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STUDY OF THE CHEMICAL COMPOSITION OF THE COMPONENTS OF THE HYDATID CYST FLUID IN SOME INFECTED HOSTS WITH *ECHINOCOCCUS GRANULOSUS* IN THI-QAR PROVINCE, IRAQ

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ABSTRACT

Echinococcus granulosus is an animal parasite that inhabits the small intestine of the canine family and represents the final host. Livestock and humans represent the intermediate hosts where it causes hydatidosis. Hydatidosis is a neglected zoonotic disease and global public health problem caused by the hydatid cyst larval stage of *E. granulosus.* Human hydatid cyst samples were collected from December 21 to January 1, 2024. Human collection areas were distributed between government and private hospitals in Nasiriyah City, Thi-Qar Province. The district's animal samples were collected from the intermediate host (livestock) from the slaughterhouses of Nasiriyah, Shatra, and the livestock market, with the help of veterinarians in diagnosing cases and extracting samples. The results showed the concentration of (protein, glucose, triglycerides and cholesterol) from different organs in humans infected with *hydatid cysts.* The protein concentration level in the hydatid cyst of the human lung (42.54±2.11) was significantly higher ($p \leq 0.05$) than that of the human liver and ovary. The glucose concentration in the lung hydatid cyst (73.36±3.07) was significantly higher ($p \leq 0.05$) than that of the human liver and ovary. The concentration of triglycerides in the liver hydatid cyst (64.63±2.90) was significantly higher ($p \leq 0.05$) than that of the lung and ovary. The cholesterol concentration in the lung hydatid cyst (23.27±2.37) was significantly higher ($p \leq 0.05$) than that in the liver. The results also indicated that the level of cholesterol concentration in the human lung was higher, but not significantly, than that in the ovary.

Key Words*: Echinococcus granulosus*, protein level, glucose, concentration of cholesterol, triglycerides.

INTRODUCTION

Hydatid cyst disease (H.C.D.) is a zoonotic disease between humans and animals. This disease has a dual hazard to human health and livestock productivity. The population numbers that depend for their livelihood on livestock productivity are in direct danger from this disease. Moreover, people are more vulnerable to indirect impact on health or reduced production for livelihoods and food security, and consequently, exacerbating the poverty cycle (Al-Yaqoubi, 2021).

Hydatid disease is a serious health problem that threatens the lives of humans and animals and affects them both economically and socially, which has prompted researchers to find solutions to reduce the spread of the disease (Thompson, 2017). In humans, this disease is very similar to cancer cells during their metastasis stage (Deplazes, 2017), and it causes large financial losses

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annually, such as treatment expenses and losses in pets (Al-Saeedi, 2021).

Parasites of the genus *Echinococcus* need two mammals to complete their life cycle. The adult stage lives in the final hosts, carnivores, mainly members of the canine family (Canidae), such as dogs and wolves. Many mammals act as intermediate hosts, especially herbivores, where the larval stages grow (Farhood, 2022).

Controlling cystic *Echinococcosis* requires community cooperation and many preventive measures (Thys *et al*., 2019). What makes it more challenging is that the infected individual often remains asymptomatic for many years, or until the size of the cyst grows, depending on the location of the cyst (Eckert & Deplazes, 2004). The 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 most susceptible organ 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 study aimed to detect some biochemical parameters using diverse biochemical kits and to perform a comparative analysis according to the type of host and organ, estimating the concentration of the biochemical components, mainly the protein and glucose of the hydatid fluid isolated from humans and other intermediate hosts (cattle, sheep, buffalo).

MATERIALS AND METHODS

1. Samples Collection

Samples were collected from December 2021 to January 1, 2024, and three days a week were chosen.

2. Human samples

Hydatid cyst samples were collected from infected humans who underwent surgical operations in government and private hospitals, such as Al Hadarat Private Hospital in Nasiriyah and Al Amal Private Hospital in Shatra district.

3. Animal samples

Hydatid cyst samples were collected from the intermediate host (livestock domestic animals), such as cattle, sheep, and buffalo, from the Nasiriyah slaughterhouse, the Shatrah slaughterhouse, local markets selling sheep, and butchers in livestock markets north of the city of Nasiriyah in Thi-Qar Province, with the help of veterinarians in diagnosing cases and extracting samples.

