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دراسة المركبات غير العضوية لسائل الاكياس العدرية في بعض العوائل المصابة بطفيلي المشوكات الحبيبية في العراق

الباحث كرار حميد طلب حشيش
جامعة ذي قار / كلية التربية للعلوم الصرفة / قسم علوم الحياة
kh2641446@gmail.com 07811235780
أ.د فاضل عباس منشد العبادي
جامعة ذي قار / كلية التربية للعلوم الصرفة / قسم علوم الحياة
Fadhil.abbas.bio@utq.edu.iq

الملخص :

طفيلي المشوكات الحبيبية من اصل حيواني يسكن الامعاء الدقيقة من العائلة الكلبية والذي يمثل العائل النهائي وتمثل الماشية والانسان العوائل الوسيطة المسببة لداء الاكياس العدرية. داء الاكياس العدرية هو مرض حيواني مهمل ومشكلة صحية عامة عالمية يسببه الاكينوكوكس حبيبي. تم جمع عينات الكيسات المائية من 21 ديسمبر الى 1 يناير 2024 وتم توزيع مناطق الجمع البشرية بين المستشفيات الحكومية والاهلية في مدينة الناصرية محافظة ذي قار واقضيتها وتم جمع عينات حيوانية من العائل الوسيط (الثروة الحيوانية) من مناطق مسالخ الناصرية والشطرة وسوق المواشي وبمساعدة الاطباء البيطريين في تشخيص الحالات واستخراج العينات. وأظهرت النتائج أن مستوى البروتين في أكباد ورئات الإنسان المصاب بـ E. granulosus كان مرتفعاً بقيمة (37.38±4.92) و (32.27±8.74) على التوالي، أي دون مستوى الاحتمالية ($p \leq 0.05$)، في حين لم تظهر العوائل الأخرى (الأبقار والأغنام والجاموس) أي فروقات بينها ($p > 0.05$). أما بالنسبة لتركيز الجلوكوز فقد ظهرت قيمه في أكباد ورئات الأغنام، بقيم (79.43±11.10) و (95.52±8.00) على التوالي، حتى مستوى الاحتمالية ($p \leq 0.05$) يليه الإنسان بقيم (17.80±58.44) للكبد و (47.45±15.04) في الرئة. لذلك فإن هذا الاختلاف في تركيز المواد العضوية (البروتين والجلوكوز) يعتمد على نوع المضيف وعضو المضيف.

الكلمات المفتاحية: الكلمات المفتاحية: طفيلي المشوكات الحبيبية، داء الاكياس العدرية ، مستوى البروتين، تركيز الجلوكوز.

Study of the Inorganic compounds of the Hydatid cyst fluid in some infected hosts with *Echinococcus granulosus* in Iraq.

karrar H. Talb
kh2641446@gmail.com
Thi -Qar University - College of Education for Pure Sciences
Department of biology
Prof.Dr Fadhil A. Al-Abady
Fadhil.abbas.bio@utq.edu.iq
Thi -Qar University - College of Education for Pure Sciences
Department of biology

Abstract:

Echinococcus granulosus parasite of animal origin that inhabits the small intestine of the canine family, which represents the final host. Livestock and humans represent the intermediate hosts that cause hydatidosis .Hydatidosis is a neglected zoonotic disease and global public health problem caused by E. granulosus. Hydatid cysts samples were collected from December 21 to

January 1 of 2024 human collection areas were distributed between government and private hospitals in the city of Nasiriyah, Thi-Qar Province, and its districts animal samples were collected from the intermediate host (livestock) from the areas of the slaughterhouses of Nasiriyah, Shatra, and the livestock market, with the help of veterinarians in diagnosing cases and extracting samples .The results showed that the protein level in livers and lungs infected human with E. granulosus was high with a value of (37.38±4.92) and (32.27±8.74) respectively, below the probability level ($p \leq 0.05$), while the other hosts (cattle, sheep, and buffalo) did not show any differences between them ($p > 0.05$) .As for glucose concentration, values appeared in the livers and lungs of sheep, with values of (79.43±11.10) and (95.52±8.00) , respectively, up to the probability level of, ($p \leq 0.05$) followed by humans with in (17.80±58.44) the liver and (47.45 ±15.04) in the lung. Therefore, this difference in the concentration of organic substances (protein and glucose) is depend to type of host and organ of host .

