

Research on the Epidemiology of Zoonotic Diseases due to Overgrazing - Take Echinococcosis as an Example

Jingyaoshu Xu

Hunan Agricultural University,
Changsha, Hunan, China
3772869388@qq.com

Abstract:

Echinococcosis is a global zoonotic disease caused by *Echinococcus granulosus* and *Echinococcus multilocularis*, posing a serious threat to human health, livestock production and ecological balance. This review examines the epidemiological characteristics of echinococcosis, focusing on the amplifying role of overgrazing in disease transmission. Overgrazing disrupts grassland ecosystems and increases contact between wild canids (foxes, wolves), domestic animals (sheep, cattle) and humans, thereby facilitating the transmission of tapeworm eggs in contaminated environments. Clinical manifestations in humans include pressure organ damage, systemic toxicity and life-threatening anaphylactic reactions, with ruptured cysts and complications leading to high rates of recurrence and mortality. Based on the analyses, this paper proposes corresponding preventive strategies that emphasise comprehensive management of domestic animals in transitional grazing areas, safe handling of infected livestock organs and public health education to interrupt the 'wildlife-livestock-human' transmission chain.

Keywords: Echinococcosis, overgrazing, zoonotic diseases, Livestock, Endoparasites

1. Introduction

Cystic echinococcosis (CE) is a parasitic disease known since ancient times, documented by Hippocrates and Aristotle as "a cyst full of water" in human livers and lungs [1]. The pathogen of this disease is the larva of *Echinococcus* tapeworm. Among them, the most common ones are the larva of *Echinococcus granulosus* (hydatid cyst) and the larva of *Echinococcus multilocularis* (alveolar hydatid cyst).

In nature, dogs, wolves, and foxes are their ultimate hosts and the most important source of infection leading to the widespread spread of the disease. Infection occurs mainly when humans or other animals accidentally ingest food and water contaminated with an encapsulated cyst. Adult tapeworms of *Echinococcus granulosus* parasitised in the intestinal tract of the final hosts lay and excrete the larvae in the feces, thus contaminating the environment, such as pasture and water sources. Intermediate hosts, such as sheep,

cattle, camels, etc., may be contaminated with food or water, causing the tapeworm larvae to hatch in the body and spread to the liver, lungs and other organs with the bloodstream, and then develop into worm cysts. If the final host ingests the infected organs of the intermediate host (e.g. liver and lungs containing cysts), the larvae develop into adult worms in the intestines, thus completing the cycle of infection. In humans, infection is mainly through accidental ingestion of the larvae, including eating without washing hands after contact with skin and feces carrying the larvae, or consuming vegetables, fruits, water or dust contaminated with the larvae.

As the population continues to grow, overgrazing in areas where animal farming is the main mode of production exerts enormous pressure on the local ecosystem while raising the chances of interaction between farm animals and wild animals. Wild animals usually carry numerous pathogens of human-animal disease, e.g., encapsulated disease, and spread them to farm animals during contact. And if humans eat or touch farm animals with pathogens, they are highly susceptible to contracting the disease. The risk of contracting this type of disease is higher, and the prevalence of the disease is particularly severe due to the lifestyle habits of pastoralists.

Therefore, this paper uses a literature review to examine the impact of cystic echinococcosis, particularly on the population and environment of overgrazed areas. The analysis aims to highlight the dangers of zoonotic disease epidemics and the contribution of overgrazing to epidemics, thus helping people to recognise the dangers of disease and to establish normal living habits and awareness of the need to protect the environment.

2. Echinococcosis

2.1 Current conditions

Echinococcosis (also known as 'hydatidosis' or 'hydatid disease') is a severe zoonotic disease that poses a dual threat to human health and animal production, especially in ecosystems where human-livestock-wildlife co-exists in a complex transmission network [2].

In Europe, the risk for echinococcoses posed by wildlife populations is well studied in Europe, mainly for *Echinococcus multilocularis*, the causative agent of alveolar echinococcosis (AE), whose lifecycle is based on a transmission system between wild canids (mainly foxes) and arvicoline rodents [3]. In these areas, echinococcosis mainly takes wild canids (mainly foxes) and arvicoline rodents as the sources of transmission, and it is transmitted to humans through the lifecycle in which both humans and wild animals are involved. In the Limpopo National

Park (LNP) area, the relatively resource-poor rural communities are predominantly based on the rearing of traditional livestock animals such as cattle, goats, pigs and dogs [1]. In recent years, the rapid development of animal husbandry in rural China has also led to the problem of zoonosis. In the Xinjiang region, where the phenomenon of overgrazing exists, Xinjiang had the highest proportion (46%) of newly diagnosed zoonotic diseases in the country by the end of 2021, with zoonotic diseases occurring in 14 cities and 81 counties in Xinjiang [4]. Among them, Changji Hui Autonomous Prefecture and Ili Kazakh Autonomous Prefecture reported the highest number of cases [5-6]. In addition, a cross-sectional study of the infection status and factors affecting three common zoonotic diseases (echinococcosis, brucellosis and tuberculosis) among rural residents in three counties/districts of Wuzhong City, Ningxia, has demonstrated that the number of people suffering from encapsulated disease is increasing in China [7].

