Epidemiological Status and Comprehensive Prevention and Control Strategies of Common Foodborne Parasitic Diseases

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Abstract: The incidence of foodborne parasitic diseases has continued to increase in recent years, becoming a public health safety issue that cannot be ignored. This raises higher requirements for related health education and preventive publicity. This paper describes common foodborne parasitic diseases and introduces the pathogens, transmission routes, and clinical symptoms of Taeniasis, Trichinellosis, Toxoplasmosis, and Paragonimiasis. Taeniasis is caused by the larval stage of the pork tapeworm, and humans become infected by consuming pork containing live cysticerci. Trichinellosis occurs when humans eat raw or undercooked pork containing Trichinella larvae cysts. Toxoplasmosis results from ingesting food or water contaminated with Toxoplasma oocysts. Paragonimiasis occurs when humans consume raw or undercooked crabs or crayfish containing live metacercariae of Paragonimus. Accordingly, comprehensive prevention and control measures are proposed, including promoting health education to enhance public awareness of disease prevention, strengthening livestock slaughter management, increasing control over dogs and cats to reduce transmission risk, and promptly understanding infection and distribution status while accurately reporting epidemics. These strategies provide effective measures for preventing and controlling foodborne parasitic diseases, reducing disease occurrence and transmission, and safeguarding public health.
***Keywords*:** foodborne parasitic diseases; comprehensive prevention and control; strategies

1. Introduction

In recent years, the reported incidence of foodborne parasitic diseases worldwide has continued to rise, which is closely related to the growth of international trade in fresh foods and the popularity of raw food consumption habits. Monitoring data show a significant increase in infections caused by foodborne parasites, which has become a major food safety concern. Foodborne parasitic diseases are characterized by strong concealment and variable incubation periods, posing great challenges to disease prevention and control. Common foodborne parasitic diseases affect the growth, development, and productivity of animals and can cause human infections, leading to various health problems. Therefore, this paper provides an in-depth understanding of the pathogens, transmission routes, and symptoms of common foodborne parasitic diseases to strengthen effective disease prevention and better ensure the safety of the public's life [1].

2. Common Foodborne Parasitic Diseases

2.1 Taeniasis

Taeniasis, also known as pork tapeworm infection, has a global distribution and is mainly prevalent in some countries in Europe and the Americas. In China, it is primarily distributed in North China, Northeast China, Northwest China, and southern regions such as Guangxi and Yunnan, with sporadic infections in other areas. The disease is mainly caused by residents' eating habits or improper methods of meat consumption, poor pig rearing practices, and improper human feces disposal. In areas with severe prevalence of taeniasis, local residents often have the habit of eating raw or undercooked pork, which plays a decisive role in disease transmission. Using the same knife and cutting board for raw and cooked pork can also cause cross-contamination, leading to human infection.In some parts of China, pigs are not kept in enclosures or toilets are rudimentary, allowing pigs to roam freely and ingest feces. In some areas, residents are not accustomed to using toilets, or human toilets are connected to pigpens, resulting in pigs becoming infected. Pigs and wild boars are the main intermediate hosts of the pork tapeworm, while humans are the only definitive host. Humans contract taeniasis by consuming raw or undercooked infected pork. Generally, there are no obvious symptoms, but a few patients may experience muscle soreness or pain. If a large number of cysticerci parasitize the muscles, pseudo-muscle hypertrophy may occur, with well-developed appearance of muscles but decreased motor ability. When cysticerci parasitize the brain, the severity depends on the number and location of cysticerci and the host's reactivity. Cysticerci in the brain can cause local inflammatory reactions, compress surrounding brain tissue, and obstruct cerebrospinal fluid circulation, leading to increased intracranial pressure [2].

Symptoms of headache may appear, and in severe cases, daily life and work can be affected. Movement disorders may occur, and as the disease progresses, paralysis can develop, seriously affecting quality of life [2].