Key Words: Echinococcus granulosus, hydatidosis, protein level, glucose concentration .

1. Introduction:

Hydatid cyst disease (H.C.D.) is a common disease between humans and animals, and this disease has a dual effect on human health and the productivity of livestock, as the population numbers that depend for their livelihood on livestock productivity are in direct danger from this disease, but they are more vulnerable to indirect impact on health or reduced production for livelihoods and food security with the exacerbation of the cycle of poverty (Al-Yaqoubi, 2021).

Echinococcosis is a serious health problem that threatens the lives of humans and animals and affects both economically and socially, which has prompted researchers to find solutions and results that reduce the spread of the disease and its effects (Thompson, 2017). This disease is very similar to cancer cells during their metastasis stage (Deplazes, 2017), and it causes large financial losses annually, such as treatment expenses and losses in Pets (Al-Saeedi, 2021).

Parasites of the genus *Echinococcus* need two of mammals to complete their life cycle, as adults live in the final hosts, which are carnivores, mainly members of the canine family (Canidae), such as dogs, wolves, etc, and many mammals that act as intermediate hosts. Especially herbivores, in which the larval stages grow (Farhood, 2022).

Controlling cystic *Echinococcosis* requires community cooperation and many preventive measures (Thys *et al*., 2019). What makes it more difficult is that the infected person does not show symptoms and may remain so for many years or until the size of the cyst grows, depending on the location of the cyst

(Eckert & Deplazes, 2004) and its treatment is generally expensive, complex, and requires prolonged health care after surgical intervention (Kern *et al*., 2017).

All body organs are susceptible to infection except hair, nails, and teeth (Efortia *et al*., 2006). The liver is the organ most susceptible to infection, followed by the lungs, then the muscles, kidneys, spleen, and brain (Farhood, 2022). Bones are rarely affected (Loker & Hofkin, 2015; Sastry and Bhat, 2014).

The aim of study to detect some of biochemical parameters using diverse biochemical kits. Acomparative analysis according to type of host and organ. estimating the concentration of the biochemical components of the hydatid fluid, mainly the concentration of protein and glucose from the hydatid fluid that was isolated from humans and other intermediate hosts (cattle, sheep, buffalo).

2. Materials and Methods:

2.1 : Samples Collection

Samples were collected from December 21 to January 1 of 2024, and three days a week were chosen. Human collection areas were distributed between government and private hospitals in the city of Nasiriyah, Thi-Qar province, and its districts. Animal samples were collected from the intermediate host (livestock) from the areas ofthe slaughterhouses of Nasiriyah, Shatra, and the livestock market, with the help of veterinarians in diagnosing cases and extracting samples.

Human samples:

Hydatid cyst samples were collected from infected humans who underwent surgicaloperations at Al Hadarat privet Hospital in Nasiriyah and Al Amal privet Hospital in Shatra district.

Animal samples:

Hydatid cyst samples were collected from domestic animals, such as cattle, sheep, and buffalo, from the Nasiriyah slaughterhouse, the Shatrah slaughterhouse, and from local markets selling sheep. And butchers in livestock markets north of the city of Nasiriyah in Thi-Qar Province.

2.2 Cyst Isolation

The samples were transported in plastic containers containing normal saline under coldconditions to the parasitology laboratory at the College of Education for Pure Science /Thi-Qar University, where each cyst underwent a preparation process. Hydatid cyst was carefully separated from the surrounding tissues, such as the liver and lungs (figure 1), using a scalpel and forceps. The surface of the cyst was disinfected with 70% ethanol and stored at room temperature for further examination (Al-Yaqoubi, 2021).