2.2 Epidemiological characteristics

Although transmission between humans and animals has also been curbed in recent years, in some areas of overgrazing, grassland degradation has led to the overlap of wildlife habitats with human pastures, forming a 'wild animal-livestock-human' transmission network, which crosses over the originally independent natural cycle with livestock production systems, significantly increasing the probability of cross-species infection.

Echinococcosis is a high fatality rate and a strong tendency to recur, causing a decline in the physical condition of livestock, the loss of reproductive ability, and even causing widespread livestock mortality. The infected organs (liver and lungs) lose their value due to the formation of encapsulation directly leading to a decrease in the yield and quality of livestock products, causing huge losses to the economy [2,8].

And since echinococcus larvae can parasitise multiple sites in the human body, the clinical manifestations of their symptoms are quite complex. The common manifestations can be summarised into 4 general categories, which are Compression and irritation symptoms, Systemic toxic symptoms, local lumps, and allergic symptoms. Localised areas of parasitic worm cysts are associated with slight pain, heaviness and distension, resulting in symptoms of compression and irritation, e.g., dull pain in the liver region in hepatic encapsulation, respiratory irritation in pulmonary encapsulation, and increased intracranial pressure in cerebral encapsulation. In both hepatic and abdominal encapsulation, localised masses of varying sizes, with smooth surfaces and clear boundaries, are usually palpable. In addition, systemic toxicity symptoms main-

ly reflected in loss of appetite, weight loss, emaciation, developmental disorders, etc.. Allergic symptoms mainly embodied in skin itching, urticaria, angioneurotic edema, and so on. Especially when the encapsulated cyst ruptures, it often causes severe anaphylaxis [9]. Among them, rupture of an echinococcal cyst is a common and serious complication, often caused by trauma or puncture. The cyst ruptures into the bile duct, abdominal cavity, or thoracic cavity. When a cyst ruptures into the bile duct, it can cause biliary obstruction, leading to paroxysmal biliary colic and jaundice. Entering the thoracic cavity can cause pulmonary oedema, lung abscess and hepatobronchial fistula, which can lead to chest pain and coughing. And entry into the abdominal cavity causes severe abdominal pain, abdominal muscle spasms, compression pain and other acute abdominal manifestations. The extremely high internal tension of *Echinococcus granulosus* inevitably leads to exudation of cystic fluid during diagnostic puncture, which in turn triggers severe allergic reactions and may even lead to anaphylaxis. Among the 1,314 cases of hepatic hydatid disease reported by Xu Mingqian, 20.2% were complicated by infection, 9.9% by rupture, 1.9% by anaphylaxis, 1.4% by disseminated secondary encysted cysts, and 2.4% by portal hypertension.

3. Overgrazing

Overgrazing refers to the behavior of having an excessively high density of livestock grazing on the grassland within a certain area, which exceeds the regulatory capacity of the regional ecosystem. Both having too many livestock grazing on the grassland or grazing for too long a time may lead to the situation where the grassland vegetation cannot be restored and renewed in a timely manner. Eventually, it will result in the degradation of the grassland, having an adverse impact on the health of the grassland ecosystem. In addition, it will also affect the soil quality and the sustainable utilization of water resources. The soil will suffer from erosion, accelerating the process of grassland land degradation and causing the pollution and loss of water and soil resources [10]. Epidemiological evidence shows that the incidence of echinococcosis in such areas is significantly higher than that in the surrounding areas that are not overgrazed, revealing that overgrazing contributes to the increase in the frequency of contact between wildlife, domestic animals and human beings by destroying the ecological boundary between humans - animals - wildlife, which not only exacerbates the diffusion of contamination of fine-grained *Echinococcus* or multi-homed *Echinococcus cestodes*' eggs in the environment such as pasture grasses and water sources but also creates the conditions for the transmission cycle of cestodes be-

tween the final and intermediate hosts, ultimately leading to the spreading of echinococcosis. This creates conditions for the transmission cycle between final and intermediate hosts, which ultimately leads to a higher risk of zoonotic diseases.

4. Treatment and recommendations

Due to the inability to control its complications and to effectively solve the problem of postoperative recurrence, the issue of drug treatment has received increasing attention from people in recent years. The commonly used drugs are albendazole (mebendazole) and praziquantel. Albendazole (mebendazole) has a very low absorption rate after oral administration, and the blood concentration varies greatly among individuals. Its effective metabolite is albendazole sulfoxide. The internationally recommended therapeutic dose is 8-15 mg/(kg·d), with continuous administration for 4 weeks followed by a 2-week drug withdrawal period. This can be repeated for 3-4 courses of treatment. In China, the commonly used dose of the tablet form is 20 mg/(kg·d), but no improvement in curative effect has been observed.

