

## Amoebiasis in One Health Perspective

### AUTHORS DETAIL

Watiba Danish<sup>1</sup>, Aamna Bibi<sup>1</sup>, Ayiza Suleman<sup>1</sup>, Fatima Naveed<sup>1</sup>, Muhammad Mehran Mouzzam Fuzail<sup>1</sup>, Momna Mehmood<sup>2</sup>, Sundas Afresham<sup>3</sup> and Muhammad Imran<sup>3\*</sup>

<sup>1</sup>Faculty of Veterinary Science, University of Agriculture, Faisalabad

<sup>2</sup>Institute of Physiology and Pharmacology, University of Agriculture, Faisalabad

<sup>3</sup>Department of Parasitology, University of Agriculture, Faisalabad

\*Corresponding author: Imran.asghar@uaf.edu.pk

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### INTRODUCTION

Amebiasis is an infection caused by the parasite *Entamoeba (E.) histolytica*, which is transmitted through contaminated food or water. Ingesting the parasite can lead to infection in the digestive tract. The parasite can also spread from person to person through contact with fecal matter, either directly or through contaminated objects (Kucik et al. 2004). People who have poor hygiene practices, those who live in areas with poor sanitation and those who travel to areas where amoebiasis is common are at a higher risk of infection. There are two main types of amoebiasis. First is Intestinal amoebiasis which is the most common form of amoebiasis and is characterized by symptoms such as diarrhea, abdominal pain, and weight loss. Second type is Extraintestinal amoebiasis (Nasrallah et al. 2022). This occurs when the parasite spreads from the intestine to other parts of the body, such as the liver, lungs, or brain. It can cause symptoms such as fever, weight loss, and pain in the affected area. It's important to note that some individuals may be infected with the parasite but show no symptoms, making it possible to spread the infection to others without realizing it (Kantor et al. 2018).

### Transmission

The most common mode of transmission for amoebiasis is through the consumption of contaminated food or water. This is because the parasite can survive for several days outside of the human body, allowing it to persist in contaminated sources (Zulfiqar et al. 2018). Contaminated

sources of food or water can include untreated water sources, such as lakes or rivers, as well as food been handled by infected individuals without proper hand washing (Uyttendaele et al. 2015). This can include raw fruits and vegetables that have not been properly washed or cooked meat that has not been fully cooked. In addition to food and water, amoebiasis can also be transmitted through person-to-person contact (Agbalaka et al. 2018). This can occur through the direct exchange of fecal matter, such as through sexual contact, or through indirect contact with contaminated objects or surfaces. For example, an infected individual who does not wash their hands after using the bathroom can spread the parasite to others by touching contaminated surfaces or objects (Dayaram et al. 2021). People who are at a higher risk for amoebiasis include those who live in areas with poor sanitation, those who travel to areas where the infection is more common, and those who have weakened immune systems. This includes individuals with HIV/AIDS, those undergoing chemotherapy, and individuals who have undergone organ transplantation. Additionally, people who have poor hygiene practices, such as not washing their hands regularly, are also at a higher risk of infection (Chappuis et al. 2004).

### Epidemiology

The prevalence studies on human amoebiasis suggest that the disease is prevalent and endemic in developing countries including South America, Asia, and Africa. It is commonly found in those areas where nutrition, water quality and hygiene status are very poor (Ali et al. 2008; Ximénez et al. 2009). The worldwide molecular prevalence of the disease is estimated up to 3.6% (Cui et al. 2019). However, the highest seroprevalence noted in Pakistan was 73% having more infection in those individuals admitted in the hospitals (Samie et al. 2020). Table 1 enlist various waterborne outbreaks of amoebiasis occurred in different regions of world.

