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Investigation of hydatid disease caused by the *Echinococcus granulosus* parasite in the livers and lungs of sheep and goats in Sirte, Libya

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Abstract:

Background: Sheep and goat meat, is regarded as a significant dietary source due to its numerous health benefits. As humans are dependent on sheep and goat meat for nutrition, they are susceptible to parasitic diseases, which can result in economic losses for livestock owners. This study was conducted from October to December 2023**,** involved the investigation of the prevalence of hydatid disease, caused by the *Echinococcus granulosus* parasite, in three slaughterhouses in the Libyan city of Sirte.

Aims: This study aims to investigate the extent to which the livers and lungs of sheep and goats are infected with hydatid disease caused by the *Echinococcus granulosus* parasite in three slaughterhouses in the Libyan city of Sirte.

Methods: In this study, the livers and lungs of 248 sheep and the livers and lungs of 338 goats were examined in three slaughterhouses in the city of Sirte. A total of 248 sheep were examined, with four cases of hydatid cysts being recorded. The majority of cysts were found in the liver. A total of 338 goats were examined, with three cases of hydatid cysts being recorded. The majority of these cysts were located in the liver.

Conclusion: Out of a total of 248 sheep examined, 4 were found to be infected with hydatid disease, with an infection rate of 1.61%, and out of a total of 335 goats examined, 3 were found to be infected with hydatid disease, with an infection rate of 0.89%.

Keywords: *Echinococcus granulosus*, Hydatid Cyst, Echinococcosis, Hydatid disease, Libya.

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التحري عن مرض الأكياس المائية والذي يسببه طفيل المشوكة الحبيبية في أكباد ورئات الأغنام والماعز في مدينة سرت– ليبيا

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الملخص:

تعتبر لحوم الأغنام والماعز من المصادر الغذائية الهامة، ونظرا" لاعتماد الكثير من الناس على لحوم الأغنام والماعز في تغذيتهم فانهم عرضة للإصابة بالأمراض الطفيلية التي تصيب هذه الحيوانات والتي بدورها قد تؤدي الى حدوث خسائر اقتصادية لمربي الحيوانات. أجريت هذه الدراسة في الفترة من شهر أكتوبر 2023م الى شهر ديسمبر 2023م، وتهدف الى التحقق من مدى انتشار داء المشوكات الذي يسببه طفيل المشوكة الحبيبية في أكباد ورئات الأغنام والماعز في مدينة سرت– ليبيا. وفي هذا السياق تم فحص 248 رأسا" من الأغنام و338 رأسا" من الماعز، وقد أظهرت النتائج إصابة 4 من الأغنام وإصابة 3 من الماعز بداء المشوكات من مجموع الحيوانات التي تم فحصها وكانت أغلبت الإصابات في الكبد، وكانت نسبة الإصابة في الأغنام 1.61%، ونسبة الإصابة في الماعز 0.89%.

الكلمات المفتاحية: المشوكة الحبيبية، الكيسة المائية، داء المشوكات، داء الكيسات المائية،الأغنام، و الماعز، سرت – ليبيا.

Introduction:

The parasite *Echinococcus granulosus* belongs to the cestode, and the primary host of these worms is dogs, as these worms parasitize the intestine of dogs. Herbivores are considered intermediate hosts for this parasite, which may also infect humans. This parasite causes hydatid disease in herbivores, as well as humans. Bad habits such as throwing dead animals and infected meat into the environment, which dogs feed on, contribute to maintaining the life cycle of the parasite and its spread (Mohammed *et al.,* 2023).

The genus *Echinococcus* comprises numerous species that exert a deleterious effect on human and veterinary health. These organisms are distributed across all countries worldwide, with the exception of

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the Antarctic continent. They are responsible for the onset of diseases in animals and have the potential to result in the demise of infected animals, thereby causing economic losses (Ian and Andrea, 2020).

Echinococcosis, a disease prevalent among animals, has the potential to infect humans incidentally through the consumption of food contaminated with the parasite. The disease is categorised into two distinct species: one is caused by *Echinococcus granulosus* and is known as cystic echinococcosis, which affects cattle and dogs. The second species is known as alveolar echinococcosis, which affects canines and is caused by *Echinococcus multilocularis* (Poleta *et al.,* 2023).

It is evident that both cystic echinococcosis and alveolar echinococcosis disease can be regarded as recurrent diseases, with the potential to inflict significant damage on their hosts, in some cases resulting in fatalities. Misdiagnosis of disease conditions is a significant contributing factor to the elevated mortality rates observed (Donald *et al*., 2003).

A total of 1,087 sheep, 881 goats, 428 camels and 614 cattle were diagnosed from the same area. The results of the diagnostic tests revealed that the infection rate with *Echinococcus granulosus* was as follows: The respective figures for the aforementioned categories are 20%, 3.4%, 13.6% and 11% (Tashai *et al*., 2013).