In the field of disease prevention, a comprehensive prevention and control system needs to be constructed in terms of both cutting the chain of transmission and strengthening individual protection. Public health measures should focus on the management of domestic dogs and slaughtering control, through the implementation of the domestic dog registration system to control the number of unowned dogs, and regular deworming treatment of sheepdogs, etc., to reduce the emission of eggs from the source. At the same time, it is necessary to regulate the market and home slaughtering process, and carry out harmless treatment of domestic animal organs infected with *Echinococcus granulosus*, so as to block the way for dogs to form the tapeworm life history cycle through ingestion of infected organs. At the level of individual protection, public awareness of the risk of egg transmission needs to be raised through health education, emphasising hygienic practices during pastoral activities and avoiding direct contact with dogs and their excreta. In case of accidental contact, hand washing is required. And not consuming unwashed raw and cold food or contaminated water sources to reduce the possibility of accidental ingestion of worm eggs. These measures work synergistically to break the vicious cycle of 'overgrazing - ecological damage - pathogen spread - trans-host transmission' and effectively control the epidemiological situation of echinococcosis among humans, animals and wildlife.

5. Conclusion

This review highlights the complex interactions between anthropogenic activities (especially overgrazing), ecological damage and the dynamics of echinococcosis transmission. Overgrazing is a key driver, eroding species-specific ecological boundaries and creating favourable conditions for cross-species transmission of pathogens and environmental contamination. Echinococcosis destroys livestock productivity and is a life-threatening human disease that requires coordinated interventions from the veterinary, medical and environmental sectors. As the global population grows and land use intensifies, addressing echinococcosis requires a holistic framework that strikes a balance between livestock development and ecological sustainability. Recognising that overgrazing harms both the environment and public health, stakeholders can implement targeted strategies to break the transmission cycle, thereby safeguarding human and animal health while protecting fragile grassland ecosystems.

However, this paper has certain shortcomings, including a lack of social experiments and a relatively small number of references and relevant data information. In addition, in response to the research on zoonotic diseases only, this paper selects only one disease to be analysed, which has limited representativeness.

References

- [1] Sotiraki, S., Himonas, C., & Korkoliakou, P. (2003). Hydatidosis–echinococcosis in Greece. *Acta tropica*, 85(2), 197-201.
- [2] Liu, B.X., Chen, Q.H., Cai, J.S., Li J. & Liu. Y.M. (2025). The Effect of Lamb Vaccination Against Echinococcosis on the Scale of Livestock Farming in Northwestern China. *Veterinary medicine and science*. (2), e70273. DOI: 10.1002/vms3.70273.
- [3] Romig, T., Deplazes, P., Jenkins, D., Giraudoux, P., Massolo, A., Craig, P.S., Wassermann, M., Takahashi, K & de la Rue, M. (2017). Chapter Five - Ecology and Life Cycle Patterns of Echinococcus Species. *Advances in Parasitology*. Ed. Thompson, R.C.A., Deplazes, P. and Lymbery, A.J. Academic Press. 95, pp. 213-314, DOI: 10.1016/bs.apar.2016.11.002.
- [4] Kuai Y., Xue C.Z., Wang X., Liu, B.X., Wang, Y., Wang, L.Y., Yang, S. J., Han, S., Wu, W.P. & Xiao, N. (2023). Progress of echinococcosis control in China, 2021. *Chinese Journal of Parasitology and Parasitic Diseases*, 41(2): 142–148. DOI: 10.12140/j.issn.1000–7423.2023.02.003.
- [5] Sun, L. (2019). Current Status of Prevention and Control of Echinococcosis in Xinjiang and Preliminary Exploration of an Integrated Medical and Preventive Model. Xinjiang Medical University, Master thesis.
- [6] Tohan, G. Chen L.H. & Liu P.P. (2024). Knowledge, attitude and practice of prevention and control of echinococcosis and influencing factors in residents in Changji, Xinjiang Uygur Autonomous Region, 2021-2022. *Disease Surveillance*, (11), 1443-1449. DOI: 10.3784/jbjc.202310300565
- [7] Huo Y., Tang, J., Guo, M.X., Hou, S.Y. & Zhao, W. (2025). Epidemic status of echinococcosis, brucellosis, and tuberculosis among rural residents in three counties of Wuzhong City, Ningxia, China in 2023. *Parasite Epidemiology and Control*, 29, e00420. DOI: 10.1016/j.parepi.2025.e00420.
- [8] Yao J.X. (2025). Review on Epidemiology and Public Health Significance of Hydatidosis. *Journal of Animal Science and Veterinary Medicine*, 44(01), 96-102. DOI: 10.7606/j.issn.1004-6704.2025.01.023
- [9] Zhao J.M., He, M. P., Kang Q. (2008). Examination of a Case of “Porcine Echinococcus Granulosus” and Its Significance in Public Health. *Livestock and Poultry Industry*. (05):70. DOI: 10.19567/j.cnki.1008-0414.2008.05.036.
- [10] Wang X.Y., Yang J.Y., Guo J.R. & Feng, J.G. (2021). An Analysis of the Existing Problems and Countermeasures in the Protection of Grasslands in Semi-farming and Semi-pastoral Areas. *Jilin Animal Husbandry and Veterinary Medicine*, 42(1): 87. DOI: 10.3969/j.issn.1672-2078.2021.01.069