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Prevalence of Hydatid Cysts in Slaughtered Animals in Wasit Province, Iraq

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Abstract

Hydatid cysts, is an infection caused by tapeworms of the genus *Echinococcus*, which infect a wide range of domestic and wild animals in addition to humans. The current study was aimed to detect the prevalence of hydatid disease in field animals with estimation the association of infection to different animal risk factors including season, age, sex and infected organ. For this purpose, slaughtered animals (buffaloes, cattle, camels, goats, and sheep) at different areas in Wasit province (Iraq) during March (2023) to the April (2024) were examined grossly to identify the presence of infection. Of totally 1841 slaughtered animals, the total prevalence rate of hydatid cysts was 3.75%. Among different animal species, values of prevalence rate and the risk of infection were increased significantly in cattle (4.68% and 2.72, respectively) and decreased in sheep (0.874% and 0.18, respectively). However, no positive infections were detected in camels and goats (0%). Distribution of hydatid cysts was showed significant higher prevalence and risk in liver (76.81% and 3.31, respectively) than other infected organs; lung (13.04% and 0.149, respectively), mesentery (5.8% and 0.062, respectively), spleen (2.9% and 0.299, respectively) and brain (1.45% and 0.015, respectively). According to season factor, the prevalence rate of hydatid cysts was differed insignificantly in comparison between values of spring (4.6%), summer (4.01%), autumn (385%) and winter (3.01%). Whilst, the risk of hydatid cysts infection was elevated significantly in spring (1.243) and reduced in winter (0.734) when compared to values of summer (1.18) and autumn (1.041). Regarding the age of study animals, the findings of prevalence rate and risk of hydatid cysts infection were increased significantly in animals aged ≥ 36 months (11.98%) more than those aged ≤ 6 months (1.18%), ≥ 7-11 months (1.23%), and ≥12-35 months (3.27%). Although no significant differences were recorded between prevalence rate values of females (5.14%) and males (2.05%), risk values of hydatid cysts infection were elevated significantly in females (2.448) compared to males (0.409). In conclusion, as the prevalence and risk of infection of hydatid cysts in cattle is higher than those in other animals, sheep might clearly have an important role to play in the continuation of the *E. granulosus* life cycle in study areas. Therefore the safe disposal of infected offal, especially of cattle and sheep, will significantly reduce the transmission of cysts from slaughterhouses to potential hosts in this region.

Keywords: Echinococcosis, *Echinococcus granulosus*, Gross diagnosis,

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Introduction

Hydatid disease or echinococcosis, is an infection caused by tapeworms of the genus *Echinococcus*, a tiny tapeworm just a few millimeters long which infect a wide range of domestic and wild animals in addition to humans (Wen et al., 2019; Gessese, 2020). Like all tapeworms, the life cycle involves two animals; carnivore is the definitive host where the adult worms live in the intestines, and any mammal including humans as an intermediate host where the worms form cysts in various organs (Parija and Pramodhini, 2022; Milgroom, 2023). The disease symptoms are caused by the cysts, which are slow growing fluid-filled structures that contain the larvae and are most often located in the liver or lungs and act like tumors to disrupt the function of the organ where they are found causing a poor growth, reduced production of milk and meat, and rejection of organs at meat inspection (Wabe et al., 2017; Ün et al., 2020; Bresson-Hadni et al., 2021).

The most widespread cycle exists for *E. granulosus* between dogs as well as field animals; which occurs when dogs are fed fresh offal or scavenge infected carcasses containing cysts to become infected and contaminate the pasture with their feces that re-infected the domestic animals during graze (Zemen et al., 2015; Woolsey and Miller, 2021). They release eggs into the environment in the feces of host animals, and are well adapted to survive in the environment for as long as a year in cool moist conditions, but are susceptible to desiccation (Thompson, 2017). Fresh eggs are sticky and may adhere to the fur of definitive hosts facilitating their spread (Parija and Pramodhini, 2022). The intermediate host ingests the eggs incidentally while grazing, foraging or drinking. The eggs hatch in the small intestine, become larvae which penetrate the gut wall, and are carried in the circulatory system to various organs to form the cysts or metacestodes (Díaz, 2017; Chubb et al., 2020). The life cycle is completed when the cysts are ingested by a carnivore definitive host, and the larvae are released from the cyst into the small intestine to develop into adult tapeworms that produce eggs which are released into the environment in the feces of the host animal within 25-80 days depending on the species and strain of *Echinococcus* (Al-Khalidi et al., 2020; Pal et al., 2022). In view of the life cycle in intermediate hosts, serological tests are available traditionally but they are not used routinely because of variable sensitivity and specificity (Siles-Lucas et al., 2017). Therefore, diagnosis depends on the post mortem detection of the cysts in different organs during meat inspection remains the gold standard (Reinehr et al., 2020; Alvi et al., 2023). In Wasit province (Iraq), since no available studies have been conducted in slaughtered animals, the current study was designed to detect the prevalence of hydatid disease in field animals with estimation the association of infection to different animal risk factors including season, age, sex and infected organ.