Canines act as the primary hosts for the parasite that causes hydatid disease. Consequently, the prevalence of the disease is observed to be concentrated in areas where canines are utilised for the purpose of herding livestock. In this region, the life cycle of the disease is complete, with millions of people worldwide being affected. In advanced cases, surgical intervention may be necessary. In recent years, stem cell therapy has emerged as a superior alternative to other treatments (Amir *et al.,* 2023).

The adult worms of the parasite, and thus its sexual stage, are located within the definitive host, which in this case is the dog. With regard to the asexual stage, which is represented by the larvae, this is found within the intermediate hosts, which include sheep, cattle, and humans. Furthermore, the infection may be transmitted indirectly via the ingestion of eggs deposited in the feces of infected canines (Adriano *et al*., 2019).

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The impact of *Echinococcus granulosus* on the economic situation of countries is detrimental, often resulting in significant economic losses. The disease under discussion is transmitted through the consumption of foodstuffs. It is evident that one of the most efficacious methods of eradicating this disease is to disrupt the life cycle of the organism responsible for its transmission. To date, no vaccine has been discovered for humans to prevent this disease (Yongxue *et al.,* 2023).

China is widely regarded as the most affected country worldwide (Jianjun *et al*., 2023).

Cystic echinococcosis disease is regarded as one of the most hazardous parasitic diseases in the world. The World Health Organization has identified it as a priority and has classified it as one of the seventeen neglected diseases (Ricardo *et al*., 2023).

This study aims to investigate the extent to which the livers and lungs of sheep and goats are infected with hydatid disease caused by the *Echinococcus granulosus* parasite in three slaughterhouses in the Libyan city of Sirte.

Materials and methods:

Study Design: This study was conducted from October 2023 to December 2023 in Sirte, Libya, a coastal city located 400 km east of the capital, Tripoli.

A total of three slaughterhouses in the city were visited, and 248 sheep and 338 goats were examined. The liver and lungs were examined with the naked eye to investigate hydatid cysts caused by the parasite *Echinococcus granulosus*. The results of the examination for all animals under study were recorded.

Results:

In the present study, 248 sheep were examined, of which 4 were found to be infected. The degree of liver injury was found to be more severe than that of the lung, with 3 sheep exhibiting signs of liver injury (Figure 1), in comparison to a single instance of lung injury (Figure 2)

The rate of sheep infection with hydatid cysts was 1.61%.

(3) out of (338) goats examined were infected, with two in the liver (Figure 3) and one in the lung (Figure 4).

The rate of goat infection with hydatid cysts was 0.89% (Figure 5).

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The chi-square test was preformed to determine if there was a significant difference between sheep and goats in the incidence.
Chi-square value = 0.35, significance level (P-value) – 0.55.
Since the P-value is greater than 0.05, there is no statistically significant difference between sheep and goats in the incidence of hydatid cysts
The overall incidence was low in the animals examined. The incidence was slightly higher in sheep compared to goats. The liver was the most affected organ in both species, the lungs were the second most affected organ (Figure 6). The results indicate that the prevalence of hydatid cysts in sheep was 1.61%, the infection rate in the liver of sheep was 1.20%, while the infection rate in the lungs of sheep was 0.40%. The overall infection rate in goats is 0.89%, in the liver of goats, the infection rate was 0.59%, while in the lung it was 0.29%. with no statistically significant differences between the two species. The results also showed that the liver is the most commonly infected organ, followed by the lungs (table 1).

Table 1. Shows the extent to which Sheep and Goats are infected with hydatid cyst and where they are infected.

Number of cases	Place of injury	The infected	Healthy	Total number	Animal
3	Liver	4	244	248	Sheep
1	Lung				
2	Liver	3	335	338	Goat
1	Lung				


Fig. 1. Hydatid cyst in sheep liver

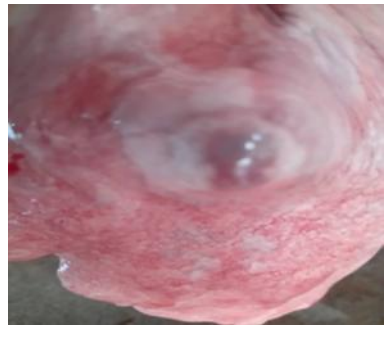
Fig. 2. Hydatid cyst in sheep lung.

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Fig. 3. Hydatid cyst in goat liver.

