



Parasitic Infections: Etiology, Epidemiology, Pathogenesis, and Diagnosis

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ABSTRACT

Parasitic infections are diseases caused by protozoa, helminths, and ectoparasites that can affect the internal organs, blood, nervous system, and skin of the human body. [1] These infections remain a significant public health concern worldwide, particularly in developing countries. [1,10] This article provides a scientific review of their etiology, global epidemiology, pathogenesis, clinical manifestations, diagnostic approaches, treatment, and prevention strategies. Special attention is given to modern laboratory, serological, and molecular diagnostic methods, including Polymerase Chain Reaction (PCR) and Enzyme-Linked Immunosorbent Assay (ELISA). [4,6]

Keywords:

Parasitic infections, protozoa, helminths, ectoparasites, epidemiology, pathogenesis, clinical symptoms, laboratory diagnostics, molecular diagnostics, PCR, antiparasitic therapy, prevention

Introduction

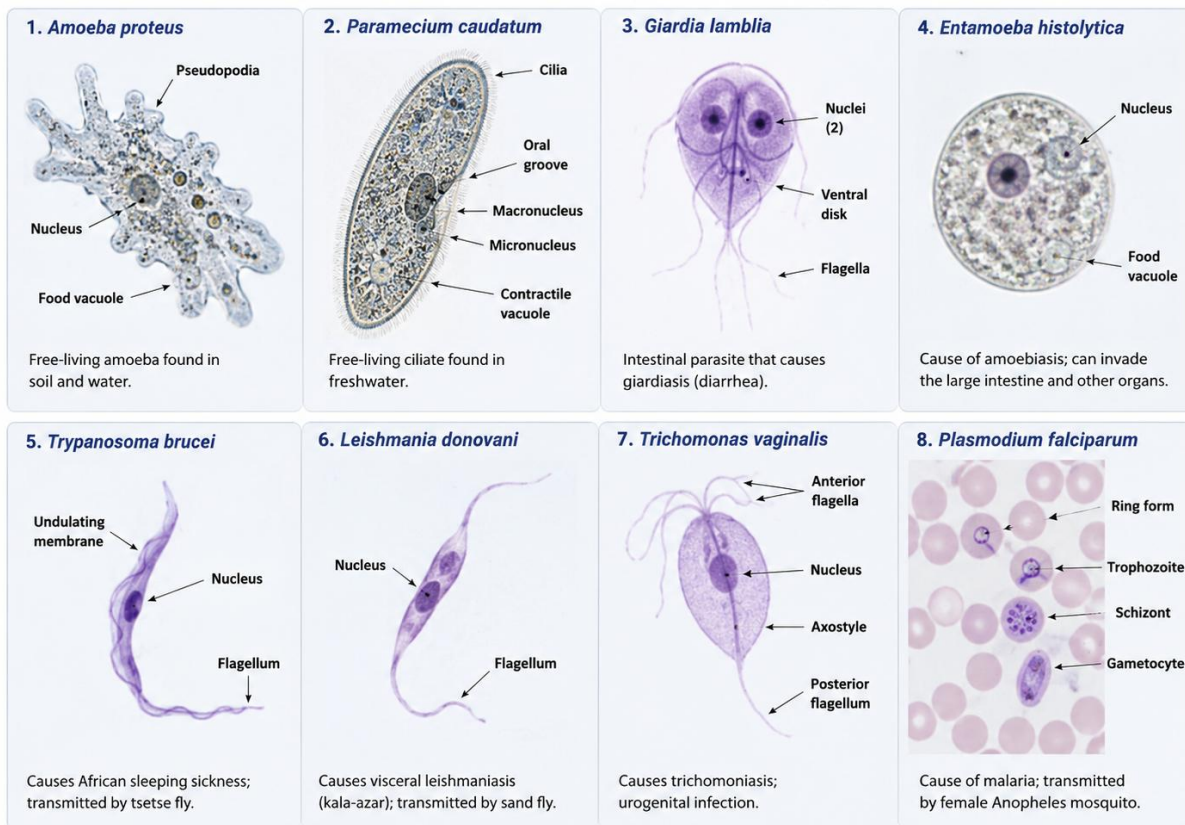
Parasitic infections are considered a serious global public health problem. [1] Parasites are organisms that live in or on another organism and obtain nutrients at the expense of the host. [2] Their effects can weaken the immune system

