeding
  - C. Boiling
  - D. Environmental sanitation
  - E. None
  
5. During evaluation of treatment outcomes in patients with intestinal parasites the nurse should expect all the following except:
  - A. Normal bowel functions
  - B. Immediate nutritional balance
  - C. Relief of pain

D. Normal vital sign

### 5.3. Learning Objectives

After reading the satellite module the learner will be able to:

- Discuss nursing assessment of clients with intestinal parasitosis.
- Describe potential and actual nursing diagnosis
- List a plan of care
- Use nursing process to prevent complications of intestinal parasitosis
- Apply standard criteria to evaluate clients with intestinal parasitosis

### 5.4. Case management

#### 5.4.1. Nursing Assessment

##### 5.4.1.1 Subjective Data

The nurse should assess a patient with intestinal parasitosis for:

Stool - frequency: is it three times or more?

- consistency (What does it contain - undigested food, watery, mucoid, others specify) and
- color (does it contain blood or not)

Others:

- Fever check axillary temperature
- chills: does it accompany rigor and fever
- abdominal cramps or discomfort (exact location on the abdomen)
- diarrhea associated with blood
- absence or presence of pain in lower right quadrant
- malaise
- A history of travel
- Information about adequate boiling of water
- Family history- any family member who has the same clinical picture
- Type of medication sought for- if possible get the names of medication including traditional medication

##### 5.4.1.2 Objective Data:

- Fever check axillary temperature
- assess the skin for signs of malnutrition and fluid and electrolyte imbalance

- Look for conjunctiva: pale or pink
- Look for mucosa for dehydration: buccal, tongue and lips
- Assess abdomen for:
  - Distension
  - Listen for (using stethoscope) borborygmi (Hyper active bowel sounds)
  - Palpate the liver for enlargement
- Assess anorectal area for:
  - Excoriations related to itching
  - rectal prolapse
  - Use adhesive tape to examine for pin worm

#### **5.4.2. Nursing Diagnosis**

1. Diarrhea related to irritation/inflammation of intestinal mucosa
2. Abdominal pain related to intestinal inflammatory process
3. Altered nutrition: Available nutrients are less than the requirement of the body, due to nausea and malabsorption related to intestinal mucosal inflammation.
4. Potential fluid volume deficit related to diarrhea
5. Potential for infection transmission related to contagious agents and poor hygiene.

#### **5.4.3. Nursing goal/planning: After a thorough assessment, planning and management, at the end**

5. The patient will return to optimum nutritional status
6. Maintain normal bowel function
7. Maintain normal fluid volume and electrolyte balance
8. Prevent spread and recurrence of the infections

#### **5.4.4. Interventions/implementation**

- Collect stool properly; inform the client about the sample
- Type
- Time
- Volume/ amount
- Number of sample
- Administer medication as prescribed.

- Monitor intake and output
- Increase oral fluid intake to at least 2000 ml per 24 hours
- Give ample information about medications, their dosage, and side effects
  - Some drugs need purging and be chewed e.g. Niclosamide.
  - Some drugs need to be taken prior to a meal with an empty stomach, e.g. Piperazine, levamisole and the like.
  - And some drugs need to be taken after a meal e.g. Mebendazole, Niclosamide
- Give health education on how to prevent parasitic infection on:
  - Personal hygiene
  - Breast feeding
  - Environmental sanitation
  - Boiling water
  - Mobilize the community to act together. Make sure that the necessary understanding and motivation are attained to prevent diseases. N.B. Active participation is expected from nurses to prevent transmission of intestinal parasitosis and promote health.
  - Identify risk group and those eligible for stool examination. These are children, pregnant ladies and those from low socio economic status.
  - Give time to discuss about patient's living condition and advice accordingly.
  - Do not simply send the patient with medication. Give an appointment for another visit.

