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Detection of Different Gastrointestinal Parasites in Cows, Sheep, and Goats in Garmian Administration, Kurdistan Region, Iraq

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Abstract

Gastrointestinal parasites are parasites with diverse effects on animal health and production. The aims of the study were to isolate, detect, and identify different gastrointestinal parasites in cows, sheep, and goats in Garmian administration area at Sulaimani province, Iraq. The study was conducted on 157 animals (60 Cattle, 43 goats, and 54 sheep). Fresh fecal samples were collected randomly. Out of 157 sampled cows, sheep, and goats, 124 samples were positive for at least one parasite at prevalence 78.980%, in which the rates were cows: 66.666% (40/60) with males 21.666% (13/60) and females 45% (27/60), sheep: 74.074 % (44/54) with males 33.333% (18/54) and females 48.148% (26/54), goats: 93.023% (40/43) with males 25.581% (11/43) and females 67.441% (29/43). Different gastrointestinal parasites were identified as *Eimeria* spp. [sheep (59.259%), cows (35%), and goats (62.790%). *Buxtonella* spp. in cows was 5%. The types of infection appeared to be highest in a single one (29.299%) than other types. The identified parasites were *Eimeria* spp. (Oocyct) 50.955%, *Trichostrongylus* spp. (Egg) 22.292%, *Balantidium* spp. (Cyst) 14.012%, *Ostertagia circumbcinata* (Egg) 14.012%, *Chabertia* ovis (Egg) 10.828%, *Monesia* spp. (Egg) 9.554%, *Marshalgia* spp. (Egg) 8.280%, *Giardia* spp. (Cyst) 6.369%, *Skrjabinema* spp. (Egg) 3.184%, *Toxocara* spp. (Egg) 3.184%, *Avittelina* spp. (Egg) 2.547%, *Haemonchus* spp. (Egg) 2.547%, *Buxtonella* spp. (cyst) 1.910%, *Dicrocoelum dendriticum* (Egg)1.273%, and *Bonostomum* spp. (Egg), *Strongyloid papillosus* (Egg), and *Trichuris* spp. (Egg) were 0.636%. The result of the study showed that different gastrointestinal parasites were presence in cow, sheep, and goats in Garmian Administration, Iraq.

Key Words

Gastrointestinal Parasites, Cows, Sheep, Goats, Nematode

Introduction

Gastrointestinal parasites are parasites with diverse effects on animal health and production. These parasites

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can cause clinical and subclinical parasitism, which represents a serious threat to animal health and causes enormous economic losses to the livestock industry (1, 2, 3). It is a worldwide problem (4) and a major threat to the livestock economy (5). Economic and productivity losses due to gastrointestinal parasites include poor body condition, reduced feed intake, weight loss, immunity, lower milk production, abortion, diarrhea, dysentery, and anemia(6,3,7), and may ultimately lead to high mortality(4,5).

Several agro-climatic factors relate to the prevalence of gastrointestinal helminths including quantity and quality of pastures, temperature, humidity, and grazing behavior of the host (1), season, age, and sex of animals (6). The geo-climatic conditions can favor the growth, development, and survival of various parasites (4). The effect of seasonality on the intensity and prevalence of gastrointestinal helminths (GIPs) has been confirmed in many areas. Higher GIPs infection has been seen in wet hot months/ winter season than in the dry winter season. This is related to the fact that high humidity and temperature are more suitable for the survival, development of optimal sporulation/hatching, and translocation of the parasitic stages of GIPs (6, 8). However, a lower percentage of GIPs in animals occurs during dry seasons, the continuous existence of GIPs in animals can be contributed to the host animals carrying infection within them from one favorable season to the next (6).

GIPs inhabit the digestive tract of cattle and sheep, and other ruminants causing parasitic gastroenteritis in these animals (7). Helminth infestation does not show clinical signs in the majority of animals due to the chronic nature of the disease but can lower the animal's immunity, and render it susceptible to other pathogenic infections (4, 9). Animal productivity is significantly affected by helminthiasis. The stress of the disease may cause a decrease in the food conversion ratio and a reduction in the food intake of diseased animals. This phenomenon reduces the absorption of energy constituents by the small and large intestines (10).

Some kinds of parasites like nematodes, trematodes, cestodes, and protozoa that affect ruminants are zoonotic and common in both humans and animals and pose a public health risk (11). Livestock plays an indispensable role in promoting human health and the economy of any region and country that not only assists to upgrade the financial condition but also makes a substantial contribution to human nutrition (4, 12). Parasites can cause financial and agriculture losses that have a substantial impact on farm profitability and are proposed to lose tens of billions of dollars worldwide. For example, the annual cost associated with parasitic diseases in sheep and cattle in Australia has been estimated at 1 billion dollars (13).