and cause pathological changes in internal organs. [3] According to WHO data, a large proportion of the world's population experiences at least one parasitic infection during their lifetime. [1,10]

Definitions and Etiology of Parasites

1. Protozoa

PROTOZOA – Common Examples



Protozoa are single-celled eukaryotic microorganisms. They may live freely in the environment or as parasites in humans and animals.

Figure 1. Common examples of protozoa and their structural features.

Definition: Protozoa are microscopic, single-celled eukaryotic organisms that can live and multiply within the human body. They commonly infect the gastrointestinal tract, blood, and various internal organs. [2,4]

Examples: Plasmodium spp., Toxoplasma gondii, Entamoeba histolytica. [4]

Modes of Transmission:

- Consumption of contaminated food and water. [2]
- Fecal-oral transmission. [2]

- Transmission through insect vectors (e.g., mosquitoes). [5]
- Contact with infected animals or contaminated environments. [4]

Pathogenesis: Protozoa invade host cells and tissues, where they multiply and cause cellular damage. Many species release toxic metabolites and evade immune defenses, resulting in inflammation, tissue destruction, and suppression of the host immune response. [3,6]

Treatment: Metronidazole, Tinidazole, or Antimalarial drugs (e.g., artemisinin-based combination therapies). [8]

2. Helminths

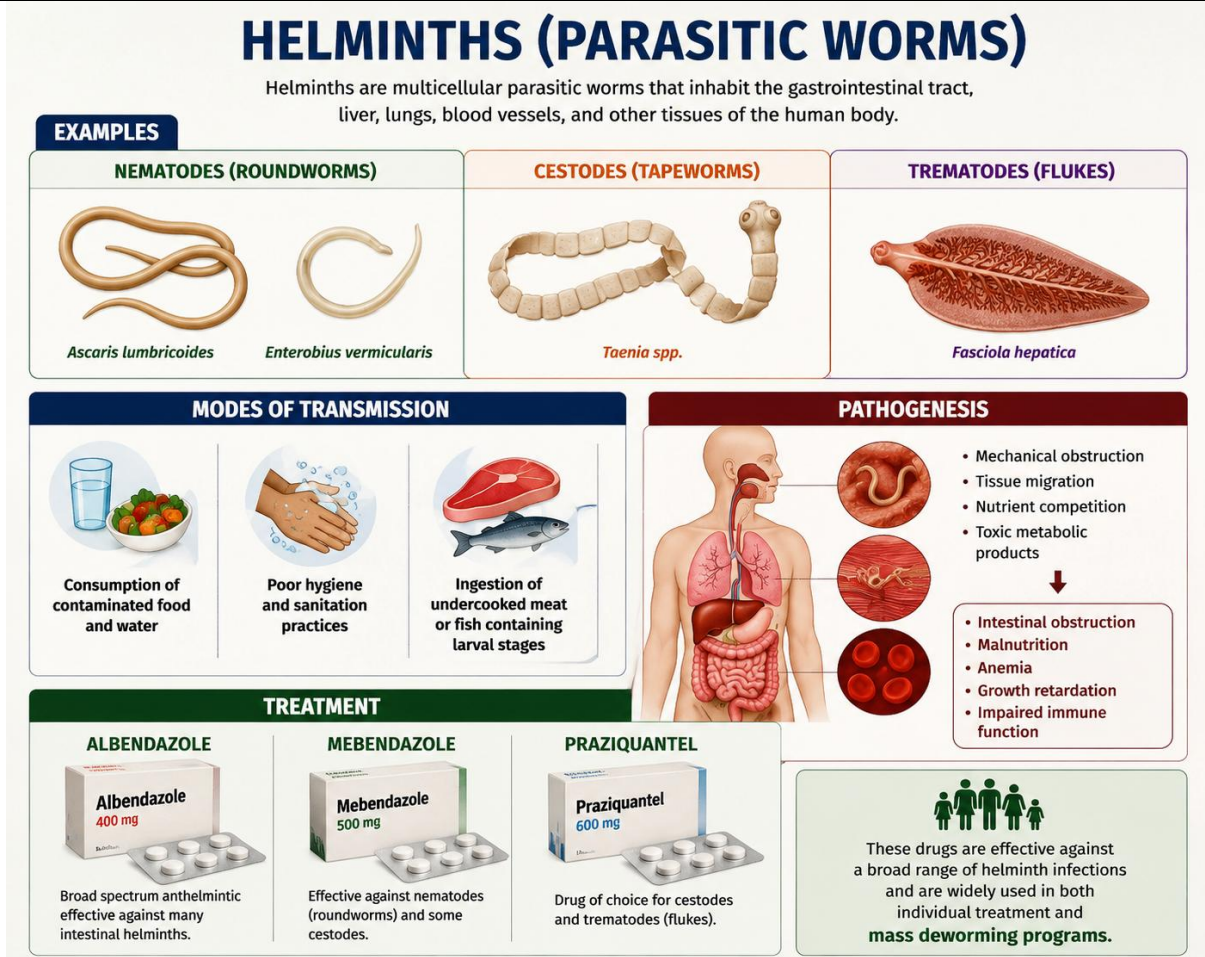


Figure 2. Helminths (parasitic worms): examples, transmission routes, pathogenesis, and treatment.

Definition: Helminths are multicellular parasitic worms that inhabit the gastrointestinal tract, liver, lungs, blood vessels, and other tissues of the human body. [3,4]

Examples:

- Nematodes (Roundworms): *Ascaris lumbricoides*, *Enterobius vermicularis*. [4,20]
- Cestodes (Tapeworms): *Taenia spp.* [4]
- Trematodes (Flukes): *Fasciola hepatica*. [4]

Modes of Transmission:

- Consumption of contaminated food and water. [2]

- Poor hygiene and sanitation practices. [1,16]
- Ingestion of undercooked meat or fish containing larval stages. [2,4]

Pathogenesis: Helminths cause disease through mechanical obstruction, tissue migration, nutrient competition, and toxic metabolic products. Chronic infections may lead to intestinal obstruction, malnutrition, anemia, growth retardation, and impaired immune function. [3,18]

Treatment: Albendazole, Mebendazole, and Praziquantel are effective against a broad range of helminth infections and are widely used in both individual treatment and mass deworming programs. [8,17]

3. Ectoparasites

ECTOPARASITES

Ectoparasites are parasites that live on the outer surface of the host's body.