Figure (1): liver Sheep and lung cattle infected with hydatid cysts isolated

2.3 Statistical Analysis:

Statistical analysis was performed using SPSS version 23. The results were statistically analyzed using Analysis of Variance (ANOVA) to compare the percentages of the study indicators, at a level of significance ($p \leq 0.05$) according to (Field, 2012).

3. Results:

The results of biochemical analyses of cyst fluids from different hosts showed the concentration of protein and glucose in the livers and lungs of intermediate hosts in this study .

Table (1): Protein concentration (g\dl) in the livers infected with hydatid cyst of intermediate hosts

Hosts		N	Protein concentration (g\dl) Mean & Std.Deviation
Cattle liver		40	0.28±0.22
Sheep liver		34	0.35±0.25
Buffalo liver		35	0.22±0.21
Human liver	18		37.38±4.92

Figure (2): Protein concentration (g\dl) in the livers infected with hydatid cyst of intermediate hosts

The results of the current study showed that the level of protein concentration in human liver (37.38±4.92) was significantly high below the level of probability ($p \leq 0.05$) compared with the other groups under study, while the other study groups did not appear (sheep liver 0.25±0.35, cow liver 0.22 ± 0.28, buffalo liver 0.21 ± 0.22). Any differences that reach the state of significance ($p > 0.05$) when comparing between them as shown inthe table (1) and figure (2).

Table (2): Glucose concentration (mg\dl) in the livers infected with hydatid cyst of intermediate hosts.

Hosts	N	Glucose concentration (mg\dl)
		Mean & Std.Deviation
Cattle liver	38	6.43±10.50
Sheep liver	37	11.10±79.43
Buffalo liver	35	2.19±4.40
Human liver	9	17.80±58.44

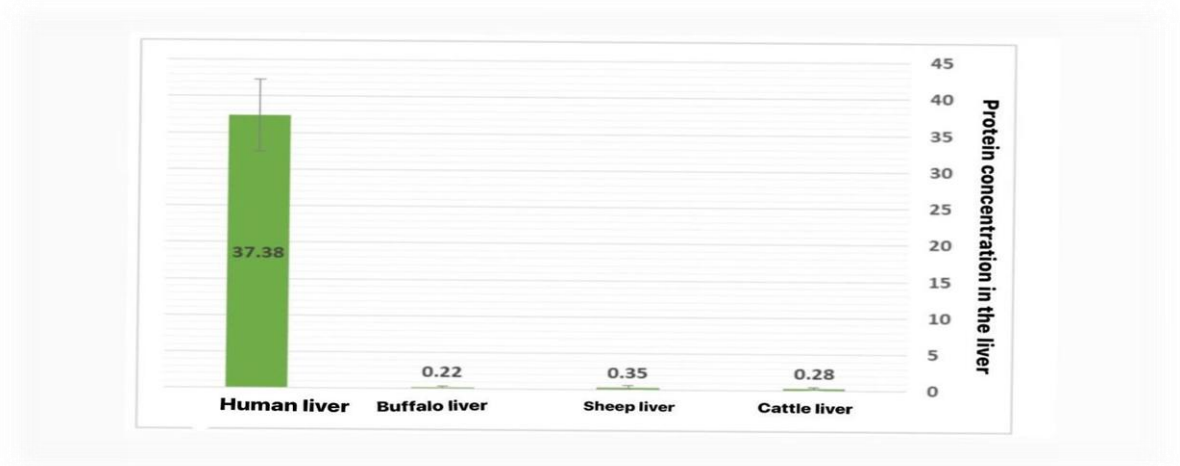

Figure (3): Glucose concentration (mg\dl) in the livers infected with hydatid cyst of intermediate hosts.

It is clear from the results of the current study that the level of glucose concentration in sheep liver (79.43±11.10) was high and significantly below the level of probability ($p \leq 0.05$) compared with the other groups in this study, followed in second place by human liver (17.80±58.44), while it was not The other study groups cow liver (6.43±10.50), buffalo liver (2.19±4.40) show no differences that reach significance ($p > 0.05$) when comparing among them as shown in the table (2) and figure (3).

