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The effect of aqueous and alcoholic extract of *Opuntia ficus indica* on biochemical parameters and kidney function in rats infected with echinococcosis

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Abstract

This study was designed to investigate the effect of the active substances in the aqueous and alcoholic extract of the *Opuntia ficus indica* on some biochemical parameters { Triglyceride, low-density lipoprotein (LDL), High-density lipoprotein (HDL), Total protein, Glucose} and kidney function {Creatinine, Urea, Uric acid} in rats infected with Echinococcosis. Protoscolices were collected from livers of sheep naturally infected with hydatid cysts from Kirkuk slaughter and we used eosin aqueous dye for measuring the vitality of these primates.

Results of this study revealed that the plant's alcoholic extract at a concentration of 200 mcg/ml was found to have the best effects on the findings compared to the other concentration.

The outcomes also showed significant decrease on biochemical parameters (Triglycerides, LDL, Total protein, Glucose). In contrast there was a noticeable increase in HDL when compared to the control group. And Kidney function showed a noteworthy decline when compared to the control group.

Keywords: *Opuntia ficus indica*; Biochemical parameters; Kidney function; Hydatid cyst

1. Introduction

Echinococcosis is one of the most common parasitic zoonoses diseases in the world, and the countries of the North Africa, Middle East, Sudan, and some countries of South America are highly endemic to this disease (Craig *et al.*, 2003). The main cause for this disease is the adult tapeworm, *Echinococcus granulosus* (Bickel *et al.*, 2001). Humans and animals are infected by the transfer of tapeworm eggs to them through polluted food and water (Naguleswaran *et al.*, 2006). The eggs have within them a six spine embryo and is capable of causing infection upon its arrival in the external environment, It is characterized by its ability to remain for a long period in the environment (Formosa and Jobre, 2011). The life cycle of *Echinococcus* parasite involve two types of hosts to complete its life cycle, the first type includes carnivorous animals such as dogs, wolves, and others, the second type of host involve herbivorous animals such as cows, sheep, pigs, and others, in addition to humans when they eat contaminated vegetables (Roberts and Janovy, 2009). Hydatid cysts are small in the primary stages of infection and thus the disease is asymptomatic (Marquardt *et al.*, 2000). Symptoms start to appear when the cysts increase in size, which creates pressure on nearby tissues and organs, the significance of these cysts varies according to their location in the host's body (Mc manus *et al.*, 2012).

Recently, interest has turned to the use of plant extracts for their effectiveness in treating hydatid cyst disease, preventing its growth, and eliminating it such as *Opuntia ficus indica* (Al-Omari, 2005). *Opuntia ficus indica* is a flowering plant whose fruits exits highly active ingredients known as phytochemicals (rich concentrations of minerals taurine,

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carbohydrates, betalains, antioxidants, vitamins and polyphenols), Polyphenols have showed pharmacological capability through their anti-inflammatory, anti-bacterial, and antioxidant (Al-Attar and Ali, 2020).

2. Material and methods

We collected samples of hydatid cysts from infected sheep livers at Kirkuk Slaughterhouse, Kirkuk province. We put the samples in special jars and saved it cold with crushed ice to maintain the *Protoscolices* vitality and transported it to the laboratory, and we are sure of their fertility through the *protoscolices* existence inside it. The *protoscolices* vitality was evaluated using (0.1%) aqueous eosin dye.

The Hydatid cyst portions were separated from one another using the Smyth (1985) method by cleaning the cyst's exterior with the physiologic saline solution after that sterilizing it with a ethyl alcohol-moistened cotton piece and then transferring the liquid to sterile test tubes.

We withdraw the created layer of *Protoscolices* fluid and the cyst with forceps, after that we opened longitudinally the generated layer using scissors then we withdraw the remainder of the liquid and added to the former liquid, and rinsed the generated layer with Ranker's solution. It must repeat these steps three to five times to ensure they are clear of *protoscolices*, then the liquid placed in sterile tubes and centrifuged for five minutes at a speed of 3500 rpm. We used Pasteur pipette to draw the hydatid liquid and placed it in sterile test tubes and we procedured chemical test. We were intended the *Opuntia ficus-indica* plant aqueous extracts using the method of (Al-Mansour 1995) by putting 100 g of dry plant material and shaking it for 90 minutes with 200 ml of distilled water and let it for 24 hours, then filtered and packed it in test tubes and put in an centrifuge device at a speed of 3000 rpm for 10 minutes.

After that the filtrate and sediment were collected in glass dishes and heated to 50 °C in an electric oven until they were completely dry, five g of the dry extract were extracted and stored in jars in the fridge till needed. The identical procedure was applied to the alcoholic extract excepting for replacing water with alcohol while dissolved it (Sarkar *et al.*, 1996)

3. Results

This study showed the effectiveness of *Opuntia ficus indica* alcoholic and aqueous extract on biochemical parameters and kidney function in rats infected with Echinococcosis, the biochemical parameters and kidney biomarkers of the experimental rats were measured prior and after infection.

The results appeared in (table 1) a significant reduction in triglycerides, LDL, Glucose and total protein, while appeared significant increase in HDL when we compared it with negative control group ($p < 0.05$).

The plant's alcoholic extract at a concentration of 200 mcg/ml was found to have the best effects on the findings compared to the other concentration.