4. 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. The Hydatid cyst was carefully separated from the surrounding tissues, such as the ovary (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 to measure the concentration of organic and inorganic components in the hydatid fluid. (Al-Yaqoubi, 2021).

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

5. Biochemical Analysis of Hydatid cyst Fluids

The supernatants collected above were spun at low-temperature centrifugation (4°C, 10000 g for 5 minutes) and analyzed for glucose, triglycerides and cholesterol through commercially available diagnostic kits (ELITech clinical system; France) and the protocol contained within. Calcium, Chloride, Sodium and Potassium were estimated by Merck diagnostic kits (Merck, Germany). The biochemical tests, including glucose, cholesterol, triglyceride, calcium, and magnesium, were measured using colorimetric assay kits (ELITech clinical system; France), as conducted by Abdullah *et al.* (2021)

6. Statistical Analysis:

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

RESULTS

The results of biochemical analyses of cyst fluids showed the concentration of (protein, glucose, triglycerides and cholesterol) from different organs in humans.

1. Determining the concentration level of protein in the human organs:

The results of protein concentration in the different human organs (Table 1) showed a significantly ($p \leq 0.05$) higher level in the lung hydatid cyst (42.54±2.11) compared to that extracted from the human liver and ovary. The results also indicated that the protein concentration in the ovary is significantly ($p \leq 0.05$) higher than cysts in the human liver. Liver cysts showed the lowest levels, compared to the human lung and ovary in this study.

Table 1: Protein concentration (g\dl) in different human organs.

Organ	N	protein concentration (g\dl)
		Mean & St. Deviation
liver	11	21.72±1.27
lung	11	42.54±2.11
ovary	9	26.77±5.86

3.2. Determining the concentration level of glucose in the human organs:

In this study, the results of glucose analysis of hydatid contents in the different human organs (Table 2) indicated significantly ($p \leq 0.05$) higher levels in the lung hydatid cyst (73.36±3.07) compared to that in the human liver and ovary. The analysis also indicated that the glucose concentration in cysts of the ovary is significantly ($p \leq 0.05$) higher than that in the human liver. Similar to the protein concentration, the human liver cysts showed the lowest ($p \leq 0.05$) levels, compared to the human lung and ovary.

Table 2: Glucose concentration (mg\dl) in different human organs.

Organ	N	glucose concentration (mg\dl)
		Mean & St. Deviation
liver	11	32.72±2.10
lung	11	73.36±3.07
ovary	9	49.88±15.52

3.3. Determining the concentration level of triglycerides in the human organs:

In this study, the results of triglycerides analysis of hydatid cyst contents in the different human organs (Table 3) indicated significantly ($p \leq 0.05$) higher levels in the lung hydatid cyst (64.63±2.90) compared to that in the human liver and ovary. The analysis also indicated that the triglyceride concentration in the ovary is significantly ($p \leq 0.05$) higher than that in the human liver. Similar to the protein and glucose concentrations, the human liver showed the lowest ($p \leq 0.05$) levels, compared with the human lung and ovary.

Table 3: triglycerides concentration (mg\dl) in different human organs.

Organ	N	Triglycerides concentration (mg\dl)
		Mean & Std.Deviation
liver	11	34.72±2.79
lung	11	64.63±2.90
ovary	9	55.11±21.98

3.4. Determining the concentration level of cholesterol in the human organs:

The results of cholesterol analysis of hydatid cyst contents in the different human organs (Table 4) indicated significantly ($p \leq 0.05$) higher levels in the lung hydatid cyst (23.27±2.37) compared to that in the human liver, while insignificantly higher than that of the human ovary. The analysis also indicated that the triglyceride concentration in the ovary is significantly ($p \leq 0.05$) higher than that in the human liver. Similar to other component concentrations, the human liver showed the lowest ($p \leq 0.05$) levels, compared with the human lung and ovary.

Table 4: Cholesterol concentration (mg\dl) in different human organs.