**5.4.5. Evaluation- use outcome criteria for achievement of goals, as follows:**

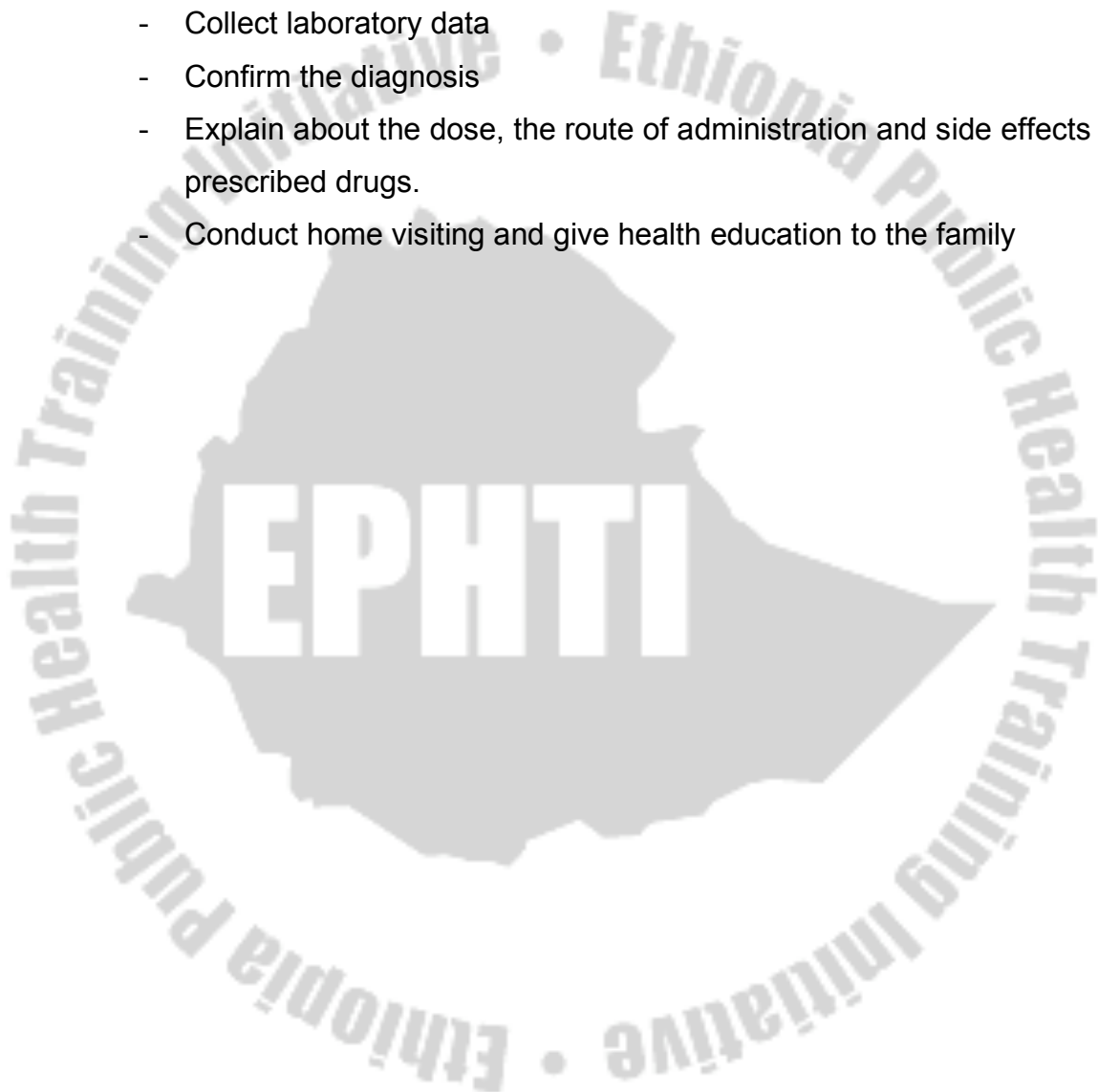
- Client will regain normal bowel function and resume regular nutritional intake.
- Client will report pain is alleviated
- Client will accurately describe measures to prevent the spread of the infectious agents.
- Client will have normal vital signs, fluid volume, and acid-base balance.