Materials and methods

Ethical approval

The current study was approved by the Scientific Committee of the College of Veterinary Medicine in University of Wasit (Wasit, Iraq).

Study animals and samples

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The present study was conducted from March (2023) to the April (2024) to gross examination of slaughtered animals (buffaloes, cattle, camels, goats, and sheep) at different areas in Wasit province (Iraq). The hydatid cysts were identified according to the descriptions of the veterinarians in the slaughtered animals and were examined for degeneration and calcification. Additional information concerning age, sex and infected organ(s) were reported as a data of risk factors. The obtained findings were collected samples were

Statistical analysis

One-Way ANOVA and Odds-ratio analysis were used in GraphPad Prism version 6.0.1 (GraphPad Software Inc. USA) to analyze data of infected animals and risk factors (season, age, sex, and organ), respectively. Values in this study are represented as number (percentage), and variation was considered significant at $p < 0.05$ (Gharban et al., 2024).

Results

Of totally 1841 slaughtered animals examined grossly, the total prevalence rate of hydatid cysts was 69 (3.75%), (Figure 1). Among different animal species, values of prevalence rate and the risk of infection were increased significantly (P≤0.049 and P≤0.0001) in cattle (4.68% and 2.72, respectively) and decreased in sheep (0.874% and 0.18, respectively). However, no positive infections were detected in camels and goats (0%), (Table 1). Distribution of hydatid cysts was showed significant higher prevalence and risk (P≤0.085 and P≤0.0001, respectively) in liver (76.81% and 3.31, respectively) than other infected organs; lung (13.04% and 0.149, respectively), mesentery (5.8% and 0.062, respectively), spleen (2.9% and 0.299, respectively) and brain (1.45% and 0.015, respectively), (Table 2).

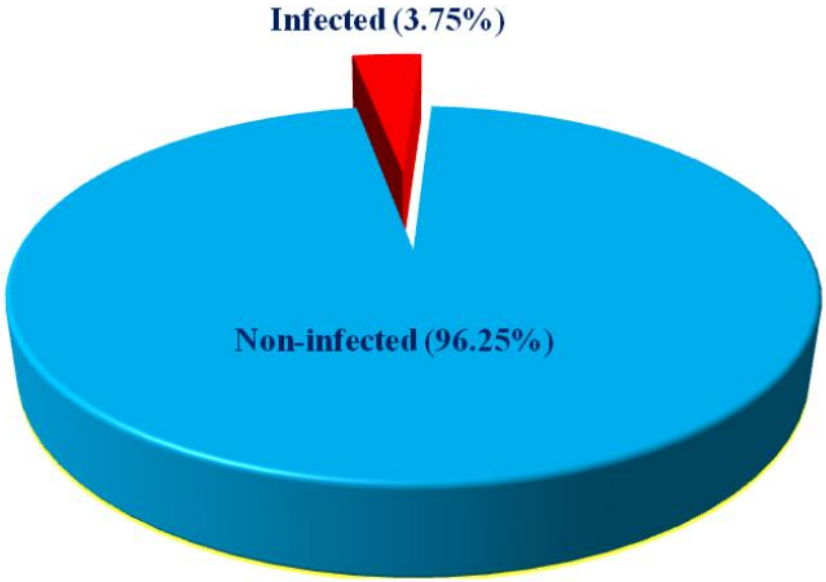

Figure (1): Prevalence rate of hydatid cysts among totally 1841 slaughtered animals

Table (1): Distribution of hydatid cysts infection among different animal species

Species	Positive / Total No.	Prevalence rate	Risk

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Buffaloes	8 / 29	27.59	8.114
Cattle	56 / 1196	4.68	2.72
Camels	0 / 3	0	0
Goats	0 / 41	0	0
Sheep	5 / 572	0.874	0.18
p-value		**0.049**	**0.0001**

Table (2): Distribution of hydatid cysts among different organs of infected animals

