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The First Investigation Of The Spread Of Parasitic Infection And Its Relation To Food Groups In The Hedgehog Caught From The City Of Samawah , Al-Muthanna Province.

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ABSTRACT

The current research is the first study on parasitic infection in hedgehog and its relation to food items, total (73) specimens of hedgehog (Hemiechinus auritus) were collected from different area in Samawah city for the period from march-august 2019. The results showed that 18 hedgehogs were infected with a total percentage of 24.66.

The results of the current study proved that the hedgehog animal was infected with six species of parasites ,the total infection with one species of parasites was 9.52, while the total infection with two species of parasites was 6.80 and reported one of infection with three species of parasites was recorded by total infection 4.762,statistical analysis showed no significant differences at the level of $P \leq 0.05$ in the percentage of infection between males and females of long-eared hedgehog. The Coefficient of Contingency test, the highest value(99.93) was recorded between Rhipicephalus turanicuss and Moniliformis moniliformis, followed by the value (98.89) between Haemaphysalis sp and Pterygodermatites plagiostoma, and the value between the parasite Archaeopsylla erinacei and Mathevotaenia erinacei was 92.8 ,the lowest value of Coefficient of Contingency test was recorded between Archaeopsylla erinacei and Pterygodermatites plagiostoma, where the value was (89.82). The results of the current study showed that there are three main nutrients that hedgehogs can eat, which are invertebrates, vertebrates, and plant parts and this indicates that hedgehogs belong to Omnivorous group.

Keywords: Coefficient of Contingency, parasites , Omnivorous group, Archaeopsylla

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INTRODUCTION

The long-eared hedgehog (*Hemiechinus auritus*) belong into family: Erinaceidae, class: Mammalia, phylum: Chordata (Hutterer et al,2005). This hedgehog is naturally parasites prone and can carry disease as plague, it is highly recommended that, it kept as pet, it should be purchased from a respected dealer. Wild hedgehogs are considering as host of a wide variety of different parasites and pathogens (Riley & Chomel, 2005).

Parasites regarded a major agent of disease that infect hedgehog and became a source of human (Brander, et al, 1990), in contrast most hedgehog carry a parasite bad that is asymptomatic in healthy animal (Reeves, 1994). Parasites infection causes several anemia and transmission of infection diseases, tumors, gingiuitis, bacterial & fungal diseases are factors that have jeopardized the life of this species (Thamm et al 2009 ; Christain et al 2014). Some Iraqi authors reported that hedgehog *H. auritus* carried several parasites such as helminthes (Jawdat & Jafary, 1979), nematodes (Al-Zihiry, 2002), Cestode (Al-Zihiry, 2009), ectoparasites (ticks and flea) (Shubeer, et al, 2014) and (Eabaid & Mallah, 2017).The hedgehog feed on small vertebrates and plants (Qumsiyeh 1996).In captivity they may live as long as (7.6) years (De Magalhaes & Costa 2009). Maheshwari (1983) found composition the food of 165 long eared hedgehog *H.auritus collaris* (Gray, 1830) studied from their stomach contents revealed that the main diet composed of insects, oligochaetes, amphibians, reptiles, aves and mammals it appears that the food of the hedgehog is related to availability of the prey. The preference of hedgehogs for insects and especially beetles could be due to the presence of chemicals and their odor emitted from their body (Brokie, 1959; Yalden, 1976).

There is no enough survey performed about ecto & endoparasites of long eared hedgehog *Hemiechinus auritus* and related between the prevalence and feeding this animal in Iraq.

METHOD & MATERIALS

The current study was in during the period from march-august 2019 and collected (73) hedgehogs (*H. auritus*) from different places in Samawah city, by some metal traps and direct catching during the night (activation period).

In the next day, the live hedgehogs were brought to the laboratory of college of education for pure sciences, Al-Muthanna University. After anaesthetized of the hedgehog by chloroform, and then tested the ectoparasites in the sample, collected fleas and ticks in tubes containing 70 % ethanol were brought to laboratory of biology department and then were dissected the samples to remove the alimentary canal and examined the endoparasites in the intestinal and isolated helminths were fixed in alcohol.

The parasites were identified under light microscope using the applicable standard identification keys by Yamaguti (1961) and Bykhovskaya et al. (1962).

The contents of the stomach were collected in Petri dishes to various groups , according to percentage of Frequency of Occurrence method by Hyslop (1980).