**5.5. Post-test Choose the correct answer & circle the corresponding letter**

1. Which of the following is not a subjective data about intestinal parasitosis?
  - A. Abdominal cramps
  - B. pale conjunctiva
  - C. Malaise
  - D. Nausea
  
2. Which of the following is not included under nursing diagnosis?
  - A. Dehydration
  - B. Abdominal pain
  - C. Potential for infection
  - D. Altered nutrition
  - E. Altered skin integrity
  
3. Which of the following information is irrelevant during the collection of stool specimens for the diagnosis of intestinal parasites?
  - A. Time
  - B. Quantity
  - C. Type
  - D. Place
  
4. Which of the following is neither a promotive nor a preventive measure for intestinal parasitosis?
  - A. Personal hygiene
  - B. Breast feeding
  - C. Boiling
  - D. Environmental sanitation
  - E. None
  
5. During evaluation of treatment outcomes in patients with intestinal parasites the nurse should expect all the following except:
  - A. Normal bowel functions
  - B. Immediate nutritional balance
  - C. Relief of pain
  - D. Normal vital sign

## 5.6. Task Analysis

- Take brief history of the patient including present and past medical history.
- Ask social and economic status of the family
- Examine the patient systematically
- Obtain appropriate specimen and send to laboratory
- Collect laboratory data
- Confirm the diagnosis
- Explain about the dose, the route of administration and side effects of prescribed drugs.
- Conduct home visiting and give health education to the family



### 5.7. Keys to pretest & posttest questions

1. B
2. A
3. D
4. E
5. B





**PART SIX**  
**SATELLITE MODULE ON**  
**INTESTINAL PARASITOSIS FOR**  
**ENVIRONMENTAL HEALTH STUDENTS**

**6.1 Introduction**

**6.1.1. Purpose and brief description of the module**

This satellite module on intestinal parasitosis, unlike the core module, is specific to the field of environmental health. Thus, its purpose is to equip environmental health students with the basic knowledge of preventing and controlling the diseases caused by medically important intestinal parasites, special emphasis being given to those prevalent in Ethiopia. The module is also believed to help the instructor to prepare and deliver lecture easily, saving ample time for discussion, as this will also give the students a chance to read these materials prior to the classroom sessions.

**6.1.2. Directions for use**

Students are advised to go first through the core module for a general understanding of the subject matter. Then read and understand the learning objectives of the satellite module and their significance. Do the pretest in order to evaluate your existing knowledge. Read through the topics of the satellite module & refer to the core module where ever necessary. Do the post test and re-evaluate yourself, compare your answers with the answer keys given at the end.

**6.1.3. Significance and brief description of the problem**

Most intestinal parasitic infections are discussed under the core module in detail. Thus, students are advised to refer to it prior to reading this satellite module and whenever necessary. Gastrointestinal diseases including those caused by intestinal parasites rank first among the prevalent communicable diseases in Ethiopia, as in other developing countries. Thus, the first strategy in fighting against such communicable diseases should be prevention through environmental sanitation interventions. This entails the concerted effort of all categories of health workers, whereas environmental health workers are supposed to play significant roles. These

roles of environmental sanitation, especially safe and adequate water supply and proper excreta disposal, have been shown to be effective in the prevention and control of parasitic diseases. This in turn necessitates equipping the environmental health students with the required knowledge and skill, for which this satellite module (together with the core module) is designed to achieve this major objective.