2.2 Trichinellosis

Trichinellosis has a global distribution. Due to its implications for food safety and its significant threat to human health, it has received considerable attention as a foodborne parasitic disease in China. Pigs are the main source of human Trichinella infection. Pigs are primarily infected by ingesting feed containing Trichinella larvae cysts. Humans are mainly infected by consuming raw or undercooked pork containing Trichinella larvae cysts. Mild infections may be asymptomatic, but in most cases, symptoms are complex and diverse. Severe infections, if not treated promptly, have a high mortality rate.

The symptoms of trichinellosis are related to the parasitic stages of the worm in the human body. First, the invasion stage (early stage): the process in which larvae develop into adults in the small intestine. Intestinal lesions are dominant, and patients may experience nausea, vomiting, abdominal pain, and diarrhea, accompanied by anorexia, fatigue, low-grade fever, and other systemic reactions. Second, the larval migration stage (acute stage): the process in which larvae invade muscles, causing vasculitis and myositis. Clinically common, the prominent symptoms are generalized muscle pain and tenderness, especially in the gastrocnemius, biceps brachii, and triceps brachii. During larval migration, acute systemic symptoms may occur, such as acute systemic vasculitis; severe infection can lead to edema (commonly in the eyelids and face), fever, and eosinophilia. Patients may also experience dysphagia and speech disorders, focal pulmonary hemorrhage, pulmonary edema, myocarditis, pericardial effusion, and if the central nervous system is involved, intracranial hypertension. Death can result from heart failure, toxemia, or respiratory complications. Third, the cyst formation stage (recovery stage): the process of repair of damaged muscle cells. Muscle cells at the parasitic site gradually enlarge and spindle around the growing, coiled larvae, forming fusiform cysts surrounding the worms. As cysts form, acute inflammation subsides, and systemic symptoms gradually diminish or disappear, though myalgia may persist for several months. Severe infections can result in cachexia and may be complicated by pneumonia or encephalitis, even leading to death [3].

2.3 Toxoplasmosis

Toxoplasmosis is a zoonotic parasitic disease with a global distribution, and human infection is quite common, though mostly latent. People engaged in animal-related occupations have higher infection rates, and the increase in both domestic and stray cats also raises the risk of Toxoplasma transmission. In addition, certain regional dietary habits can increase the risk of Toxoplasma infection. The definitive hosts of Toxoplasma are mainly felines, while the intermediate hosts are diverse and widely distributed, ranging from reptiles and birds to mammals. Humans are primarily infected by ingesting food or water contaminated with Toxoplasma oocysts.

Toxoplasmosis can be classified as congenital or acquired. Congenital toxoplasmosis occurs when the fetus is infected via the placenta. Infection during early pregnancy can lead to stillbirth, miscarriage, preterm birth, or fetal malformation. Infection during mid to late pregnancy often results in asymptomatic infants at birth, who may later develop symptoms such as chorioretinitis or neurological disorders associated with congenital toxoplasmosis. Acquired toxoplasmosis occurs postnatally and generally presents without specific symptoms; commonly observed manifestations include lymphadenopathy, followed by irregular low-grade fever, encephalitis, or meningoencephalitis. Adults are typically asymptomatic carriers [5], showing only positive serological antibodies. When immune function is impaired, latent infection may progress to severe disease. Severe toxoplasmosis often occurs secondary to HIV/AIDS, leukemia, or the use of high-dose immunosuppressants.

2.4 Paragonimiasis

Paragonimiasis, commonly known as lung fluke disease, involves freshwater crabs and crayfish (small lobsters in Northeast China) as the intermediate hosts of Paragonimus westermani. The metacercariae of P. westermani parasitize the bodies of crabs and crayfish, and humans become infected by consuming raw or undercooked crabs or crayfish containing live metacercariae. The cysts of P. westermani are highly resistant; pickling or preparing “drunken” crabs cannot kill the metacercariae, making consumption extremely hazardous. In addition, live cysts contaminating utensils or water sources can lead to infection if people drink such untreated water. Many factors influence the prevalence of paragonimiasis. Mountainous geography, suitable climatic conditions, and the abundance and diversity of animal hosts provide a broad basis for its natural endemic distribution. Crabs and crayfish from endemic areas may cause infections or even disease outbreaks among urban residents. Adult flukes parasitize the lungs of carnivores such as dogs, cats, tigers, leopards, pigs, foxes, leopard cats, wildcats, civets, and binturongs, and humans can also become infected.