Organ	Positive / Total No.	Prevalence rate	Risk
Liver	53 / 69	76.81	3.31
Lung	9 / 69	13.04	0.149
Mesentery	4 / 69	5.8	0.062
Spleen	2 / 69	2.9	0.299
Brain	1 / 69	1.45	0.015
p-value		**0.0085**	**0.0001**

According to season factor, the prevalence rate of hydatid cysts was differed insignificantly (P≤0.0918) in comparison between values of spring [4.6% (8/174)], summer [4.01% (41/1023)], autumn [385% (3/78)] and winter [3.01% (17/566)], (Figure 2). Whilst, the risk of hydatid cysts infection was elevated significantly (P≤0.0001) in spring (1.243) and reduced in winter (0.734) when compared to values of summer (1.18) and autumn (1.041), (Figure 3).

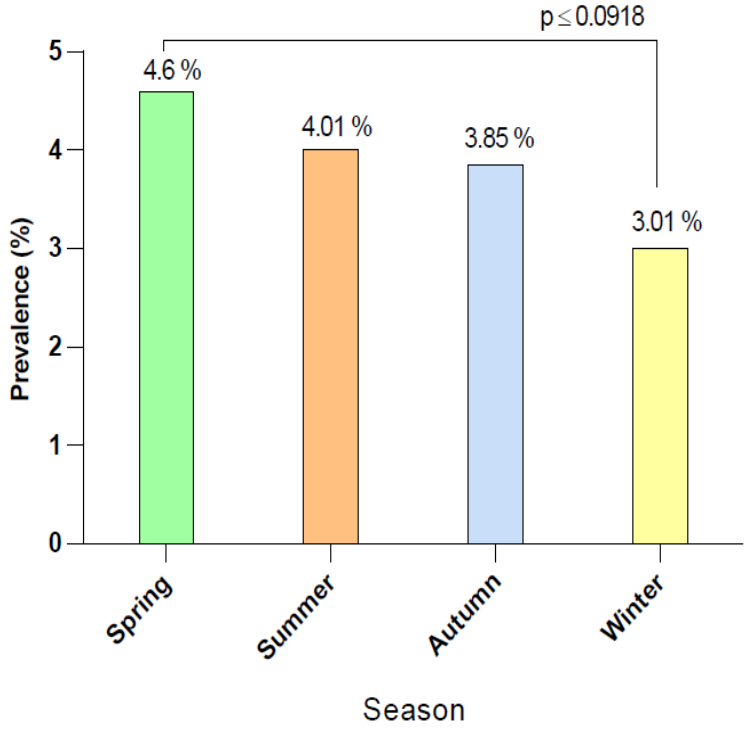

Figure (2): Prevalence rate of hydatid cysts infection among different seasons

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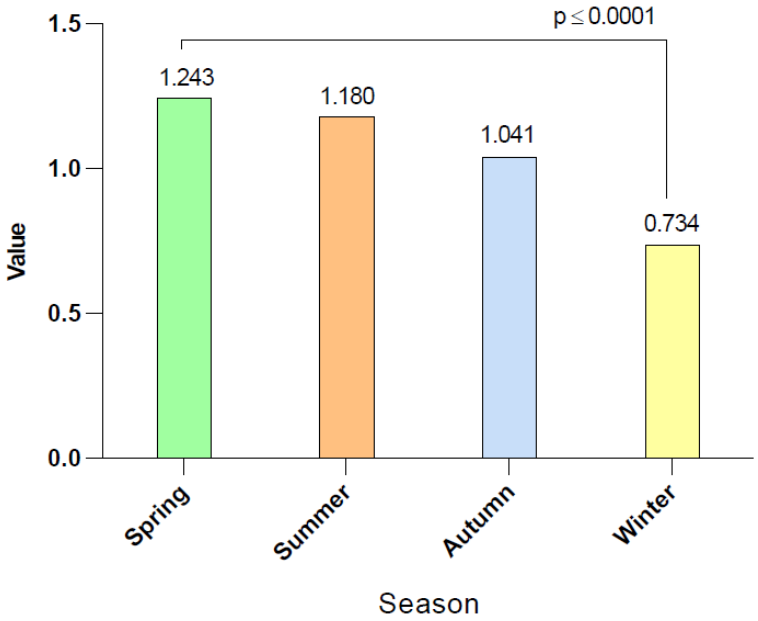

Figure (3): Level of risk of hydatid cysts infection among different seasons

Regarding the age of study animals, the findings of prevalence rate and risk of hydatid cysts infection were increased significantly (P≤0.0336 and P≤0.0001, respectively) in animals aged ≥ 36 months [11.98% (26/217)] more than those aged ≤6 months [1.18% (1/85)], ≥ 7-11 months [1.23% (5/408)], and ≥ 12-35 months [3.27% (37/1131)], (Figures 4, 5).