Fig. 4. Hydatid cyst in goat lung

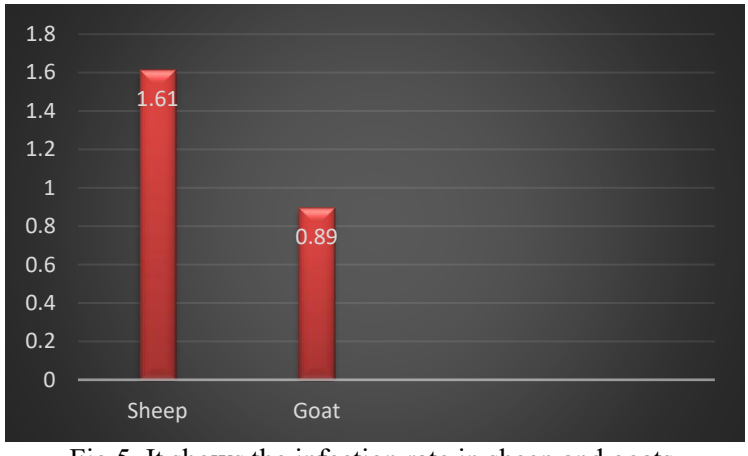

Fig.5. It shows the infection rate in sheep and goats

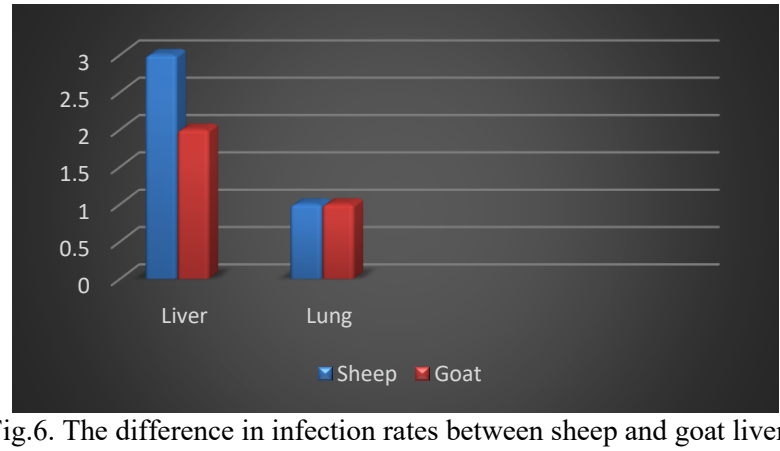

Fig.6. The difference in infection rates between sheep and goat livers, and the equal infection rates between sheep and goat lungs, illustrates this difference.

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Discussion:

Out of 248 sheep examined, four were found to be infected with hydatid disease, representing an infection rate of 1.61%, out of 338 goats examined, three were found to be infected with hydatid disease, representing an infection rate of 0.89%.

In a study on the prevalence of (CE) disease, 2898 sheep and 703 cattle were examined. The results demonstrated that the infection rate in sheep and cattle was 4.52% and 4.84%, respectively (Baoping *et al*., 2023). In a study designed to ascertain the presence of (CE) in the visceral organs, particularly the liver and lungs, of cattle and buffaloes following their demise, the findings indicated that 18 animals out of a total of 950 animals examined were infected, yielding an infection rate of 1.89% (Mughees *et al*., 2023).

A total of 325 sheep and 440 goats were examined. The results indicated that 25 sheep and 27 goats were found to be infected with hydatid cysts. The prevalence rate in sheep was found to exceed that observed in goats. fifteen sheep were observed to have lung infections, nine in the liver, and one in both the liver and lungs. The distribution of infection sites was as follows: 19 goats were infected in the lungs, 5 in the liver, one in the kidney, 2 in the heart, and 2 in the muscles. The results demonstrated that the infection rate in the lungs was the highest, followed by the liver (Daniel *et al*., 2012).

The results demonstrated that 64% of the sheep examined (n = 1081) were infected, with the older sheep being the most affected, suggesting that the infection rate increases with age (Torgerson *et al*., 2009).

A total of 1,270 sheep, 550 goats and 320 cattle were examined. The results of this examination revealed the following infection rates for hydatid cysts: 15.0%, 6.2% and 10.9%, respectively (Saeed *et al*., 2007).

A study was conducted on 7,000 cattle, 19,950 sheep, and 5,180 goats. The study spanned a period of three years, during which a total of 2,043 animals were infected, yielding an infection rate of 6.35%. The highest infection levels were observed in cows, while the lowest levels were observed in goats (Abdolali *et al*., 2016).

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A study was conducted to ascertain the prevalence of hydatid disease in buffaloes. A total of 832 buffaloes were examined as part of the study, with the results indicating that 112 were infected, yielding an infection rate of 13.46%. The liver was the most affected organ, followed by the lungs. The study also found that females were more infected than males, with infection rates of 14.43% and 9.77%, respectively (Muhammad *et al*., 2017).

Conclusion and Recommendations: In this study, 4 out of a total of 248 sheep examined were found to be infected, with an infection rate of 1.61%, and 3 out of 338 goats tested were infected, with an infection rate of 0.88%. I recommend that infected meat be disposed of properly and that the life cycle of the *Echinococcus granulosus* parasite be broken by burning it instead of throwing it into the environment, as dogs may eat it, completing the parasite life cycle and increasing its spread, thus exposing people to the risk of infection. I also recommend conducting more research studies on the *Echinococcus granulosus* parasite.

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