**6.2. Pre – Test: Instruction - Choose the best answer and circle the letter.**

1. Which of the following stages of *E. histolytica* is responsible for the causation of the disease amoebiasis?
  - A. Larvae
  - B. Trophozoite
  - C. Cysts
  - D. Eggs
  - E. Adult
  
2. Which of the following are possible source(s) of fecal contamination of food and water?
  - A. Night soil fertilization
  - B. Defective piping
  - C. Flies
  - D. Soiled fingers
  - E. All of the above
  
3. Which of the following is not true about the prevention of Intestinal protozoan infection?
  - A. Hand washing after defecation and before eating
  - B. Sanitary disposal of human feces
  - C. Protection of food against fly contamination by screening
  - D. Health education of food handler about personal hygiene
  - E. None of the above
  
4. Which of the following is the possible mode of transmission of intestinal nematodes?
  - A. Through a contaminated finger
  - B. Through contaminated food
  - C. Through contaminated clothing or toys
  - D. All of the above

5. Which of the following is not true about the prevention and control of intestinal nematode infection?

- A. Provision of adequate latrines and their proper use
- B. Avoiding unsanitary vegetables from the diet
- C. Preventing skin penetration of larvae by wearing shoes
- D. Washing hand before eating and after visiting the toilet
- E. Treatment of infected individuals
- F. None of the above

6. Which of the following preventive measure is most effective in controlling all intestinal cestodes?

- A. Hand washing before eating
- B. Use of latrine
- C. Avoiding eating raw meat
- D. Inspection of carcasses of beef and pork

7. Which of the following environmental factor is related to the transmission of intestinal trematodes?

- A. Air
- B. Soil
- C. Water
- D. Food

8. Which of the following methods of prevention and control of intestinal trematodes is the most effective one?

- A. eradicating snails
- B. treating all patients
- C. environmental sanitation and environmental management
- D. Killing all infected sheep and cattle, and replacing by new ones.

9. Which of the following category of professionals is necessary for effective prevention and control of intestinal trematode infection? It requires the involvement of

- A. the health professionals only
- B. the integrated work of veterinarians and environmental health experts.

- C. Multi-sectoral approach in the eradication of the intermediate hosts & treatment of patients.
- D. All of the above



**6.3 Learning Objectives:** After going through this satellite module the student will be able to:

1. Describe the medically important intestinal parasites in terms of reservoir hosts and modes of transmission.
2. Identify those environmental factors that are associated with the transmission of intestinal parasitosis
3. Plan and implement preventive and control measures, more focus being given to environmental sanitation and environmental management.
4. Evaluate the effects of such intervention programme to ensure its sustainability.

**6.4. Case Study** Please, refer to the core module

## **6.5. Intestinal parasites**

### **6.5.1. Intestinal protozoa**

Definition- See core module

Etiology - See core module

Pathogenesis- See core module

Epidemiology - See core module

Clinical manifestations - See core module

Diagnosis - See core module

Treatment - See core module

### **Prevention and Control**

#### **1) Primary prevention.**

##### **I) Environmental sanitation**

The measures aimed at primary prevention centre around preventing contamination of water, food, vegetables and fruits with human faeces.

**A) Sanitation:** Safe disposal of human excreta coupled with the practice of washing hands after defecation and before eating are crucial factors in the prevention and control of intestinal protozoa.

**B) Water supply:** The protection of water supplies from faecal contamination is very important because the cysts may survive for several days and weeks in water and external environment.

Prevention is possible through:

- Sand filtration of the water to remove cysts
- Boiling of drinking water to kill cysts
- Chlorination of water (disinfection of water)

The cysts are not killed by chlorine in amounts used for water disinfection. Therefore, the concentration of chlorine should be increased; especially for emergency water supplies. Treat water with chlorine or iodine, by using 0.1 to 0.2 ml (2 to 4 drops) of household bleach or 0.5 ml of tincture of iodine per liter of water for 20 minutes or longer if the water is cold.

**C) Food hygiene:** Environmental measures should also include the protection of food and drink against contamination. Uncooked vegetables and fruits can be disinfected with aqueous solution of acetic acid (5-10 percent) or full strength vinegar. In most instances, thorough washing with detergents in running water will remove cysts from fruits and vegetables. Since food handlers are major transmitters of protozoa's, they should be periodically examined, treated and educated in food hygiene practices such as hand washing. Fly control and protection of foods against fly contamination by proper screening and other appropriate means to prevent flies which act as cyst carriers.