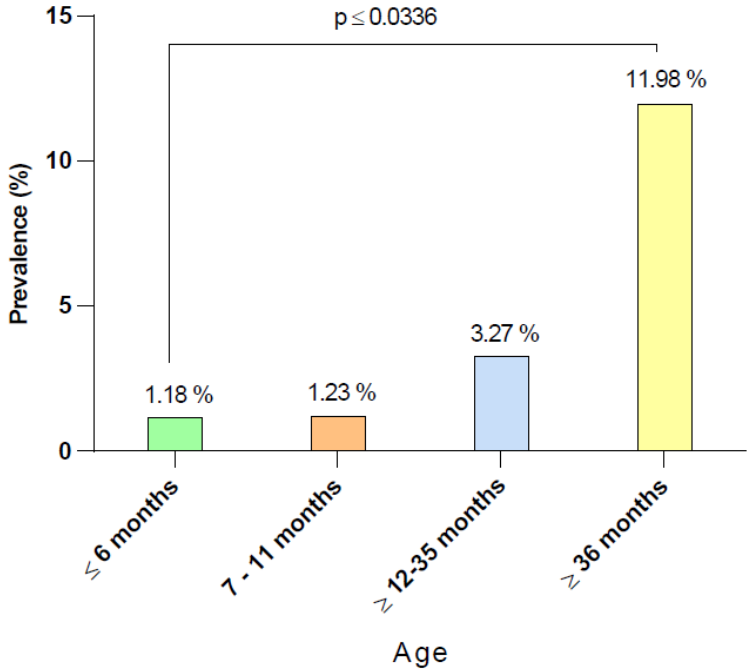

Figure (4): Prevalence rate of hydatid cysts infection among different age groups

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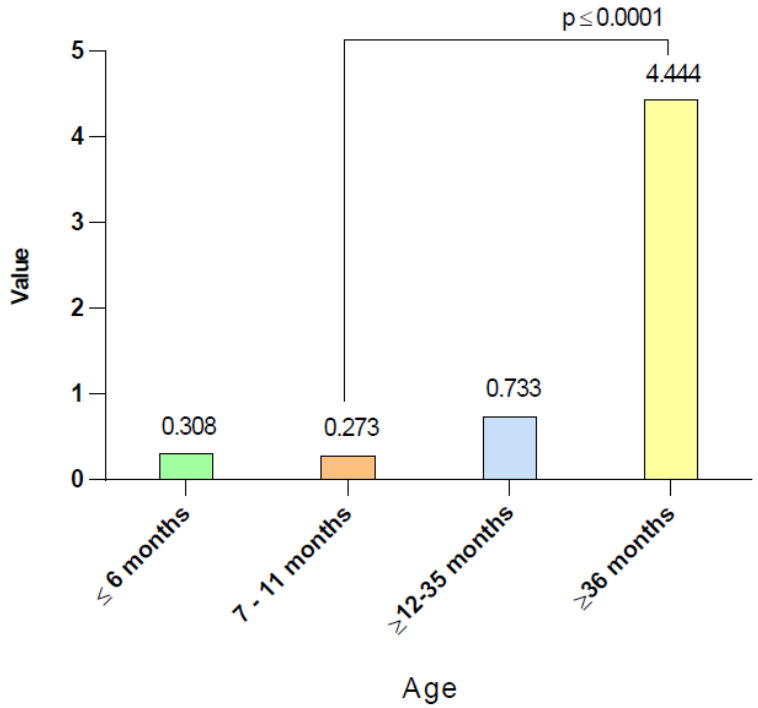

Figure (5): Level of risk of hydatid cysts infection among different age groups

Although no significant differences (P≤0.0669) were recorded between prevalence rate values of females [5.14% (52/1011)] and males [2.05% (17/830)] (Figure 6), risk values of hydatid cysts infection were elevated significantly (P≤0.0001) in females (2.448) compared to males (0.409), (Figure 7).