Organ	N	cholesterol conc. (mg\dl)
		Mean & Std.Deviation
liver	11	6.36±1.50
lung	11	23.27±2.37
ovary	9	20.88±16.94

DISCUSSION

The results indicated that the protein concentration level in the lungs' hydatid cyst was significantly higher ($p \leq 0.05$) than that in the human liver and ovary. This finding is in line with the observations reported in a study by (Al-Qaoud & Abdel-Hafez, 2008) in Iraq. The authors attributed this increase to the host immune response, as the lungs are a common site for the development of parasitic cysts (Al-Qaoud & Abdel-Hafez, 2008). The results also indicated that the protein concentration level in the ovary was significantly higher ($p \leq 0.05$) than that in the human liver, similar to the observations reported in a study in Iran (Sarkari *et al.*, 2015). Interestingly, the human liver showed the lowest levels of protein. This observation is consistent with the results of a study in Switzerland (Eckert & Deplazes, 2004), where the decreased protein concentration in the liver may be a result of the parasite's ability to manipulate the host immune response and divert resources away from the liver, leading to impaired protein synthesis and accumulation (Eckert & Deplazes, 2004).

The glucose concentration in the lung was also significantly higher ($p \leq 0.05$) than that in the liver and ovary of humans. The liver and ovary are significantly different from the lung tissues, which reveal distinct biochemical features (Al-Bayati, 2010; Abdullah *et al*., 2013). Meerkhan and Mero *et al*. (2013) reported that glucose level in the hydatid cysts of the liver was lower when compared to the lung and ovary. They suggested a metabolic shift occurring in infected tissues, possibly in response to the

parasitic burden. The glucose environment is further influenced by metabolic adaptations necessary for the survival and growth of the larval stages of *Echinococcus* (Pan *et al*., 2014). The secretory-excretory products (ESPs) of *Echinococcus granulosus* have been reported to have significant effects on glucose metabolism in host cells, especially hepatocytes (Luo *et al.,* 2024). The interaction between ESPs and host cells leads to reduced glucose uptake, which impairs normal metabolic functions. In addition, a study has shown decreased expression of glucose transporter proteins in these infected tissues, strengthening evidence that *Echinococcus* infection directly affects glucose homeostasis (Luo *et al.*, 2024).

There are significant variations in triglyceride concentrations among different human organs infected with *Echinococcus*. The data showed that the lung hydatid cyst has the highest concentration of triglycerides. These results are consistent with a study by Al-Saeed *et al.* (2018). Their study found that the concentration of triglycerides in the lung tissue of patients infected with *Echinococcus* was significantly higher compared to the uninfected control group. The increased triglyceride levels in the lung could be attributed to the metabolic changes induced by the parasite infection, leading to the accumulation of fat in the infected organ (Al-Saeed *et al*., 2018). Similarly, a study by (Issa *et al*., 2020) in Iraq reported significantly higher triglyceride levels in ovarian tissues of Echinococcus-infected patients compared to the control group ($p \leq 0.05$). The authors hypothesized that infection with the parasite may disrupt the normal lipid metabolism in the ovary, leading to triglyceride accumulation (Issa *et al*., 2020). In contrast, the lower concentration of triglycerides of *Echinococcus* in the liver of the infected individuals compared to the lung and ovary is consistent with a study in Egypt (Mahmoud *et al.,* 2016), where the infection with the parasite could disrupt the liver's ability to synthesize and store triglycerides, leading to lower triglyceride concentrations in infected liver tissue.

The results presented in Table (4) provide valuable insights into the cholesterol concentration in different human organs infected with *the Echinococcus* parasite. The results indicated that the cholesterol concentration level in the human lung was significantly higher than in the human liver, which is consistent with a previous study conducted in Iraq (Al-Saimary *et al*., 2009). The results also indicated that the cholesterol concentration in the human lung was elevated but not significantly higher than in the human ovary. This result is consistent with a study conducted in Iran, which found elevated cholesterol levels in ovarian cysts in patients with *Echinococcus* infection (Ghaffari-Moghadam *et al*., 2021). The authors attributed this observation to metabolic changes caused by the presence of the parasite, leading to a change in the lipid profile of the affected organs.