Table (3): Protein concentration (g\dl) in the lungs infected with hydatid cyst of intermediate hosts.

Hosts	N	Protein concentration (g\dl)
		Mean & Std.Deviation
Cattle lung	40	0.23±0.28
Sheep lung	40	0.23 ± 0.45
Buffalo lung	38	0.14 ± 0.23
Human lung	11	32.27±8.74

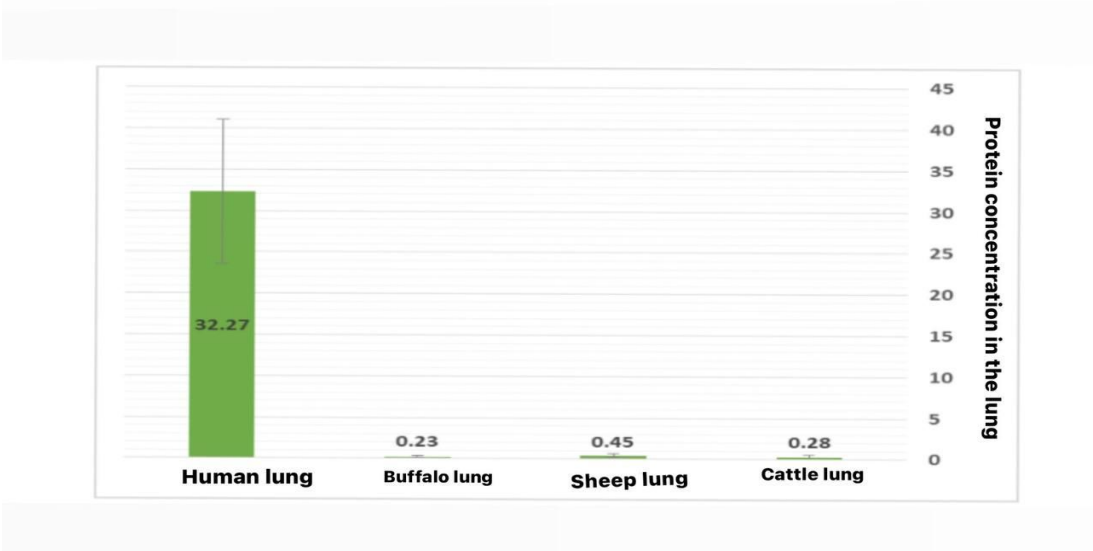

Figure (4):Protein concentration (g\dl) in the lungs infected with hydatid cyst of intermediate hosts.

The results of the current study showed that the level of protein concentration in human lungs (32.27±8.74) was significantly high below the level of probability ($p \leq 0.05$) compared with the other groups under study, while the other study groups did not appear (cattle lungs 0.23±0.28, sheep lungs 0.23 ± 0.45, buffalo lungs 0.14 ± 0.23), meaning that there are differences that reach the state of significance ($p > 0.05$) when comparing between them, while the results showed that there are significant differences ($p \leq 0.05$) when comparing between human lungs and the lungs of other intermediate additives with regard to protein concentration as shown in table (3) and figure (4).

Table (4): Glucose concentration (mg\dl) in the lungs infected with hydatid cyst of intermediate hosts.

Hosts	N	Lung glucose concentration (mg\dl)
		Mean & Std.Deviation
Cattle lung	40	0.96± 0.91
Sheep lung	40	8.00± 95.52
Buffalo lung	38	28.50± 6.02
Human lung	11	15.04 ±47.45