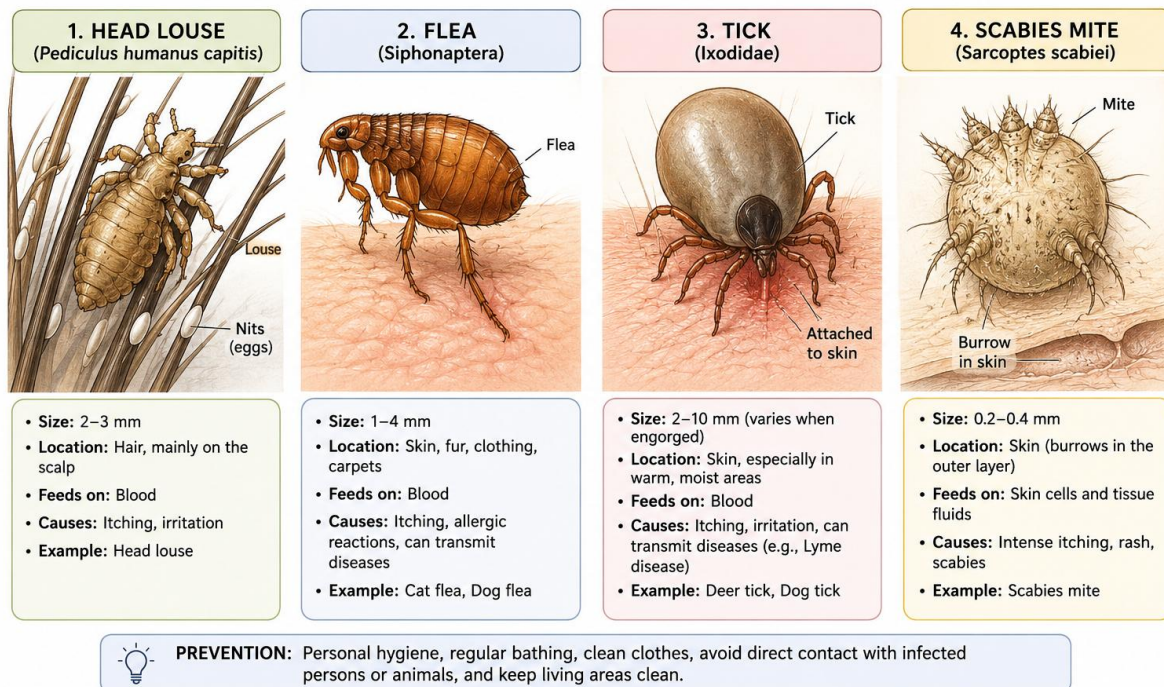


Figure 3. Common ectoparasites: head louse, flea, tick, and scabies mite.

Definition: Ectoparasites are parasites that live on the surface of the host's body, especially on the skin, hair, or clothing, and feed on blood or skin tissues for nutrition. [2,11]

Examples: Head louse (*Pediculus humanus capitis*), flea (*Siphonaptera*), tick (*Ixodidae*), scabies mite (*Sarcoptes scabiei*). [11]

Pathogenesis: Ectoparasites cause disease through direct skin irritation, blood feeding, and sometimes by transmitting infectious agents. [5,13]

Main Clinical Features:

- Intense itching (pruritus). [11,12]
- Allergic and inflammatory reactions. [12]
- Skin lesions and excoriations. [12]
- Secondary bacterial infections due to scratching. [13]
- In some cases, transmission of bacterial, viral, or parasitic diseases. [5,13]

Treatment: Permethrin, Malathion, medicated shampoos, lotions, and creams. Environmental decontamination and treatment of close contacts when necessary. [14]

Epidemiology

Parasitic infections are widely distributed worldwide and remain a major public health problem, especially in tropical and subtropical regions. [1] According to the World Health Organization (WHO), billions of people are at risk of parasitic diseases, and these infections continue to cause significant morbidity and mortality globally. [1,10]

The spread of parasitic infections is strongly associated with:

- Poor sanitation and hygiene. [16]
- Lack of access to clean drinking water. [16]
- Poverty and overcrowding. [7]
- Limited healthcare services. [7]
- Favorable environmental conditions for parasite survival. [5]

Many infected individuals remain asymptomatic, acting as reservoirs and contributing to ongoing transmission in the community. [15]

Socioeconomic Consequences:

- Reduced work productivity: Chronic infection may lead to fatigue, anemia, malnutrition, and decreased physical and cognitive performance. [10,18]

- Healthcare system burden: Diagnosis, treatment, and control programs require significant healthcare resources. [7]
- Organ damage and severe complications: Untreated infections may affect multiple organ systems, leading to disability or death. [6]