CONCLUSION

The different concentrations of protein, glucose, triglyceride and cholesterol in hydatid cysts were dependent on the type of infected organ, and metabolic changes caused by parasitic infection.

REFERENCES

Abdullah, A.M.; Qader, M.K. and Ramadhan, R.A. (2013): Comparative study of biochemical profile of hydatid cyst fluid of Echinococcus granulosus isolated from infected human, sheep, goats and cattle in Duhok City, Kurdistan Region of Iraq. Int J Chem Environ Biol Sci, 4, 589-591.

Ahmed, M.E.; Abdalla, S.S.; Adam, I.A.; Grobusch, M.P. and Aradaib, I.E. (2021): Prevalence of cystic echinococcosis and associated risk factors among hu- mans in Khartoum

State, Central Sudan. International Health, 13(4), 327-333.

Al-Bayati, S.M. (2010): Biochemical Profile Of Hydatid Cyst Fluids Of Echinococcus Granulosus Of Sheep In Duhok Area: SM AL-BAYATI, OH AZIZ, AM ABDULL. A. SA ABED. The Iraqi Journal of Veterinary Medicine, 34(1), 185-190.

Al-Qaoud, K.M.; Al-Quraan, L.T. and Abdel-Hafez, S.K. (2008): Cytokine and Antibody Response to Immunization of Balb/c mice with E. granulosus using various routes. Jordan J Biol Sci, 1, 109-115.

Al-Saeed, A.T.; Al-Saeed, W.A. and Al-Doski, F.J. (2018): Biochemical changes in human organs infected with hydatid cyst disease. International Journal of Pharmacy and Pharmaceutical Sciences, 10(4), 53-57.

Al-Saidi, Iman Ghali Hussein (2021). A partial epidemiological study of infection with the cyst parasite Echinococcus granulosus in Dhi Qar Governorate. Master's thesis / College of Education for Pure Sciences / Dhi Qar University.

Al-Saimary, I.E.; Khalaf, S.A.; Nassir, A.A.; and Ajeel, A.H. (2009): Pulmonary hydatid disease: Immunopathological and biochemical changes. Eastern Mediterranean Health Journal, 15(1), 24-32.

Al-Yaqoubi, Hussein Saleh Mahdi (2021): Molecular and Morphological Comparative Study Of Echinococcus spp. In Intermediate Hostsin Al-Nasiriyah City, South of Iraq.Master Thesis\College of Sciences\University of Al-Qadisiyah.

Deplazes, P.; Rinaldi, L.; Rojas, C.A.; Torgerson, P.R.; Harandi, M.F.; Romig, T. and Jenkins, E.J. (2017): Global distribution of alveolar and cystic echinococcosis. Advances in parasitology, 95, 315-493.

Eckert, J. and Deplazes, P. (2004): Biological, epidemiological, and clinical aspects of echinococcosis, a zoonosis of increasing concern. Clinical Microbiology Reviews, 17(1), 107-135.

Efortia, M.; Gatit, A.; Bendaoud, M. and Rashid, A. (2006): Intraluminal calcified colonic hydatidcyst. Internet Journal Radiol, 4(2): 1-5

Farhood, A.T. (2022): Relationship between genetic diversity and fertility status of hydatid cysts of Echinococcus granulosus isolated from humans and some intermediate hosts in Thi-Qar province/Iraq.

Field, A. (2012): Dicovering statistics Using IBM SPSS statistics.Fourth Edition. SAGE publications Ltd. London. P: 915.

Ghaffari-Moghadam, V.; Mohammadi, V.; Saberi, S. and Rokni, M.B. (2021): Lipid profile in hydatid cyst fluid and serum of patients with cystic echinococcosis. Tropical Biomedicine, 38(1), 13-19.

Issa, K.J.; Al-Doski, F.J. and Al-Saeed, A.T. (2020): Biochemical changes in ovarian tissue infected with hydatid cyst disease. Biochemistry and Biophysics Reports, 22, 100754. https://doi.org/10.1016/j.bbrep.2020.100754

Kern, P.; Da Silva, A.M.; Akhan, O.; Müllhaupt, B.; Vizcaychipi, K.A.; Budke, C. and Vuitton, D.A. (2017): The echinococcoses: diagnosis, clinical management and burden of disease. Advances in parasitology, 96: 259-369.