## **II) Health information dissemination**

Education of the general public in personal hygiene

- Sanitary disposal of feces and hand washing after defecation and before preparing or eating food.
- Dissemination of information regarding the risks involved in eating uncooked vegetables and drinking water of questionable purity. This is because they may be contaminated by the cysts of intestinal protozoa.
- Use of disinfectant dips for fruits and vegetables are of significance though not proven.

## **2) Secondary prevention**



## **I) Case control and treatment**

- Isolation is not required, but known cyst passers should be treated and thoroughly indoctrinated on the need for very careful post defecation hand washing; such positive actions should be taken especially when cyst-passer's occupation is a potential risk to the public such as food handling.
- Concurrent disinfection (sanitary disposal of feces)
- Investigation of contacts and source of infection

Household members and other suspected contacts should have adequate microscopic examination of their feces and modes of transmission should be investigated epidemiologically.

## **II) Epidemic measures**

Although it is rare, the detection of a group of cases from a single area or institution requires prompt confirmation of the etiologic agent and epidemiologic investigation to determine the source of infection and the mode of transmission. If a common vehicle is identified such as water or food; appropriate measures should be taken to correct the situation.

### **6.5.2. Intestinal nematodes**

Definition- See core module

Etiology - See core module

Pathogenesis- See core module

Epidemiology - See core module

Clinical manifestations - See core module

Diagnosis - See core module

Treatment - See core module

## **Prevention and control**

### **A. Prevention**

1. Preventing the fecal contamination of top soil by:

- Sanitary disposal of human excreta through installation of sewage disposal system and promoting the use of “sanitary latrines”.

- Avoiding the use of untreated sewage and raw feces as fertilizer
- Proper disposal of children's stools.

## 2. Preventing eggs from being ingested

- Avoid over crowding in residential areas (*E. vermicularis*)
- Washing hands before eating and after visiting a toilet.
- Washing the peri-anal skin each morning, soon after waking (*E. vermicularis*)
- Washing of clothing worn at night (*E. vermicularis*)
- Avoiding eating uncooked vegetables (leafy-green & root-vegetables) normally eaten raw, which may be contaminated with feces containing viable eggs from contaminated top soil

3. Preventing the penetration of the skin by larvae of hookworm or strongyloides by wearing shoes.

4. Health education about the causative agents, mode of transmission, and control and prevention measures especially on how to establish an efficient excreta-disposal system, and how to use it properly. Moreover, proper habits of defecation must be taught to small children, who are likely to contaminate the surface soil around the houses, and strict practice of hand washing should be habitual.

In general, prevention to be effective must take into consideration the life cycle of the parasite and the peculiar ecological, social and cultural circumstances that prevail in a community.

## B. Control

- Concurrent disinfections and sanitary disposal of feces to prevent contamination of top soil and change bed linen and under wear of infected person daily with care to avoid dispersing eggs into air. Eggs on discarded linen are killed by exposure to temperatures of 55°C for a few seconds in the case of *E. vermicularis*.
- Investigation of contacts and source of infection: Environmental sources of infection should be sought particularly in the premises of affected families.
- Treatment of infected individuals as part of the prevention and control program
- Mass screening and treatment (Periodic deworming) in institutions (schools) where parasites and protein energy malnutrition are highly prevalent.

- Improve the standard of living

### **C. Epidemic measures.**

- Undertake survey of the diseases to see their prevalence in highly endemic areas,
- Give health education on environmental sanitation and personal hygiene
- Provide effective treatment.