Statistical analysis

To determine the differences in parasitic infection between males and females, use the statistical program SPSS (20) and

the Coefficient of Contingency test to determine the compatibility of the parasites isolated from long-eared hedgehog (*Hemiechinus auritus*) using Microsoft Excel (windows 10).

RESULTS AND DISCUSSION

A Total 73 long-eared hedgehog (*Hemiechinus auritus*) samples were collected from different regions belonging to the city of Samawah in Muthanna province. divided into 46 males , 26 females individuals, sex ratio was 1.70:1, with the total percentage of infection was 24.66 (Table1). Statistical analysis showed no significant differences at the level of $P \leq 0.05$ in the percentage of infection between males and females of long-eared hedgehog therefore, the percentage of infection was calculated in both sexes as shown in table (2), it may be due to the nature life and feeding habits and consumed food in same habitat" , as well as breeding season when females keep offspring with them (Ballenger, 1999).

The genus Mathevotaenia was recorded from the intestine of the hedgehog *H. auritus* in Kuwait (Khalil and Abdul-Salam, 1985) and in Iraq- Basrah (Al-Zihiry , 2009).Also the human infection with *Mathevotaenia erinacei* was reported in 10 months old girls in Bangkok , Thailand (Lamon and Greer , 1986) and the present study reported this parasites in the intestine of *H.auritus* in Al-Muthanna, Iraq.

Moniliformis moniliformis was isolated from *H. auritus* (intestine) in Mongolia by Linnin et.al. (1979) , and in Iraq-Baghdad on the same host (Jawdat and Al-Jafary , 1979) .Also the present study reported *M. moniliformis* from the intestine of *H. auritus* in Al-Muthanna, Iraq.

The nematode *Pterygodermatites plagiostoma* was isolated from the intestine of hedgehog *H. auritus* in Iraq-Basrah by Al-Zihiry (2002) and in the current study indicated from the intestine of *H. auritus* in Iraq- Al- Muthanna (table , 3).

Archaeopsylla erinacei: This flea was 9.52 % infected the *H.auritus* and it live in the hairs of this hedgehog , also Eabaid & Mallah , 2017 recorded (29.6%) infection for this flea in the same host. *A.erinacei* infect anthers hedgehogs such as *Erinaceus europaeus* & *E.roumanicus* (Dziemian et al. ,2015).

Rhipicephalus turanicus: This present study appeared high infestation rate with tick *R. turanicus* (19.05%) and the lowest by *Mathevotaenia erinacei* and *Haemaphysalis sp* (4.762%) and the total infection with one species of parasites was 9.52, while the highest infection with two species of parasites was recorded by *Rhipicephalus turanicuss* and *Moniliformis moniliformis* (14.29%), and the total infection with two species of parasites was 6.80 and in male hedgehogs, one of infection with three species of parasites was recorded 4.762 with the following parasites, *Rhipicephalus turanicuss ,Archaeopsylla erinacei* and *Mathevotaenia erinacei*

As indicated in table(3) , the infection with one species of parasites is higher than the infection with two or three species of parasites in *H. auritus* ,it is possible that there is a compatibility between the parasites that cause this type of infection .As for the low percentage of two or three species infections, it may be due to the presence of an antagonism between the two species of organisms that cause parasitic infection.This result agree with Eabaid and Mallah (2017), Shubber et al. (2014) was mentioned that the Rhipicephalus genus is wide spread among domestic and wild hosts and recorded from buffaloes, cow, sheep, goat and long eared hedgehog *H. auritus* in Iraq and Nematollahi et al. (2014) in Iran from hedgehog *Erinceus concolar*.Some authors indicated tick Haemaphysalis in some hosts in Iraq such as Hubbared (1955) in the wild jungle cat and Hasson (2012) in red fox , also Shubber et al. (2014) in the black bird red fox , Asiatic jackal , wild jungle cat and buffaloes and the current study recorded this tick Haemaphysalis sp. In the hedgehog *H. auritus*.By conducting the Coefficient of Contingency test, the highest value(99.93) was recorded between *Rhipicephalus turanicuss* and *Moniliformis moniliformis*, followed by the value (98.89) between *Haemaphysalis sp* and *Pterygodermatites plagiostoma*, and the value between the parasite *Archaeopsylla erinacei* and *Mathevotaenia erinacei* was 92.8 ,the lowest value of Coefficient of Contingency test was recorded between *Archaeopsylla erinacei* and *Pterygodermatites plagiostoma*, where the value was (89.82).

