

Study of public awareness, risk factors and preventive practices related to cystic echinococcosis in the endemic regions of the Republic of Azerbaijan

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Received: May 03, 2026; Reviewed: June 14, 2026; Accepted: June 18, 2026

Cystic echinococcosis remains an important zoonotic disease and a persistent public health concern, particularly in rural and endemic regions. The present study aimed to assess the level of knowledge, attitudes, and practices (KAP) related to echinococcosis and to identify the main epidemiological risk factors among the rural population. A cross-sectional questionnaire survey was conducted among 120 respondents from endemic areas. The questionnaire was structured into three sections covering epidemiological risk factors, medical history, and KAP-related indicators. Data were analyzed using descriptive statistical methods. The results demonstrated that favorable conditions for the transmission of echinococcosis are widely present in the study population. A high proportion of respondents reported dog ownership (68.3%), frequent contact with dogs (66.7%), and the presence of stray dogs in their environment (74.2%). In addition, livestock farming (57.5%), home slaughtering practices (52.5%), and feeding dogs with animal offal (30.0%) were identified as significant risk factors contributing to the maintenance of the parasite's life cycle. Hygienic practices were found to be suboptimal. Regular deworming of dogs was reported by only 39.2% of respondents, while inadequate hand hygiene and reliance on non-centralized water sources were common. Furthermore, only 50.0% of respondents had general knowledge about echinococcosis, and awareness of preventive measures was even lower (43.3%). However, a relatively high proportion (69.2%) expressed willingness to participate in educational activities. In conclusion, the study highlights insufficient awareness and widespread risk behaviors contributing to the transmission of echinococcosis. Strengthening public health education, improving veterinary control measures, ensuring safe water supply, and promoting hygienic practices are essential for effective disease prevention in endemic regions.

Keywords: *Cystic echinococcosis, risk factors, rural population, dog ownership, hygiene practices, endemic regions, epidemiology*

INTRODUCTION

Cystic echinococcosis remains a significant public health concern worldwide. Increased prevalence of the disease has been associated with residence in rural areas, low educational attainment, engagement in agricultural and livestock-related activities, dog ownership, inadequate hand hygiene practices, and the use of non-centralized water sources. These findings highlight the importance of implementing targeted

public health interventions, particularly educational and awareness-raising programs, as well as improving access to safe drinking water and promoting proper hygiene practices (Kakamad et al., 2024). A study conducted in China assessed disease-specific prevalence rates at both national and regional levels according to sex, age group, occupation, and educational status. The findings demonstrated that female sex, older age, shepherding as an occupation, engagement in religious activities, and illiteracy

were significant risk factors for both forms of echinococcosis (Ma et al., 2023). In populations with a low level of education, the use of drinking water shared with animals and inadequate personal hygiene are considered important risk factors for cystic hydatid disease (Oguz et al., 2018). The authors note that treatment of dogs (deworming) and improving the population's level of awareness could lead to significant progress in controlling the disease in endemic areas (Moshfe et al., 2019). According to WHO data, there is a strong need to expand knowledge and skills among populations living in endemic areas, as well as among healthcare and veterinary professionals (Echinococcosis, 2021).

Studies have shown that a total of 13 potential risk factors were identified in the surveys, including participants' sex, ethnicity, dog ownership, contact with fox pelts, not washing hands before eating, playing with dogs, shepherding as an occupation, feeding offal to dogs, consumption of unboiled water, nomadic lifestyle, consumption of raw vegetables, presence of stray dogs, and the number of dogs kept in households (Zhang et al., 2022).

Considering the above-mentioned factors, the study aimed to conduct a questionnaire survey among the rural population within the framework of our research to evaluate their level of knowledge and skills regarding echinococcosis, as well as their awareness of preventive and treatment measures.

MATERIALS AND METHODS

Based on the investigations carried out and the results obtained, a questionnaire was developed by the authors. The survey was designed to examine epidemiological risk factors associated with echinococcosis, the population's level of awareness, and behavioral characteristics.

The information provided in the survey was kept confidential and used exclusively for scientific purposes.

The questionnaire was analyzed in three sections. Questions 7-24 were intended to identify risk factors contributing to the occurrence of echinococcosis in a specific region or settlement. Questions 25-29 were mainly of a medical anamnesis nature. These questions allow for

drawing conclusions regarding the health status of individuals, households, or even communities within a given region, as well as the possible prevalence, distribution patterns, and forms of this disease. The third section, consisting of questions 30-39, assessed the population's level of knowledge about echinococcosis, their motivation to engage in preventive measures, and the extent to which they adhere to appropriate behavioral practices. This section also provides a basis for developing future prevention strategies and action plans.