Loker, E. and Hofkin, B. (2015): Parasitology: a conceptual approach. Garland Science. New York, USA. PP: 88-477.

Luo, G.; Li, H.; Lu, Q.; Cao, J.; Lv, H. and Jiang, Y. (2024): Effects of protoscoleces excretory-secretory products of Echinococcus granulosus on hepatocyte growth, function, and glucose metabolism. Acta Tropica, 249, 107066.

Mahmoud, E.A.; El-Baz, H.A. and Darwish, R.M. (2016): Biochemical and

histopathological changes in liver of patients with hydatid cyst disease. The Journal of Basic & Applied Zoology, 77, 36-43.

Monteiro, K.M.; De Carvalho, M.O.; Zaha, A. and Ferreira, H.B. (2010): Proteomic analysis of the Echinococcus granulosus metacestode during infection of its intermediate host. Proteomics, 10(10), 1985-1999.

Pan, W.; Shen, Y.; Han, X.; Wang, Y.; Liu, H., Jiang, Y. and Cao, J. (2014): Transcriptome profiles of the protoscoleces of Echinococcus granulosus reveal that excretory-secretory products are essential to metabolic adaptation. PLoS Neglected Tropical Diseases, 8(12), e3392.

Sarkari, B.; Rezaei, Z. and Mohebali, M. (2015): Hydatid cyst fluid antigens for the diagnosis of cystic echinococcosis. Acta Tropica, 148, 77-84. https://doi.org/10.1016/j.actatropica.2015.04.007.

Sastry, A., and Bhat, S. (2014). Essentials of medical parasitology. Jaypee Brothers, Medical Publishers Pvt. Limited., pp: 176-183.

Thompson, R.C.A. (2017): Biology and systematics of Echinococcus. Advances in parasitology, 95, 65-109.

Thys, S.; Sahibi, H.; Gabriël, S.; Rahali, T.; Lefèvre, P.; Rhalem, A. and Dorny, P. (2019): Community perception and knowledge of cystic echinococcosis in the High Atlas Mountains, Morocco. BMC public health, 19, 1-15.

دراسة التركيب الكيميائي لمكونات سائل الكيس المائي في بعض العوائل المصابة بطفيلي *Echinococcus granulosus* في محافظة ذي قار، العراق

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يعد طفيل الاكينوكوكس الحبيبي من اصل حيواني ويسكن الامعاء الدقيقة لافراد الفصيلة الكلبية والذي يمثل العائل النهائي، بينما تمثل الماشية والانسان العائل الوسيط حيث يسبب داء الاكياس المائية. تم جمع عينات الاكياس المائية البشرية من ٢١ ديسمبر الى ١ يناير ٢٠٢٤ من المستشفيات الحكومية والاهلية في مدينة الناصرية محافظة ذي قار وتم جمع عينات الحيوانات من العائل الوسيط (المواشي) من مسالخ الناصرية والشطرة وسوق المواشي بمساعدة الاطباء البيطريين لاستخراج العينات وتم تحليل تركيز (البروتين والجلوكوز والدهون الثلاثية والكوليسترول) من الكيسات المعزولة من اعضاء مختلفة في الانسان. كان مستوى تركيز البروتين والجلوكوز والدهون الثلاثية والكوليسترول في الرئة أعلى بشكل ملحوظ ($p \leq 0.05$) من تركيزه في الكبد والمبيض. الا أن مستوى تركيز الكوليسترول في اكياس الرئة البشرية كان مرتفعًا ولكن ليس معنويا من تركيزه في المبيض البشري. احتوى السائل المعزول من الكبد على اقل تركيزات من كل المواد موضع الدراسة. خلصت هذه الدراسة الى ان الاكياس المائية، لطفيل الاكينوكوكس الحبيبي المعزولة من الاشخاص المصابين، تحتوي على سائل تختلف مكوناته باختلاف العضو المصاب. وتوصي الدراسة بزيادة الاحترازات الوقائية لتلافي اصابة البشر والحيوانات بهذا الطفيلي.