The high infestation rates of ticks and fleas were in spring – summer, this may be due to suitable time for reproductive of ectoparasites, these results are consistent Agreed with Zolfaghari (2015) and Eabaid & Mallah (2017).

Table(4) shown that hedgehog animal belong to Omnivorous group where The results of present study indicted that plant parts (stems, roots and leaves, grass) were of inordinate importance in feeding hedgehog animal, with the highest value (98.72) followed by vertebrates Birds (feathers and legs , 38.35) ,Mammalia (hair and bons, 85.63) and while the invertebrates record the lowest value (Arthropoda , 21.92 and Insects 65.75). Statistical analysis indicated no significant differences are found in food items which consumed by hedgehog animal in both sexes. shows that the highest percentage of infection with internal and external parasites in both sexes of the hedgehog animal occurred when eating plants with their different parts (stems, roots, leaves and herbs), where it was 76.71% and the highest percentage of Frequency of Occurrence method for plants (98.72)

the results of present study confirm powerfully the results of previous studies, which indicated that the hedgehog is omnivorous but feeds mainly on insects. and small invertebrates Preferred foods include Coleoptera, grasshoppers, Lepidoptera, Dermaptera, Hymenoptera and Orthoptera. They as well consume fruit , eggs, vegetables and small vertebrates for example snakes and lizards. They are remarkably resistant to scarcity of water and food; in the laboratory they have persisted as long as 10 weeks without water and food (Ballenger 2020, Chris et al.2014) .

Table 1.A Total number of hedgehogs caught and Number of examined for studying their parasites on each sex.

Total number	Males		Females		Sex ratio For males	Number of hedgehogs examined for parasitic infection	Total percentage of infection
	Total NO.	Infection %	Total NO.	Infection %			
73	46	12(26.09)	27	6(22.22)	1.70:1	18	24.66

Table 2. shows number of single and mixed infections.

Parasite	Positive	Prevalence	Type of infection / total prevalence
Mathevotaenia erinacei	1	4.762	Infection with one species of parasites / 9.52
Archaeopsylla erinacei	2	9.52	
Rhipicephalus turanicuss	4	19.05	
Moniliformis moniliformis	2	9.52	
Haemaphysalis sp	1	4.762	
Haemaphysalis sp Ptreygodermatites plagiostoma	2	9.52	Infection with two species of parasites / 6.80
Mathevotaenia erinacei Rhipicephalus turanicus	1	4.762	
Archaeopsylla erinacei Mathevotaenia erinacei	1	4.762	
Archaeopsylla erinacei Ptreygodermatites plagiostoma	1	4.762	
Rhipicephalus turanicuss Moniliformis moniliformis	3	14.29	
Haemaphysalis sp Mathevotaenia erinacei	1	4.762	
Haemaphysalis sp Moniliformis moniliformis	1	4.762	
Rhipicephalus turanicuss Archaeopsylla erinacei Mathevotaenia erinacei	1	4.762	Infection with three species of parasites /4.762
Total	21	100%	

Table 3. Comparison of the parasitic infection in different areas with the results of the current study.

The parasites	The place	The reference
Moniliforms moniliformis	Iraq. Baghdad Mongolia. Al-Muthanna	Jawdet & Al-Jafary, 1979 Tinnin, et.al., 2008 present study (2019)
Pterygodermatites plagiostoma	Iraq, Basrah Iraq, Al-Muthanna	Al-Zihiry, 2002 present study
Mathevotaenia erinacei	Iraq, Basrah Iraq, Al-Muthanna	Al-Zihiry, 2002 present study (2019)
Archaeopsylla erinacei	Iraq, Al-Muthanna Iraq, Al-Muthanna	Eabaid & Mallah, 2017 Present study (2019)
Rhipicephalus turanicus	Iraq, Al-Muthanna Iraq, Al-Muthanna	Eabaid & Mallah, 2017 Present study (2019)
Haemaphysalis sp.	Iraq, Diwaniya	Shubeer, et.d, 2014

Table 4. Relationship between percentage of infection of internal and external parasites (above)with percentage of Frequency of Occurrence method of food (At the bottom) in both sexes hedgehog.

Foods items		Total percentage	
Invertebrates	Arthropoda	10.96	21.92
	Insects	19.18	65.75
Vertebrates	Birds (feathers , legs)	35.61	38.35
	Mammalia (hair, bons)	34.25	85.63
Plants	Stems ,Roots, Leaves Grass	76.71	98.72

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