The questionnaire is based on the KAP (Knowledge – Attitude – Practice), or “knowledge–attitude–practice”, model and allows for a comprehensive assessment of the epidemiology of echinococcosis, its risk factors, and population behavior (Li et al., 2015). At the same time, considering main risk factors such as contact with dogs, animal slaughter practices, and hygienic habits, it provides broad analytical opportunities for identifying the mechanisms of disease transmission.

We conducted a survey among 120 respondents from endemic regions using the proposed questionnaire. Of the respondents, 66 (55,0%) were male, and 54 (45.0%) were female.

RESULTS AND DISCUSSION

The distribution of respondents by sex was relatively balanced, although males slightly predominated. This may be explained by the higher involvement of men in agricultural and livestock activities. Regarding marital status, 62 (51.7%) respondents were married and 58 (48.3%) were single. The single group included widowed, divorced, and never-married individuals. Overall, the proportions of married and single respondents were nearly equal, which allows for a balanced analysis of social factors.

The distribution of respondents by educational level was as follows:

- Higher education – 12 (10.0%) persons;
- Secondary specialized education – 23 (19.2%) persons;
- Secondary education – 53 (44.2%) persons,
- Incomplete secondary education – 32 (26.7%) persons.

As can be seen, the largest proportion of

respondents had secondary education (44.2%). This was followed by individuals with incomplete secondary education (26.7%) and secondary specialized education (19.2%). The proportion of respondents with higher education was the lowest (10.0%). Overall, 70.9% of respondents (secondary + incomplete secondary) had low to medium levels of education. This suggests that a large proportion of the population may have limited medical and hygienic knowledge. The small proportion of individuals with higher education (10%) may be considered one of the contributing factors to the low level of awareness regarding zoonotic diseases such as echinococcosis. Although respondents with secondary specialized education (19.2%) may possess some practical knowledge, theoretical awareness in this group may still be insufficient.

The minimum age of respondents was 18 years, the maximum was 69 years, and the mean age was 42.8±15.1 year (median: 41.5). The fact that the mean age is above 40 indicates that the survey predominantly involved middle-aged and older individuals, who represent a high-risk group for echinococcosis.

Subsequently, responses to questions related to dog ownership and husbandry practices among respondents were analyzed (Table 1).

Based on the survey results, it was found that main epidemiological risk factors for echinococcosis are widely present among the study population. Regarding dog ownership in households, 68.3% (n=82) of respondents reported keeping dogs at home. This indicates close and frequent contact with definitive hosts of the parasite and, consequently, a higher risk of infection. Overall, this finding suggests that dog ownership is highly prevalent in the population and represents one of the principal epidemiological risk factors for echinococcosis.

Analysis of the number of dogs showed that 43.3% (n=52) of respondents kept two or more dogs in their households: 18.3% kept 2–3 dogs, while 25.0% kept four or more dogs. Keeping multiple dogs is considered an important epidemiological factor that facilitates the maintenance and transmission of the parasite's life cycle.

Table 1. Distribution of respondents according to dog ownership and related practices in households (n=120).

Questions	Responses	n	%
Dog ownership	Yes	82	68.3
	No	38	31.7
Number of dogs	1	40	33.3
	2–3	22	18.3
	≥4	30	25.0
	None	28	23.3
Contact with dogs	Yes	80	66.7
	No	40	33.3
Presence of stray dogs	Yes	89	74.2
	No	31	25.8
Livestock farming	Yes	69	57.5
	No	51	42.5
Home slaughtering	Yes	63	52.5
	No	57	47.5
Feeding dogs with animal organs	Yes	36	30.0
	No	84	70.0

About contact with dogs, 66.7% of respondents reported frequent contact with dogs, whereas 33.3% reported no such contact. This finding indicates an increased likelihood of contact transmission of parasitic infection. It also suggests that approximately two-thirds of the respondents are directly within a high-risk exposure group, which plays a significant role in the transmission dynamics of echinococcosis.

Furthermore, 74.2% of respondents reported the presence of stray dogs in their living areas, while only 25.8% reported their absence. The high prevalence of stray dogs contributes to the uncontrolled circulation of infection and continuous environmental contamination. In addition, 57.5% (n=69) of respondents were engaged in livestock farming, which is a significant risk factor in the transmission of zoonotic infections.