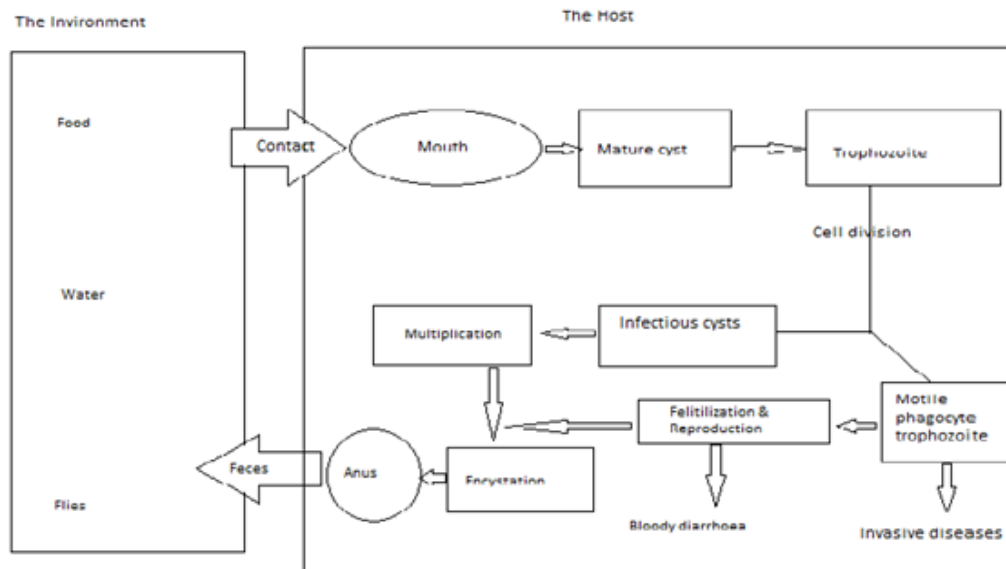
### Life Cycle

The life cycle of the parasite responsible for amoebiasis, *E. histolytica*, is relatively simple and involves three main stages: the cyst stage, the trophozoite stage, and the infective stage (Guillén 2023).

1. Cyst Stage: This stage is characterized by the formation of protective cysts that encapsulate the parasite and help it survive in the environment. The cysts are spherical structures with a tough outer layer that protects the parasite from harsh environmental conditions, such as changes in temperature, pH, and desiccation.

**Table 1:** Outbreaks of human amoebiasis in various regions of the world

Country	Cases	Suspected sources	Reference
US, Chicago	1507	Leaked sewage which contaminated the water pipes of hotels	Markell 1986
Italy	17	Contaminated ice cream and raw fruit consumption	De Lalla et al. 1992
Taiwan (China)	730	Contaminated underground water supply	Kow-Tong et al. 2001
Taiwan (China)	140	Traveling to endemic areas	Lai et al. 2000
Georgia	177	Contaminated municipal water	Barwick et al. 2002
Japan	13	-	Abe et al. 1999

**Fig. 1:** Life cycle of *E. histolytica* in humans (Hategekimana et al. 2016).

2. Trophozoite Stage: The cysts are ingested by a host and then release the trophozoites, which are the actively growing and reproducing stage of the parasite.

3. The trophozoites invade the intestinal wall and cause tissue damage, leading to symptoms such as abdominal pain, diarrhea, and bloody stools. In severe cases, the parasite can invade the liver and cause liver abscesses (Assafa et al. 2006).

4. Infective Stage: The trophozoites can then re-encapsulate themselves into cysts, which are then excreted from the host in the feces. These excreted cysts can infect new hosts when they are ingested, completing the life cycle of the parasite (Mortelmans et al. 1997). Fig. 1 illustrate the different stages of *E. histolytica* life cycle.

### Clinical Signs

Clinically, amoebiasis is of 2 types i.e., intestinal, and extra-intestinal amoebiasis. In majority of the infection (almost 90%) parasite colonizes in the large intestine of host leading to asymptomatic intestinal amoebiasis, while in others (10%) parasite may cross the intestinal barrier leading to amoebic abscesses and amoebic colitis (Kantor et al. 2018).

In asymptomatic infections, parasite colonizes in the colon, feeds on the commensal organisms and take nutrient from the host leading to the development of cyst that passes through the faeces and locate new host to continue its life cycle

(Carrero et al. 2020). In case of pathogenic *E. histolytica*, the trophozoite form of parasite may become invasive in nature and start to destroy the intestinal epithelium which provokes the inflammatory process ultimately leading to amoebic colitis (Nagaraja and Ankri 2019). The symptoms of amoebiasis can range from mild to severe and can include abdominal pain, diarrhea and bloody stools. In more severe cases, the parasite can invade the liver, causing liver abscesses, which can be life-threatening if left untreated (Li et al. 2021).

### Diagnosis

Early diagnosis and treatment of amoebiasis is important to prevent the progression of the infection and minimize the risk of complications. In this note, we will discuss the various methods of diagnosing amoebiasis (Shirley and Moonah 2016).