Paragonimiasis is mainly caused by adult flukes migrating or residing in the body, or by their metabolic products, which can lead to lesions in multiple tissues and organs. Clinical manifestations are complex and can be divided into two types. First, the pulmonary type: symptoms include cough, chest pain, rust-colored or blood-streaked sputum, and “peach-bloody”

sputum, as well as signs related to pleural lesions. Mild infections may be asymptomatic. Second, the extrapulmonary type: commonly presents as subcutaneous nodules, abdominal type, hepatic type, or pericardial type; less commonly, cerebral, spinal, ocular, and scrotal nodule types may occur, each with associated symptoms. Mild infections may also show no obvious symptoms.

3. Specific Measures for Infection Prevention and Control in Public Health Education

3.1 Conducting Health Education

To improve public awareness and prevention capabilities regarding foodborne parasitic diseases, specialized programs should be produced, popular science articles released, interactive educational games developed, and online prevention knowledge competitions actively organized. Professional personnel should be organized to conduct centralized training, explaining the hazards, transmission routes, and prevention and control methods of foodborne parasitic diseases. Public lectures on common foodborne parasitic diseases should be conducted to help the public recognize the potential health risks associated with certain behaviors. Experts introduce the types of common foodborne parasitic diseases and elaborate on their harm, including damage to various human organs. The symptoms of foodborne parasitic diseases should be explained; for example, Ascaris infection may cause abdominal pain, loss of appetite, and nausea, while Paragonimus infection may present with cough, hemoptysis, and chest pain resembling pneumonia, enabling the public to preliminarily assess potential infection based on their own symptoms.Regarding food sources, guidance should be provided on which foods are likely to carry parasites. Freshwater fish, shrimp, crabs, and snails may carry liver or lung flukes. Raw or undercooked pork and beef may harbor tapeworms. Vegetables and fruits irrigated with contaminated water and inadequately washed may carry Ascaris eggs. Unhealthy dietary habits are an important cause of infection: consuming raw fish, drunken shrimp, drunken crabs, and other raw foods, insufficient cooking during meal preparation, and using the same cutting boards and knives for raw and cooked foods can all easily lead to parasitic infection.Regarding dietary hygiene, the public should be instructed to ensure that food is thoroughly cooked, with meat and fish heated to sufficient temperatures and durations to kill potential parasites. When cooking freshwater fish, the internal temperature should reach above 70°C for several minutes. The public should be reminded not to drink raw water and not to eat foods of unknown origin or without inspection and quarantine.For personal hygiene, hands should be washed frequently, especially before and after handling raw food and before meals and after using the toilet. Fingernails should be trimmed regularly to prevent dirt accumulation and reduce the chance of parasite eggs entering the mouth. Regarding kitchen hygiene, the public should be advised to store raw and cooked foods separately, use different cutting boards and knives for raw and cooked foods, and regularly clean and disinfect kitchen utensils. In dietary habits, strong promotion should encourage the public to gradually abandon the consumption of raw or undercooked fish, mollusks, and meats. When enjoying barbecues, hot pots, or Western cuisine, the mindset of eating medium-rare meat solely for taste should be changed, ensuring that meat is fully cooked before consumption.In the agricultural and animal husbandry production process, measures should be taken to reduce environments conducive to parasite growth and transmission, creating a healthy and safe living and production environment [6].