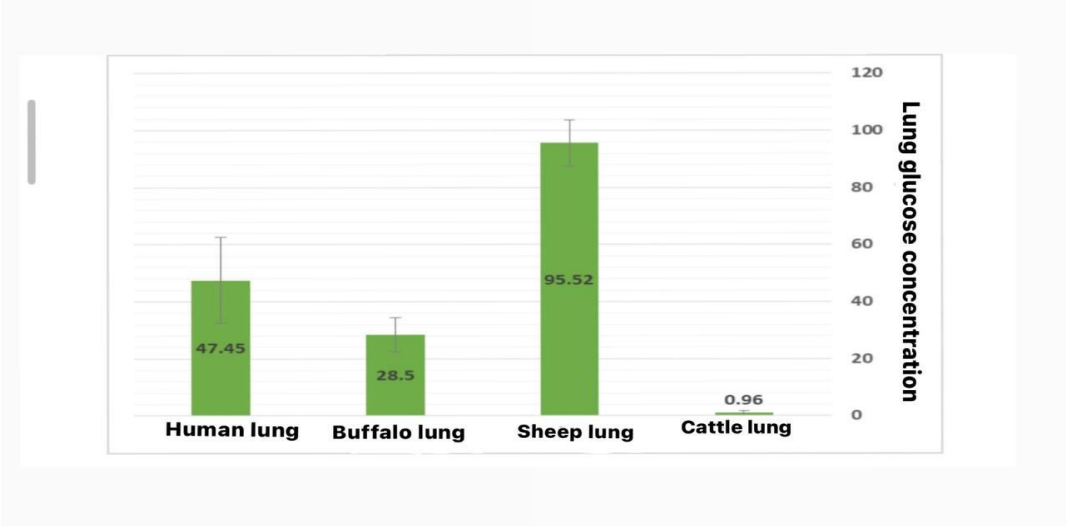

Figure (5): Glucose concentration (mg\dl) in the lungs infected with hydatid cyst of intermediate hosts.

The results showed that the level of glucose concentration in sheep lungs (95.52±8.00) was high and significantly below the level of probability ($p \leq 0.05$) compared with the other groups under study, followed in second place by human lungs with a value of (47.45±15.04), followed by this is buffalo lungs with a value of (6.02±28.50), and finally Cattle lungs with a value of (0.91±0.96) as shown in table (4) and figure (5).

4. Discussion:

The significantly higher concentration of protein observed in human livers (37.38±4.92) compared to other groups sheep liver (0.25±0.35), bovine liver (0.22±0.28) buffalo liver (0.21±0.22) is an exciting finding that requires further investigation. This finding is in line with previous studies conducted in Iraq, which also reported elevated protein levels in the livers of humans infected with *E. granulosus* (Issa *et al*., 2017; Molan & Faraj, 2009). The high concentration of the protein in human livers can be attributed to the response of the host immune system and the ability of the parasite to manipulate the host's metabolic pathways to ensure its survival and reproduction (Zhang & McManus, 2006).

The lack of significant differences in protein concentration between the livers of sheep, cows, and buffalo suggests that these animal hosts may have similar physiological responses to *Echinococcus* infection. This observation is in line with studies conducted in other regions, such as Iran and Turkey, which reported similar protein levels in the livers of these animal hosts (Ahmadi & Badi, 2011; Yaman *et al.*, 2016). Similar protein concentrations between these animal hosts may be evidence of their co-evolutionary adaptations to the *Echinococcus*

parasite, which has co-evolved with these hosts over time.

The significantly higher concentration of glucose in sheep livers (79.43±11.10) compared to the other groups ($p \leq 0.05$) suggests that sheep may have a unique metabolicresponse to *Echinococcus* infection. This observation is in line with previous studies conducted in Iraq, where elevated glucose levels were also reported in the livers of sheepinfected with *E. granulosus* (Saad & Al-Saqur, 2015; Molan & Faraj, 2018). The high glucose concentration in sheep livers may be a result of the parasite's effect on host carbohydrate metabolism, leading to enhanced de novo gluconeogenesis or reduced glucose utilization by host tissues.