The first step in diagnosing amoebiasis is to take a thorough medical history and perform a physical examination. During this examination, the healthcare provider will ask about symptoms such as diarrhea, abdominal pain and weight loss, which are commonly associated with the infection. They may also ask about recent travel to areas where amoebiasis is more common, as well as any risk factors for the infection. The most common diagnostic test for amoebiasis is a stool sample

analysis. This test involves collecting a sample of stool and examining it for the presence of the parasite. This test is simple, non-invasive, and is often used as the first line of diagnosis for amebiasis. The healthcare provider may also perform a rectal swab test, which involves collecting a sample of the stool from the rectum (Tanyuksel and Petri Jr 2003).

### Tests for Amebiasis

In addition to stool sample analysis, other diagnostic tests that may be used to diagnose amebiasis include 1- Blood tests: This can help detect antibodies produced by the body in response to the parasite. This test is particularly useful in diagnosing extraintestinal amebiasis, which occurs when the parasite spreads to other parts of the body. 2- Imaging tests: This may include an X-ray, CT scan, or MRI, which can help detect the presence of the parasite in other parts of the body, such as the liver or lungs. 3- Endoscopy: This procedure involves inserting a flexible tube with a camera attached into the digestive tract in order to examine the intestinal lining. This test can help diagnose the presence of the parasite in the intestines and can also be used to obtain a sample for further testing. Once the diagnosis of amebiasis has been confirmed, the healthcare provider will discuss the appropriate treatment options with the patient. Treatment options may include medication, such as metronidazole or tinidazole, which are effective in eliminating the parasite. In severe cases, surgical intervention may be necessary to remove the infected tissue (Haque et al. 2003).

### Molecular Detection

Molecular detection methods are increasingly being used to diagnose amebiasis due to their high sensitivity and specificity compared to traditional diagnostic methods. Some of the most commonly used molecular detection methods for amebiasis include:

1. Polymerase Chain Reaction (PCR): PCR is a powerful technique that allows for the detection and amplification of specific DNA sequences. In the case of amebiasis, PCR can be used to detect the presence of the parasite's DNA in stool samples, providing a highly sensitive and specific diagnosis of the infection (Li et al. 2021).
2. Loop-Mediated Isothermal Amplification (LAMP): LAMP is a rapid, low-cost, and highly specific molecular detection method that is particularly useful for the detection of parasitic infections in resource-limited settings. LAMP can be used to detect the DNA of *E. histolytica* in stool samples, providing a rapid and accurate diagnosis of amebiasis (Uddin et al. 2021).
3. Real-Time PCR: Real-time PCR is a variation of PCR that allows for the simultaneous amplification and detection of DNA in real-time. This technique is highly sensitive and specific and can be used to detect the presence of the parasite's DNA in stool samples, providing a rapid and accurate diagnosis of amebiasis (Li et al. 2021).

4. Microarray: Microarray is a high-throughput molecular detection method that allows for the simultaneous analysis of multiple DNA sequences. In the case of amebiasis, microarray can be used to detect the presence of specific genetic markers associated with the parasite, providing a highly sensitive and specific diagnosis of the infection (Nagaraja and Ankri 2019).

It is important to note that molecular detection methods are not always readily available, particularly in resource-limited settings. Additionally, these methods may not be as accessible as traditional diagnostic methods, such as stool microscopy or antigen detection tests. Nevertheless, molecular detection methods have the potential to revolutionize the diagnosis and treatment of amebiasis and other parasitic infections, providing a rapid, accurate, and cost-effective means of detecting and managing these infections (Nagaraja and Ankri 2019).

### Treatment

Early detection and treatment of amebiasis is crucial to prevent the progression of the infection and minimize the risk of complications. Diagnosis of amebiasis is often delayed due to the lack of noticeable symptoms in the early stages of the infection. The symptoms of amebiasis can be similar to those of other digestive tract infections, such as dysentery, and therefore a correct diagnosis is often not made until the condition has advanced. In some cases, amebiasis can cause serious complications, such as liver abscesses or perforations in the intestine, which can be life-threatening if not treated promptly. Early treatment of amebiasis is also important to prevent the spread of the infection to others. The parasite that causes amebiasis is highly contagious and is spread through contaminated food, water, and surfaces. In addition, individuals who have been infected with amebiasis are at risk of re-infection, especially if they do not practice good hygiene habits and follow proper food and water safety practices. Early detection and treatment of amebiasis is also important to minimize the impact on a person's quality of life. Individuals who have been infected with amebiasis may experience a range of symptoms, including diarrhea, abdominal pain, and weight loss, which can be distressing and can significantly affect a person's daily life. Early treatment can help to alleviate these symptoms and minimize the impact on a person's quality of life. In conclusion, early detection and treatment of amebiasis is crucial in order to prevent the progression of the infection and minimize the risk of complications. By working with a healthcare provider and following proper hygiene practices, individuals can reduce their risk of infection and ensure prompt and effective treatment if necessary. Early detection and treatment can also help to minimize the impact on a person's quality of life and prevent the spread of the infection to others. By understanding the importance of early detection and treatment, individuals can take steps to ensure their health

and well-being, and prevent the spread of amoebiasis in their communities (Montaño et al. 2020).