Table 1 The effect of plant extract on some biochemical parameters in infected rats with Echinococcosis.

Group	Parameters				
	Triglycerides mg/dl	LDL mg/dl	HDL mg/dl	Total protein mg/dl	Glucose mg/dl
Control Negative	113.3 ^a	60.4 ^b	91.1 ^c	8.3 ^a	109.2 ^a
Control Positive	103.7 ^b	71.5 ^a	88.7 ^d	4.1 ^{cd}	79.8 ^{cd}
<i>Opuntia ficus indica</i> Aqueous 100 mcg/ml	98.6 ^{cd}	56.6 ^{cd}	95 ^{ab}	4.6 ^{cd}	80.1 ^c
<i>Opuntia ficus indica</i> Aqueous 100 mcg/ml	99.3 ^c	56.8 ^{cd}	94.2 ^{ab}	4.9 ^d	85.6 ^{ab}
<i>Opuntia ficus indica</i> Alcoholic 100 mcg/ml	100.2 ^{ab}	58.9 ^d	96.6 ^b	5.9 ^c	99.4 ^b
<i>Opuntia ficus indica</i> Alcoholic 200 mcg/ml	65.2 ^d	59.2 ^c	97.7 ^a	6.6 ^b	78.8 ^d

Numbers with various letters following them vertically denote statistically significant differences ($P < 0.05$).

The values of uric acid, urea and creatinine of treated animals with aqueous and alcoholic extract of plant were significant decrease compared it with negative control group, as shown in table(2).

Table 2 The effect of plant extract on some kidney biomarker in rats infected with Echinococcosis

Group	Parameters		
	Creatinine mg/dl	Urea mg/dl	Uric acid mg/dl
Control negative	86.7 ^a	52.1 ^a	31.8 ^a
Control positive	79.5 ^b	39.8 ^b	28.8 ^b
<i>Opuntia ficus indica</i> Aqueous 100 mcg/ml	65.8 ^{ab}	36.6 ^{ab}	26.8 ^c
<i>Opuntia ficus indica</i> Aqueous 100 mcg/ml	63.3 ^c	32.4 ^c	26.1 ^{ab}
<i>Opuntia ficus indica</i> Alcoholic 100 mcg/ml	58.2 ^d	31.8 ^{cd}	21.5 ^c
<i>Opuntia ficus indica</i> Alcoholic 200 mcg/ml	55.9 ^{cd}	33.6 ^d	20.9 ^d

Numbers with various letters following them vertically denote statistically significant differences (P<0.05).

4. Discussion

Cystic Echinococcosis (CE) is a major global health and economic concern, it caused by several species of the genus *Echinococcus* (Ali *et al.*,2020). Since ancient people have used herbs and plant extracts and plants oils to treat diseases and remove their side effects and risks (Ahmed *et al.*, 2023).

Opuntia ficus indica is the most important plants that were used because its chemical content of the active components such as phenols, alkaloids, tannins, flavonoids, and actins (Kaur *et al.*, 2012). Flavonoids show essential role for reducing the sugars which causes an imbalance in the metabolism of carbohydrates and decrease in the amount of ATP which provided for the parasite's the essential functions (Lehane & Saliba, 2008). The mixture of alkaloids and phenols affects nitrogen metabolism and constructs the body's Golgi, nucleus, and mitochondrial membrane, all of which are critical to the viability of microorganisms (Galati *et al.*, 2003).

The results of the present study showed that the vital proportion of protoscolices decreases with increasing concentration of the plant extract, and these results are agree with (Hamad,2021). Alkaloids cause damage of vital organelles and destroy the nuclei of the cells created in protoscolices leading to their death(Gidado *et al.*,2007). As well the plant have role in stimulating the enzyme lipoprotein in adipose tissue, which works to break triglycerides into fatty acids that are absorbed it by the fatty cells (Hassan *et al.*,2006).

Also the current study results agreed with(Juyi *et al.*,2013) who conducted his study on the serum of people infected with the *Echinococcus granulosus*, the study showed declining in glucose absorption compared to infected people, minor concentrations of glucose can be attributed to taking drug against the parasite, the most important of which is Mebendazole, which avoids microtubule development and prevents glucose absorption, so the energy level decreases until the parasite dies(Mosby- year Book,1996).

This study also agrees with the study (Hamad, 2021)who showed that the concentration of biochemical parameters (protein, urea, glucose) was low, The variation in protein concentrations may be due to the consuming of protein by the parasite, as the parasite's protoscolices can assimilate the host's protein in varying amounts depending on the type of host(Delorenzi *et al.*, 2001).

5. Conclusion

The results of this study revealed the plant's alcoholic extract at a concentration of 200 mcg/ml was the best effects on the findings compared to the other concentration.

The outcomes also showed that the aqueous and alcoholic extract of the *Opuntia ficus indica* decrease some biochemical parameters (Triglycerides, LDL, Total protein, Glucose) in rats infected with Echinococcosis. In contrast there was a noticeable increase in HDL when compared to the control group. As kidney function showed a noteworthy decline when compared to the control group.

This study encouraged to use the plants as alternative means of treatment for parasitic infections.

Compliance with ethical standards

Statement of ethical approval

The current study was conducted with agreement with the ethics of the European and German Animal Welfare law, announcement principles set out by Helsinki, and the National organizations of the Health and care animals and use them in researches.

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