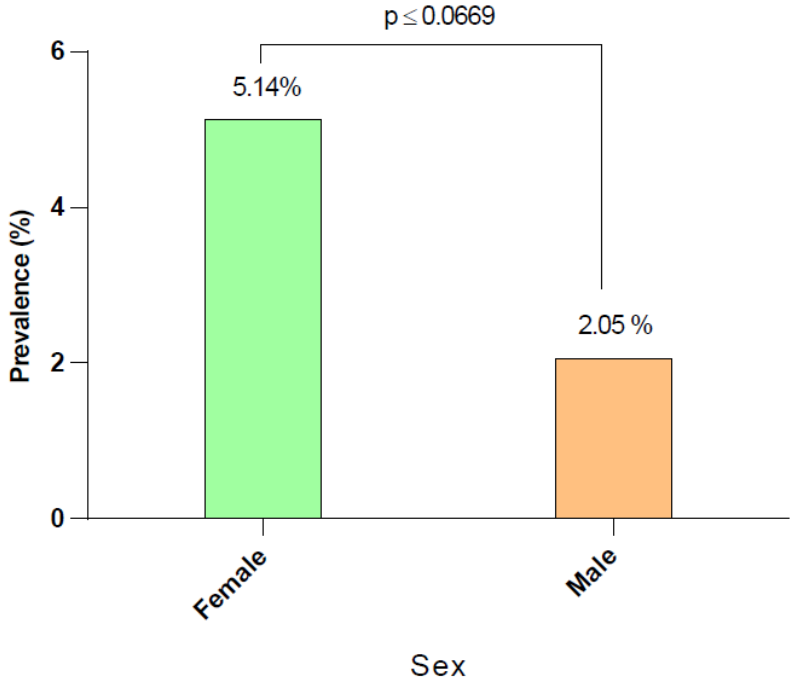

Figure (6): Prevalence rate of hydatid cysts infection among different sex groups

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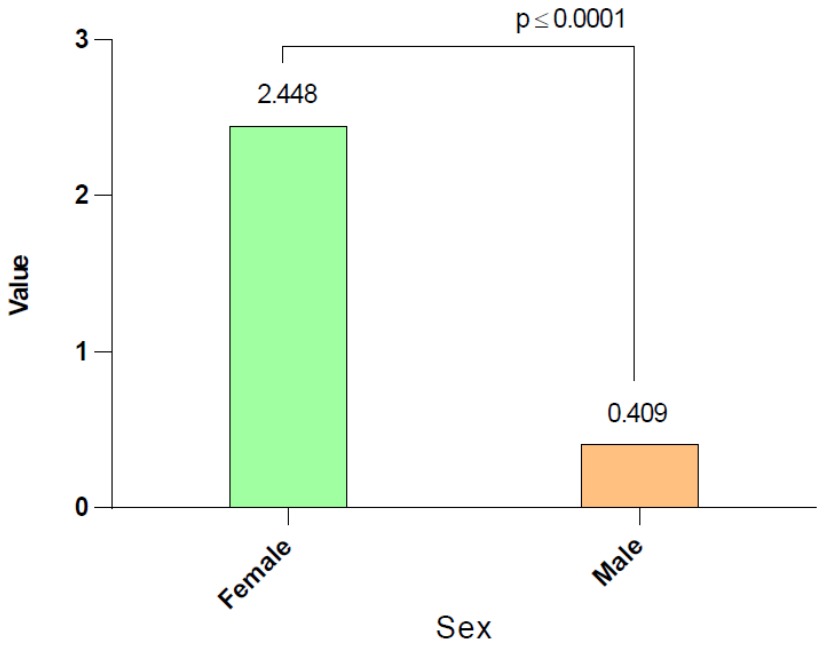