#### **6.5.3. Intestinal cestodes/tapeworms**

Definition- See core module

Etiology - See core module

Pathogenesis- See core module

Epidemiology - See core module

Clinical manifestations - See core module

Diagnosis - See core module

Treatment - See core module

#### **Prevention and Control**

1. As can be seen from the life cycle, the eggs are voided with the feces of the infected person. Therefore, the ultimate prevention lies in proper excreta disposal.
2. Adequate cooking of beef, pork or fish, exposure to temperatures of 56°C and above for 5 min will destroy cysticerci.
3. Inspection of the carcasses of beef and pork ensures that the meat which reaches the consumers is free from the cysticerci of tapeworm. Infected carcasses should be condemned, or processed into cooked products accordingly.
4. Practicing personal hygiene, especially washing hands before eating and after visiting a toilet and avoiding uncooked food which may potentially be contaminated with human feces (for the prevention of H.nana).
5. The consumption of raw beef, pork or fresh water fish must be avoided. Yet we acknowledge that avoiding raw beef eating is unlikely to be successful in present-day Ethiopia, because of the long held tradition of raw beef as one of the most popular national dishes.

6. Educate the public to prevent fecal contamination of soil, water and human and animal food; about the modes of transmission of Cestodes and about the importance of having latrine and its proper use.
7. Treatment of cases.

#### **6.5.4. Intestinal trematodes**

Definition- See core module

Etiology - See core module

Pathogenesis- See core module

##### **A. Epidemiology**

The epidemiologic importance of intestinal trematodes varies from region to region. The epidemiologic persistence of the parasites depends on the presence of an appropriate snail as an intermediate host. Accordingly, for example, *Schistosoma mansoni* with its appropriate intermediate host (snail) species of the genera *Biomphalaria* is the one that is prevalent in Ethiopia. Similarly, *Fasciola hepatica* is also prevalent in the country. Please refer to the core module for the occurrence of other species).

The magnitude of morbidity and mortality also depends on the species of the trematode. For instance schistosomiasis causes greater damage in terms of human life, economic losses etc, while fascioliasis is relatively mild.

Their mode of exit being similar i.e., through human excreta, their mode of entry is however, different in that the cercaria (infective stage of schistosoma) penetrates through the skin when the human host is in contact with water after the parasite finishes its life cycle in the intermediate host (the snail) and becomes free swimming. On the other hand, the metacercaria of Fascioliasis, that attach to aquatic plants encyst when ingested with uncooked aquatic plants, causing the disease in humans.

Their reservoirs are also different. Humans are the principal reservoir of *S. mansoni*, but they are an accidental host in Fascioliasis. The infections are maintained in nature in a cycle between other animal species, mainly sheep and cattle for fascioliasis and snails of the family Lymnacididae for *S. Mansoni*.

As to their incubation periods, acute systemic manifestations may occur in primary infections of Schistosomiasis 2 - 6 weeks after exposure, while it is variable in fascioliasis.

Susceptibility is universal in both, while reports indicate that schistosomiasis is more prevalent in people who have more contacts with infected water. Whereas fascioliasis is more common among people raising sheep and cattle, both diseases are not directly transmitted from person to person.

## **B. Clinical manifestations**

Please, refer to the core module

## **C. Diagnosis**

The general diagnostic methods are indicated in the core module, but the environmental health experts can also detect the adult flukes during post mortem examination of sheep and /or cattle, by slicing through the liver across the bile duct. Details can be learnt in the meat hygiene course.

## **D. Case Management**

This is beyond the scope of the satellite module. Any interested student can refer to the core module.

## **E. Prevention and control**

As in most infections caused by the etiologies that have their life cycles in two hosts (definitive and intermediate hosts) eradication of the infections of intestinal trematodes is very difficult, since the strategies of eradication should involve two or more focal areas, variety of methods, and multidisciplinary approach.

These, in turn require huge resources as well as dedications from the responsible and collaborators. Thus, prevention and control techniques are the options given attention, though these techniques themselves have been partially successful due to the above mentioned associated problems.

On the other hand, the infections have common environmental factors that can be intervened simultaneously for cutting of the chain of transmission of at least the two underlying medically important trematodes, most prevalent in the country. These are human excreta and human water supply.