In contrast, human liver samples showed relatively lower glucose concentration (17.80±58.44) compared to sheep livers. This finding is in line with international researchthat has reported variable glucose levels in *Echinococcus* infections in humans, often dependent on the stage and severity of the disease (Mandal & Mandal, 2012; Brunetti *et al*., 2010). The wide range of glucose concentrations observed in human livers may be attributable to individual variations in metabolic responses and the complex interaction between the parasite and the human immune system.

Cattle and buffalo liver samples did not show any significant differences in glucose concentration (6.43±10.50 and 2.19±4.40, respectively) when compared to each other ($p > 0.05$). This observation suggests that these two ruminant species may have similar metabolic adaptations to *Echinococcus* infection. Previous studies conducted in Iraq also reported similar glucose levels in the livers of *Echinococcus* infected cows and buffaloes(Al-Qaisi & Al-Azizz, 2016; Jassim *et al.*, 2019). The relatively lower glucoseconcentrations observed in cattle and buffalo livers compared to sheep livers may indicate more efficient regulation of carbohydrate metabolism in these ruminant hosts.

Determine the level of protein concentration in the lungs of the hosts under study:

The results of the present study on measuring protein concentration in the lungs of different species of hosts infected with the *Echinococcus* parasite suggest valuable insights into the dynamics of host-parasite interaction. The results indicate that the protein concentration level in the lungs of humans (32.27±8.74) was significantly higher($p \leq 0.05$) compared to the other groups investigated, including the lungs of cows (0.23±0.28), sheep (0.23±0.45), and buffalo (0.14±0.23) (Abdi *et al.*, 2022).

The significantly higher protein concentration in the lungs of humans infected with *Echinococcus* can be attributed to the host immune response and adaptations of the parasite to the human host. Hydrocystosis, caused by the

tapeworm *Echinococcus*, is a zoonotic disease that can infect many intermediate hosts, including humans (Eckert & Deplazes, 2004). The high protein concentration in human lungs may reflect a complex interplay between host defense mechanisms and parasite strategies to avoid or modulate the immune system (Mandal, 2012).

Interestingly, the study did not find significant differences ($p > 0.05$) in protein concentration between the other intermediate host species, namely cattle, sheep and buffalo. This suggests that host type may play a critical role in the pathogenesis and immune response to *Echinococcus* infection. The similarities in protein concentration observed in the lungs of these intermediate hosts may indicate a common adaptive strategy used by the parasite to successfully establish infection (Yaman, 2016).

The results of the current study are consistent with previous research conducted in Iraq and internationally. A study by (Al- Kinani *et al*, 2020) on protein concentration in the lungs of Iraqi patients infected with *Echinococcus* reported similar elevated levels in the lungs of humans compared to other host species. Researchers attributed this to complex host-parasite interactions and the host's immune response to the presence of the parasite (Al-Kinani *et al*., 2020).

High glucose levels in the lungs of sheep infected with *Echinococcus* can be attributed to metabolic adaptations of the parasite to the host environment. *Echinococcus*, being a tape parasite, is known to depend on host resources for survival and growth (Brunetti *et al*., 2010). The ability of the parasite to manipulate host glucose metabolism has been reported in several studies, suggesting that it may be a strategy used by the parasite to ensure its survival and reproduction (Brehm & Koziol, 2014).

In a study conducted by (Al-Salhi *et al.*, 2018) in Iraq, researchers investigated glucose levels in the lungs of sheep infected with *Echinococcus*. Their results were consistent with those reported in the current study, as they observed significantly higher glucose concentrations in the lungs of infected sheep compared to uninfected hosts. This suggests that metabolic changes induced by *Echinococcus* infection may be a common phenomenon across different geographic regions.

Furthermore, a study by (Gupta *et al.*, 2016) in India explored glucose metabolism in lungs of humans infected with *Echinococcus*. The researchers reported elevated levels of glucose in infected human lungs, which is consistent with the results of the current study. This similarity in glucose dynamics across different host species infected with *Echinococcus* highlights the potential role of glucose as a vital resource for the survival and reproduction of the parasite.

Conclusion:

The different concentration of protein and glucose dependent to type of intermediate host and the organ infected.

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