Prevalence of Ascariasis in the Kashkadarya Region

The highest prevalence of infection is observed among children, reaching 20–25%. [20] In adults, the infection rate is also relatively high, at 9–12%. [20]

| Region | Age Group | Morbidity Rate (%) | Notes |
|-------------|-----------|--------------------|---|
| Kashkadarya | 0–5 | 22–25 | Frequent contact with soil and an immature immune system are contributing risk factors. |
| Kashkadarya | 6–12 | 18–20 | Poor personal hygiene is common among school-aged children. |
| Kashkadarya | 13–17 | 15–18 | Children can prevent infections by maintaining proper personal hygiene. |
| Kashkadarya | 18–40 | 9–12 | The infection rate among adults is comparatively low. |
| Kashkadarya | 41–60 | 8–10 | Lower incidence is associated with reduced exposure to soil. |
| Kashkadarya | 60+ | 7–9 | Decreased immune status and reduced exposure to soil. |

Risk Factors:

- Frequent contact with soil due to agricultural activities. [20,21]
- Poor sanitation conditions. [1,16]
- Inadequate personal hygiene among children. [22]

The region can be considered endemic; therefore, treatment and preventive measures are necessary. [17] In rural areas such as Kashkadarya, soil contamination with parasite eggs is likely to be high. [20] Household sanitation plays an important role: in families with multiple children, transmission occurs more rapidly. [16] During the summer season, increased outdoor activities and frequent contact with soil contribute to higher infection rates. [21]

Prevention Measures:

- Improving personal hygiene. [16,22]
- Limiting contact with contaminated soil. [20]
- Implementing school-based health improvement programs. [22]

- Regular deworming (dehelminthization) in endemic areas is strongly recommended. [17]

Clinical Features, Pathogenesis, and Diagnosis

Clinical Features

- Digestive system: Diarrhea, abdominal pain, nausea, vomiting, and weight loss. [3,4]
- Skin: Itching (pruritus), rash, and redness. [12]
- Nervous system: Headache, sleep disturbances, irritability, and seizures. [3,6]
- Blood system: Anemia, fever, and lymphadenopathy (enlarged lymph nodes). [6,18]
- Respiratory system: Cough and difficulty breathing. [3]

Pathogenesis

Parasites invade body tissues, release toxic substances, suppress the host immune response, and disrupt normal organ function.

[3,6] Continuous tissue damage and immune modulation lead to chronic inflammation, malnutrition, and multi-organ dysfunction. [6,18]

Diagnosics

- Laboratory tests: Stool, blood, and urine analysis. [4]
- Microscopy: Detection of parasite eggs, larvae, or cysts. [4]
- Molecular methods: Polymerase Chain Reaction (PCR) and Enzyme-Linked Immunosorbent Assay (ELISA). [4,6]
- Imaging techniques: Ultrasound (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI). [6]
- Clinical evaluation: Patient history, living conditions, and hygiene assessment. [2]

Combined diagnostic approaches are considered the most reliable method for early detection of parasitic infections and for reducing complications. [4,6]

Treatment and Prevention

Treatment by Parasite Type

- Protozoa: Metronidazole, Tinidazole. [8]
- Helminths: Albendazole, Mebendazole, Praziquantel. [8,17]
- Ectoparasites: Permethrin, Malathion, medicated creams and shampoos. [14]

Prevention

- Hand washing with soap. [16]
- Drinking clean and safe water. [16]
- Proper food cooking and handling. [2]
- Maintaining personal hygiene. [22]
- Protection against insect bites. [5,13]
- Improving sanitation and environmental hygiene. [16]

Conclusion

Parasitic infections are a serious global public health problem that can damage multiple organ systems. [1,10] Implementation of evidence-based diagnostic methods, modern treatment approaches, and effective preventive measures can significantly reduce the burden of these diseases and prevent their spread. [4,17]

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