3.2 Strengthening Livestock Slaughter Management

To effectively prevent and control common foodborne parasitic diseases, the national regulations should be strictly followed to implement the policy of designated livestock slaughtering. During the slaughter process, quarantine and inspection work must be thoroughly conducted, leaving no potential hazards unchecked. Lesioned internal organs identified during quarantine inspections should undergo standardized harmless disposal. Management of diseased internal organs should be strengthened, strictly prohibiting their random disposal to avoid environmental exposure that could increase the risk of parasite transmission. Discarded livestock organs should be deeply buried, using soil coverage and natural degradation to minimize the possibility of parasite survival and spread. Quarantine supervision of the transportation of animals and animal products should be reinforced, strictly controlling the circulation of animals and products to ensure that those entering the market have passed rigorous inspection and meet safety standards. This reduces the transmission risk of common foodborne parasitic diseases such as cysticercosis, trichinellosis, toxoplasmosis, and sarcocystosis [7].

In the management of cats and dogs, basic information for each animal, deworming dates, and details of deworming medications should be recorded to track the health status of domestic dogs and cats. In terms of raising practices, owners should be guided to keep dogs on leashes and cats in enclosures, thereby reducing contact with the external environment, lowering the probability of parasite infection, and preventing the spread of parasites through free-roaming pets. Effective control measures should be applied to stray dogs and cats, including centralized adoption. In dedicated adoption facilities, stray dogs and cats should be provided with necessary living conditions. Harmless disposal of dog and cat feces should be

carried out using deep burial or incineration to eliminate parasite eggs and larvae, effectively interrupting the transmission pathways of parasites [8].

3.3 Strengthening the Monitoring and Management of Foodborne Parasitic Diseases

Foodborne parasitic diseases are characterized by strong concealment and variable incubation periods, making epidemic reporting a crucial step for timely detection and control of disease transmission. Therefore, during disease prevention and control, reporting procedures should be clarified, report contents standardized, and relevant units such as medical institutions and disease control centers encouraged to strictly follow standards when reporting epidemics. An effective supervision mechanism should be established to strictly handle behaviors such as underreporting or omission, ensuring timely and accurate transmission of epidemic information. Furthermore, the parasitic disease prevention and control information system should be improved, with data collection encompassing case information of foodborne parasitic diseases, epidemiological survey data, and related environmental factors [9].

Specific monitoring programs should be formulated for each foodborne parasitic disease. In the management of cysticercosis, monitoring should be strengthened at all stages of pig farming, slaughter, and sales, with regular testing of pigs to prevent infected pork from entering the market. Monitoring of trichinellosis should focus on meat processing enterprises to ensure that meat products undergo strict inspection and quarantine. In the monitoring of toxoplasmosis, special attention should be given to pet owners and pregnant women, strengthening health education and screening among these populations. Monitoring of sarcocystosis, Haplorchis taichui, and Clonorchis sinensis should focus on transmission pathways, including surveillance of aquaculture and water sources. The monitoring network should cover both urban and rural areas, establishing multi-level monitoring stations. Local stations are responsible for collecting regional epidemic information and promptly reporting it to higher authorities. Higher-level authorities can then understand the incidence patterns of foodborne parasitic diseases across different regions and seasons, providing strong support for targeted prevention and control measures [10].

4. Conclusion

Foodborne parasitic diseases are diverse and have complex pathogenic causes. People often become infected due to a lack of understanding of these diseases. Therefore, controlling sources of infection, interrupting transmission routes, and protecting susceptible populations are the main strategies for prevention and control.

Prevention of foodborne parasitic diseases focuses on understanding their transmission pathways and hazards, enhancing public knowledge of common diseases such as cysticercosis, trichinellosis, toxoplasmosis, and paragonimiasis, and effectively promoting health education in practice. This improves public awareness and preventive capabilities, encouraging the modification or abandonment of poor hygiene and dietary habits, thereby reducing disease transmission at its source. Strengthening livestock slaughter management and improving the control of dogs and cats effectively lowers the risk of parasite transmission, safeguarding both animal and human health. Establishing a sound monitoring network and reporting epidemics promptly and accurately helps track infection and distribution patterns, providing strong support for targeted prevention and control measures.With coordinated action across society and the active implementation of comprehensive and effective control measures, the occurrence and spread of foodborne parasitic diseases can be minimized, thereby protecting public health.

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