Home slaughtering practices were also common, with 52.5% (n=63) of respondents indicating that animal slaughter was performed at the household level. In the absence of proper sanitary measures, this practice may facilitate the spread of echinococcosis.

A particularly notable finding was that 30.0% (n=36) of respondents reported feeding dogs with internal organs. This behavior plays a crucial role in sustaining the parasite's life cycle

and represents a high-risk epidemiological practice.

Overall, the findings demonstrate that the study population is exposed to favorable epidemiological conditions for the transmission of echinococcosis. Especially dog ownership, multiple dogkeeping, the high prevalence of stray dogs, and insufficient adherence to hygienic practices collectively contribute to the maintenance and amplification of the infection cycle.

Based on the survey results, respondents' hygienic behaviors and attitudes toward preventive measures were identified as important factors directly influencing the risk of echinococcosis transmission (Table 2).

Regarding anthelmintic treatment of dogs, only 47 (39.2%) respondents reported regular administration of antiparasitic drugs. In contrast, 41 (34.2%) reported irregular (occasional) deworming, while 32 (26.7%) stated that they never carried out such measures. This indicates favorable conditions for the continuous maintenance of the parasite's life cycle.

Hand hygiene practices, although relatively satisfactory, were not at an optimal level. While 71 (59.2%) respondents reported always washing their hands, 36 (30.0%) did so only occasionally, and 13 (10.8%) reported non-compliance with handwashing practices. This creates a potential risk for fecal – oral transmission pathways.

Vegetable washing practices demonstrated a heterogeneous pattern: 48 (40.0%) respondents reported thorough washing of vegetables, 32 (26.7%) used basic washing methods, and 40 (33.3%) applied more specialized methods. These findings suggest that hygienic standards are not uniform, and a proportion of the population remains at risk of exposure.

Analysis of drinking water sources revealed that only 36 (30.0%) respondents used centralized water supply systems. The remaining respondents relied on alternative sources, including transported water (25.0%, n=30), satisfactory water (24.2%, n=29), and spring water (20.8%, n=25). Given the potentially limited sanitary control of these sources, they may contribute to an increased risk of infectious diseases, including echinococcosis.

Overall, the findings indicate that preventive measures and hygienic behaviors are insufficient. Especially, irregular deworming of dogs, inadequate compliance with hand hygiene practices, and the use of unsafe water sources represent significant epidemiological risk factors for the transmission of echinococcosis.

The results of the survey demonstrated that both the level of awareness regarding echinococcosis and the distribution of clinical manifestations among respondents were heterogeneous (Table 3).

Table 2. Quantitative indicators of adherence to hygienic practices among respondents (n=120).

Questions	Responses	n	%
Administration of anthelmintic treatment to dogs	Regularly	47	39.2
	Occasionally	41	34.2
	Never	32	26.7
Handwashing practices	Always	71	59.2
	Sometimes	36	30.0
	Never	13	10.8
Washing of vegetables	Proper	48	40.0
	Basic	32	26.7
	Specialized	40	33.3
Source of drinking water	Centralized supply	36	30.0
	Well water	29	24.2
	Spring water	25	20.8
	Transported water	30	25.0

Table 3. Quantitative indicators of echinococcosis history and knowledge level among respondents.

Questions	Responses	n	%
Echinococcosis anamnesis	Yes	16	13.3
	No	84	70.0
	Do not know	20	16.7
Presence of symptoms	Yes	41	34.2
	Sometimes	36	30.0
	No	43	35.8
Knowledge about the disease	Yes	60	50.0
	No	60	50.0
Knowledge about transmission routes	Yes	65	54.2
	No	55	45.8
Knowledge about preventive measures	Yes	52	43.3
	No	68	56.7
Interest in awareness activities	Yes	83	69.2
	No	15	12.5
	Undecided	22	18.3

In terms of disease history, only 13.3% (n=16) of respondents reported having had echinococcosis, while 16.7% (n=20) were unaware of their health status, indicating the possible presence of undiagnosed or unrecognized cases. Most respondents, 70.0% (n=84), reported no history of the disease.

Regarding clinical symptoms, 34.2% (n=41) of respondents reported frequent symptoms consistent with those listed in the questionnaire, 30.0% (n=36) reported occasional symptoms, and 35.8% (n=43) reported no symptoms. These findings confirm that echinococcosis often has an asymptomatic or nonspecific clinical course.