### **1. Preventive measures**

#### **1.1. Proper excreta/waste disposal and provision of safe water supply**

The portal of exit of both the trematodes under discussion is through infected human feces. When this infected feces get access to water bodies (rivers, streams...) harboring the proper snails (intermediate hosts), the life cycles of the worms can be completed, i.e., the infections can be transmitted. This also indicates that the continuation of the generations of the parasites can be interrupted here, as they cannot develop/exist without getting access to water bodies containing the proper snail host. Therefore, if this connection is interrupted, the transmission of the infections is said to be stopped. Furthermore, it is clear that there will be a gradual decrease in the parasitic density.

Based on this background, the availability and proper utilization of excreta disposal/latrines is the basic preventive measure to focus on. The elimination of open defecations/urination and the proper construction of latrine so as not to contaminate water bodies is the primary effort expected from the health professionals in general, and the environmental health workers in particular.

However, failure of such strategies may occur with the involvement of wastes from other domestic or wild animals that can easily get access to water bodies (as in the case of cattle, sheep, etc). The intervention should be making water safe for human health. This includes making water free of the intermediate hosts as well as vegetation that temporarily serve as a habitat for the infective stages of the worms (as in fascioliasis). Moreover, animal wastes (dung) should not be allowed to contaminate any water body. Elimination of contacts with water bodies harboring snails is also recommended in the case of schistosomiasis.

The provision of adequate and safe water both for consumption and recreation (bathing and swimming) reduces the contact of humans with water bodies that carry the infectious agents (cercaria). But this advice is impracticable, because the use and habits related to water contact are difficult to alter. If this is unavoidable, then drying of the body with clean towel just after swimming/ washing/ contact of the body with contaminated water is mandatory in order to prevent the penetration of the skin with cercaria.

**1.2. Proper Cooking of aquatic plant** for human consumption and avoiding their exposure to wild or domestic animals will stop the transmission of fascioliasis. This requires

- Avoiding eating raw or under-cooked aquatic plants by humans.
- Avoid feeding the animals on aquatic plants



- Avoid growing aquatic plants with animal wastes
- Treat the animals to stop the shedding of eggs in their dung

### **1.3 Health Information Dissemination**

This aims at giving information about the cause, the mode of transmission and prevention of the infections. Besides this, it is used to develop the behavior of using proper excreta disposal to stop the transmission. Moreover, teaching about the early utilization of health services before irreversible damages/complications occur.

The above preventive measures are generally summarized under environmental sanitation. Next are measures dealing with the intermediate hosts and are usually known as **control measures**.

### **2. Control measures**

These measures are aimed at decreasing the density as well as the longevity of the intermediate hosts (snails)

#### **Measures of eliminating/reducing breeding sites**

This includes the management of water bodies so as to minimize the breeding conditions of the snails. The snails are known to inhabit and breed in relatively stagnant and deep water. Thus, making the water bodies comparatively shallower (exposed to the sun) and running (cascading) will make their environment unfavorable. Clearing plants that provide shades as well as habitat for metacercaria of fascioliasis is also necessary to alter the living and breeding environment. This process of environmental management for the prevention of infections requires a multilateral approach. This emanates from the fact that water bodies are used for irrigation purposes, power generations, and other economic purposes that necessitate the building of dams, canals, ponds, etc. Some of these constructions if not assessed and planned with health considerations, can enhance the breeding of the mollusks, which in turn may increase the prevalence and incidence of the infections especially in endemic areas. Therefore, intersectoral approach is recommended when dealing with such control strategies.

### **Biological control**



The introduction of other snail species that either compete for food and other life conditions of the snails or those that are predators of other mollusks are another way of decreasing their longevity as well as density. For example, *Marisa compatriotism* (snail species) eliminates the snail genera *Biomphalaria* (intermediate host for *Schistosoma mansoni*) and the snail family *Lymnacidae* (Intermediate host for *F. hepatica*).

### **Chemical control (molluscicides)**

This option is recommended when the other options can not be used due to different reasons (resource, skill, etc), because.