### Home Remedies for Amoebiasis

Amoebiasis is an infection caused by the parasite *E. histolytica* and is most commonly found in developing countries with poor sanitation conditions. While it is important to seek medical treatment for amoebiasis, there are also several home remedies that can help to alleviate the symptoms and speed up the recovery process.

1. **Garlic:** Garlic has antimicrobial properties that can help kill the parasite causing amoebiasis. Crush 2-3 cloves of garlic and mix with a glass of water. Drink this mixture 2-3 times a day.
2. **Ginger:** Ginger has anti-inflammatory and anti-parasitic properties, making it effective in treating amoebiasis. Simply add 1-2 inches of fresh ginger to a cup of boiling water and let it steep for 10 minutes. Drink this tea 2-3 times a day.
3. **Aloe Vera:** Aloe vera has antimicrobial and anti-inflammatory properties, making it an effective home remedy for amoebiasis. Mix 1 tablespoon of aloe vera juice with 1 glass of water and drink 2-3 times a day.
4. **Turmeric:** Turmeric has antimicrobial properties that can help kill the parasite causing amoebiasis. Mix 1 teaspoon of turmeric with a glass of warm milk and drink twice a day.
5. **Papaya:** Papaya contains an enzyme called papain that helps break down proteins and has been found to be effective in treating amoebiasis. Eat 1-2 slices of ripe papaya daily, or take papaya supplements as directed by a healthcare professional.
6. **Yogurt:** Yogurt contains beneficial bacteria that can help restore the balance of bacteria in the gut and prevent the growth of the parasite causing amoebiasis. Eat plain, unsweetened yogurt daily.
7. **Fennel seeds:** Fennel seeds have antimicrobial and anti-inflammatory properties, making them effective in treating amoebiasis. Drink fennel seed tea 2-3 times a day. Simply boil 1 teaspoon of fennel seeds in a cup of water for 10 minutes, strain, and drink.
8. **Lemon:** Lemon is high in vitamin C, which has been shown to have antimicrobial properties. Mix 1 tablespoon of lemon juice with a glass of warm water and drink 2-3 times a day.
9. **Oregano:** Oregano has antimicrobial properties that can help kill the parasite causing amoebiasis. Add 1-2 drops of oregano oil to a glass of water and drink 2-3 times a day.
10. **Pumpkin seeds:** Pumpkin seeds are high in zinc, which has been shown to have antimicrobial properties. Eat a handful of pumpkin seeds daily or add them to your diet in the form of pumpkin seed oil or pumpkin seed supplements. It is important to note that these home remedies should not be used as a substitute for medical treatment, but rather as a complementary therapy to help alleviate symptoms and speed up the recovery process. If patient is experiencing symptoms

of amoebiasis, it is important to seek medical treatment as soon as possible (Mishra 2020; Passos et al. 2021).

### Preventive Measures

There are several prevention measures that can be taken to reduce the transmission of amoebiasis. These include:

1. **Proper hand washing:** Regular hand washing with soap and water is essential in reducing the spread of the parasite. This is particularly important after using the bathroom and before handling food.
2. **Safe food and water practices:** This includes avoiding contaminated food and water sources, as well as properly washing fruits and vegetables and cooking meat to the appropriate temperature.
3. **Safe sexual practices:** This includes avoiding sexual contact with infected individuals and using protection during sexual activity.
4. **Improved sanitation:** Improving sanitation in areas with a high incidence of amoebiasis can help reduce the spread of the parasite. This can include measures such as proper disposal of human waste, providing access to clean water, and increasing awareness about the importance of hygiene practices.
5. **Vaccinations:** Currently, there is no vaccine for amoebiasis, but research is ongoing to develop a vaccine that can prevent the infection (Li et al. 2021).

### Conclusion

Amoebiasis is a serious infection that requires prompt medical treatment. With proper treatment, the infection can be effectively treated and prevented from spreading to others. However, it is important to seek early detection and treatment to minimize the risk of complications and prevent the recurrence of the infection.

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