Analysis of knowledge levels revealed that only half of the respondents – 50.0% (n=60) had general knowledge about echinococcosis. Although 54.2% (n=65) were aware of transmission routes, knowledge regarding preventive measures and hygienic practices was considerably lower (43.3%), indicating insufficient effectiveness of public health education efforts.

At the same time, most respondents (69.2%) (n=83) expressed willingness to participate in awareness-raising activities. However, 18.3% (n=22) were undecided, and 12.5% (n=15) showed no interest. This suggests the presence of a favorable social basis for future preventive programs.

According to the results of our research, the following main findings should be highlighted:

1. The survey conducted in endemic regions revealed that 68.3% of respondents keep dogs at home, 43.3% own two or more dogs, 66.7% have regular contact with dogs, and 74.2% reported the presence of stray dogs in their living areas. These findings indicate favorable epidemiological conditions for the transmission of cystic echinococcosis.

2. Livestock farming (57.5%), home slaughtering practices (52.5%), and feeding dogs with animal organs (30.0%) were identified as main risk factors contributing to the maintenance of the parasite's life cycle.

3. Assessment of hygienic behavior showed that only 39.2% of respondents regularly deworm their dogs, 40.8% do not fully comply with hand hygiene practices, 60.0% do not properly wash vegetables, and 70.0% rely on non-centralized water sources. These factors significantly increase the risk of infection transmission.

4. Only 50.0% of respondents had general knowledge about echinococcosis, while awareness of preventive measures was lower (43.3%), indicating insufficient public health education.

5. A total of 13.3% of respondents reported a history of echinococcosis, while 16.7% were unaware of their status. Additionally, 64.2% reported nonspecific symptoms consistent with the disease, suggesting possible undiagnosed cases and the non-symptomatic nature of infection.

6. A high level of interest (69.2%) in participating in educational programs represents a favorable social foundation for implementing preventive interventions.

7. Based on the findings, it is recommended to implement targeted public health education programs, ensure regular deworming of dogs, strengthen sanitary control of home slaughtering practices, improve access to safe water, and promote proper hygiene practices among the population.

8. Furthermore, the development and implementation of a comprehensive preventive strategy based on the KAP (Knowledge – Attitude – Practice) model is strongly recommended. This approach may contribute to improving knowledge levels, reducing risk behaviors, and facilitating early detection of the disease.

CONCLUSIONS

The results of our research indicate that favorable epidemiological conditions for the transmission of echinococcosis exist within the studied population. The fact that 68.3% of respondents keep dogs at home, 66.7% have regular contact with dogs, and 74.2% report the presence of stray dogs in their living areas demonstrates the widespread distribution of main risk factors involved in disease transmission.

These findings are consistent with the results reported by Torgerson and Budke (2003), who demonstrated that dog ownership, insufficient deworming practices, and feeding dogs with infected animal offal are among the primary epidemiological factors contributing to human transmission of echinococcosis (Torgerson, Budke, 2003).

In our study, only 39.2% of respondents reported regular administration of anthelmintic treatment to their dogs, while 30.0% reported feeding dogs with internal organs. These practices facilitate the continuation of the parasite's life cycle. Similar findings have also been reported in the World Health Organization (WHO) reports. According to WHO data, public awareness raising and regular deworming of dogs are among the most effective measures for controlling echinococcosis in endemic areas (World Health Organization. Echinococcosis, 2023).

The survey results also demonstrated that the population's level of awareness was not satisfactory. Only half of the respondents had general knowledge about echinococcosis, while awareness of preventive measures accounted for 43.3%. These findings are consistent with the results of a large-scale epidemiological study conducted in China. That study showed that low educational attainment, limited hygienic knowledge, and insufficient awareness of zoonotic infections are closely associated with the spread of echinococcosis (Wang et al., 2014). In our study, the fact that 70.9% of respondents had only secondary or incomplete secondary education can be considered an important factor supporting this relationship.

Thus, the obtained results are consistent with findings from international studies and indicate that, in the prevention of echinococcosis, main endemic areas should include public health education, regular deworming of dogs, strengthened control of home slaughtering practices, and improvement of access to safe drinking water.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The author declares no conflict of interest related to this study.

AI STATEMENT

The author confirms that no artificial intelligence (AI) tools were used to generate, analyze, interpret, or validate the research data presented in this study. Any AI-assisted technologies, if used, were limited to minor language editing and formatting support. The author takes full responsibility for the accuracy, integrity, and originality of the manuscript.

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