- Most molluscicides are highly toxic and thus dangerous to other aquatic life and humans
- Some of the chemicals persist for a long time in the environment (non biodegradable)
- They are expensive and also not available locally
- Their applications require skill

Therefore, their selection and application should be based upon toxicity level, persistence condition, cost, etc. Some recommended molluscicides are.

- Niclosamide (Bayluscide, Mallutox) (10 mg/L at room temperature)
- Endod (*Phytholecca dedocandra*) (Lemma toxin) dose similar with Niclosamide

- N.B.**
1. Preventive and control measure are usually used in two or more combinations
  2. The strategies and the methods should aim at humans and the intermediate hosts simultaneously.

**6.6. Post Test - Instruction** - Choose the best answer and circle the letter.

1. Which of the following stages of *E. histolytica* is responsible for its transmission?
  - A. A Trophozoite
  - B. B Larvae
  - C. C Cysts
  - D. D Eggs
  - E. E Adult
  
2. Which of the following are possible source(s) of fecal contamination of food and water?
  - A. Night soil fertilization
  - B. Defective piping
  - C. Flies
  - D. Soiled fingers
  - E. All of the above
  
3. Which of the following is not true about the prevention of Intestinal protozoan infection?
  - A. Hand washing after defecation and before eating
  - B. Sanitary disposal of human feces
  - C. Protection of food against fly contamination by screening
  - D. Health education of food handler about personal hygiene
  - E. None of the above
  
4. Which of the following is the possible mode of transmission of intestinal nematodes?
  - A. Through a contaminated finger
  - B. Through contaminated food
  - C. Through contaminated clothing or toys
  - D. All of the above

5. Which of the following is *not true* about the prevention and control of intestinal nematode infection?
- A. Provision of adequate latrines and their proper use
  - B. Avoiding uncooked vegetables from the diet
  - C. Preventing skin penetration of larvae by wearing shoes
  - D. Washing hand before eating and after visiting the toilet
  - E. Treatment of infected individuals
  - F. None of the above
6. Which of the following preventive measure is most effective in controlling all intestinal cestodes?
- A. Hand washing before eating
  - B. Use of latrine
  - C. Avoiding eating raw meat
  - D. Inspection of carcasses of beef and pork
7. Which of the following environmental factor is related to the transmission of intestinal trematodes?
- A. Air
  - B. Soil
  - C. Water
  - D. Food
8. Which of the following methods of prevention and control of intestinal trematodes is the most effective one?
- A. eradicating snails
  - B. treating all patients
  - C. environmental sanitation and environmental management
  - D. Killing all infected sheep and cattle, and replacing by new ones.
9. Which of the following category of professionals is necessary for effective prevention and control of intestinal trematode infection? It requires the involvement of
- A. the health professionals only

- B. the integrated work of veterinarians and sanitarians
- C. Multi-sectoral approach in the eradication of the intermediate hosts & treatment of patients.
- D. All of the above

### **6.7. Task Analysis**

The environmental health experts is expected to

1. Undertake periodic inspection and assessment of the sanitary conditions of bars, abattoirs, and other public catering places
2. Do periodic sampling and quality assessment of water and immediately notify to the concerned authority when it is found to be dangerous to health
3. Give health education to the community, families and the individual to bring about behavioral changes
4. Collaborate with other sectors to design and implement effective preventive and control measures for intestinal parasitosis.
5. Ask food handlers to have periodic medical check up and stool examination and get health certification as a requirement.
6. Carry out research in the field.

### **6.8. Keys to pretest & posttest**

1. C
2. E
3. E
4. D
5. F
6. C
7. C
8. C
9. D

## 6.9. References

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2. Parasitology for health Sciences students, lecture note series, Debu University, 2004.
3. Park's text book of preventive and social medicine; M/s Bandarsidas, Bhanot Publishers, Jabalpur, India.
4. CDC for figures on Life Cycles.