Figure (7): Level of risk of hydatid cysts infection among different sex groups

Discussion

In current study, the total prevalence rate of hydatid cysts was 3.75% involving 4.68% in cattle, 0.874% in sheep but not in camels and goats (0%). In agreement with our findings, the infection was higher in cattle was recorded in Morocco (22.98%) and Algeria (24.8%), (Bardonnet et al., 2003; Azlaf and Dakkak, 2006). Banks et al. (2006) reported that the growth rates in some other species of livestock such as sheep are depressed by infection with hydatid cysts but this did not occur in cattle in this survey. It was clear from the model applied to cattle that geographical origin had the greatest influence on prevalence of infection (Tamarozzi et al., 2020). This finding prompted inclusion of a larger group of records of examination to confirm and refine the distribution and prevalence of cystic echinococcosis in cattle. Stock movements between properties may have introduced some inaccuracies but trace-back, nevertheless, gave a precision not available to previous workers (Banks et al., 2006). Despite this increased precision, it has been suggesting that the endemic zone is stable and had not changed appreciably during the intervening 30 years (De Wolf, 2011). In a recent study (Jasim et al., 2024), the findings revealed that the total proportion of infection of hydatid cysts was 9.33% distributed as 12.29% in sheep, 8.97% in cattle, 8.26 % in buffalo and 4.08% in camels. Also, the authors showed a significant difference between the infection rate and the infected organ with recording that liver and then lunge are the only affected organs. In Iran, prevalence of hydatid cysts was 5.1-74.4% in sheep, 1.7-20% in goats, 3.5-38.3% in cattle, and 11.4-70% in camels (Adinehbeigi et al., 2013). In contrast to our findings, the rate of infection in camels of North Africa countries was higher than that in sheep and cattle suggesting that camels might play an important role in the local sustenance of the life cycle and may be the main host for transmission of the hydatid infection (Elmajdoub and Rahman, 2015). The absence of positive infection in the resent study might be explained that when the residents needed camel meat for wedding celebrations, the camels were

not slaughtered in the abattoir under the supervision of a veterinarian. It was only in the few abattoirs that different livestock were slaughtered under the supervision of a veterinarian. One possible reason for the variation in the infection rate for all the slaughtered livestock in overall study areas could be the variations in environmental factors, such as temperature, humidity and the nature of the pasture. Furthermore, these variations could be related to the different strains of *E. granulosus* (Singh et al., 2014).

Distribution of hydatid cysts was showed significant higher prevalence and risk in liver than other infected organs (lung, mesentery, spleen, and brain). Worldwide, cystic hydatid disease is one of the most widespread and serious helminthic zoonotic infections in developing and undeveloped countries. Usually, livestock species are more susceptible to infection by contamination through the viable eggs of *E. granulosus*. Anatomical location was associated with co-infection status, with a decrease in liver-affected animals and an increase in lung-only-affected animals. In *E. granulosus*, portal circulation has been described as the primary route of infection by oncospheres, with a high tropism for the liver (Brehm and Koziol, 2017). As *Fasciola hepatica* in acute and chronic infections can damage the liver (Sohair and Eman, 2009), it could interfere with the establishment of *E. granulosus* in this organ. In the absence of *F. hepatica*, small hydatid cysts were mainly located in the liver, whereas when *F. hepatica* was present, small cysts were found in a larger proportion in the lungs only. Small cysts may represent either immature cysts that could develop into fertile or infertile cysts, or they could be non-viable cysts (Stoore et al., 2018).

Our findings showed that hydatid cysts infection increased significantly with age in particular in animals aged ≥ 36 months, and increasing the risk of infected females more than males. The increase in prevalence with age is in accordance with many worldwide surveys (Adinehbeigi et al., 2013; Chihai et al., 2016; Poglayen et al., 2017). Failure of prevalence to continue to rise after about 4 years of age suggests either development of an age-dependent immunity or, more probably, an acquired resistance to super-infection. In this region, females remain longer than males for reproductive purposes, therefore the probability of having more infective prevalence and mean intensity is higher in females than in males. Similarly, old animals have a chance to be infected or more time for cyst to develop than young animals. The results showed that the infection prevalence and mean intensity were higher in the older age classes. The age-dependent increase in infection rate among examined animals is in accordance with other researchers (Khan et al., 2020; Omondi, 2021; Mares et al., 2023). This age variation can be translated into differential exposure to infection because older livestock may have been exposed to more infective stages (Omadang et al. 2024).

For the findings of the present research, there were some significant differences in infection rates in some seasons, where differences were only seen between spring and autumn and between winter and summer. Similarly, it found significant differences in infection rates between spring and autumn in Saudi Arabia, as well as between autumn and winter in many countries (Tashani et al., 2002; Ibrahim, 2010; Elmajdoub and Rahman, 2015).

Conclusion

As the prevalence and risk of infection of hydatid cysts in cattle is higher than those in other animals, sheep might clearly have an important role to play in the continuation of the *E. granulosus* life cycle in study areas. Therefore the safe disposal of infected offal, especially of cattle and sheep, will significantly reduce the transmission of cysts from slaughterhouses to potential hosts in this region. Also, furthermore studies in other areas with utilization of advanced diagnostic techniques such as molecular assays can actively provide more information about distribution of infection in live animals at field.

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Conflict of interest

No.

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