Small ruminants like sheep and goats can spread the parasitic infestation to other animals in the environment. Routes of transmission of gastrointestinal parasites through the ingestion of fecal matter in water, soil, and food are required during grazing. The fecal–oral route of parasitic

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transmission represents the most infection route (14). This is amplified by the fact that different groups of ruminants may come into contact if feeding together in the same areas and share food or water (10). Co-grazing of sheep and goats together can transmit the disease to larger ruminants like cattle and buffalo via sharing pasturage (10).

Garmian area is a semi-governmental area located in the southeastern of the Kurdistan region and mid-eastern part of Iraq near Iranian borders. This area is rich with many resources especially livestock including cattle, sheep, goats, and buffalos. People in this area raise animals for milk, meat, and fur production. However, the burden of GIPs in the region has been reported in some studies (15) but still more research need for the detection of different kinds of parasites. The aims of the study were to isolate, detect, and identify different gastrointestinal parasites in cows, sheep, and goats in Garmian administration area at Sulaimani province, Iraq.

Materials and Methods

The study was conducted in eight villages distributed in Garmian Administration region from April to July 2021. A random sampling was designed, in which an overall (157) samples were collected from sheep, goats, and cattle in about 24 flocks in eight villages. The study was conducted on 157 animals (60 Cattle, 43 goats, and 54 sheep) at different ages. Fresh fecal samples were collected randomly. 10 g of feces were collected directly from the rectum of each bovine, goats, and sheep, after that samples were refrigerated and processed in the Laboratory of Kalar Technical College. The fecal samples were cultivated at room temperature in Petri dishes using for 24 hrs. finally that they were processed by different parasitological techniques. Direct examination technique was used to detect trophozoite form of different protozoan parasites, while the floatation technique was used to determine the oocysts per gram (OPG) of feces and eggs per gram (EPG) of feces, using Sheather's flotation solution, and the sedimentation techniques was employed to detect the heavy parasite eggs.

Morphological characteristics of the different parasitic stages were recorded, which include shape, color and measuring the parasitic forms' dimensions with the microscope equipped with a calibrated ocular micrometer using 40X magnification lens (each division of ocular micrometer measured 2.5 micrometers). All photos of identified parasites were taken accurately with a special microscopic camera (WISBIOMED, B-AM423, 23 mm). Their identifications to the level of genera or species were based on the standard parasitological keys and descriptions (16, 17, 18).

Results

The study was conducted between, April to July 2021 the most favorable months for the development of GIPs in

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this area. The result of the study showed that the prevalence of positive samples in between all tested samples was 78.980% (124 /157) of samples of cows, sheep, and goats. The rate of positive samples in cows was 66.666% (40/60) with males 21.666% (13/60) and females 45% (27/60), sheep: 74.074 %(44/54) with males 33.333% (18/54) and females 48.148% (26/54), goats: 93.023% (40/43) with males 25.581% (11/43) and females 67.441% (29/43) (**Table 1)**.

Table 1: Total prevalence of positive samples in Cows, Sheep and Goats

Total Prevalence rates of identified parasites in different animal species									
Cows (60 samples)			Sheep (54 samples)			Goats (43 samples)			
sex	Rates %	Total rates %	sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Total rates in sheep, cows, and goats
Male	21.666 %(13/ 60)	66.666 %(40/ 60)	Male	33.333% (18/54)	74.074% (44/54)	Male	25.581% (11/43)	93.023% (40/43)	78.980% (124/157)
Female	45% (27/60)		Female	48.148% (26/54)		Fema le	67.441% (29/43)		

Four types of protozoa were identified, *Eimeria* spp., *Buxtonella* spp., *Giardia* spp., and *Balandodium*. Whereas ten types of nematodes were diagnosed including *Haemonchus* spp., *Trichostrongylus* spp., *Bonustomum* spp., *Strongyloides papillosus*, *Chabertia* ovine, *Skrjabinema* spp., *Ostertagia circumcincta*, *Trichuris* ovis, *Marshalgia marshali*, and *Toxocara*. Cestode parasites identified were *Moniezia* spp. and *Avitllina* app while the only trematode found was *Dicrocoelium dendriticum* **(Figures 1& 2).**

The most identified protozoa (cysts) were *Eimeria* spp. (50.955%), *Balantidium* spp. (14.012%), *Giardia* spp. (6.369%), *Buxtonella spp. (*1.910%) **(Table2).**

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Table 2: Prevalence rates of each identified protozoan parasite infection in 157 fecal samples of Cows, Sheep and Goats

		Prevalence rates of identified parasites in different animal species									
Identified parasites		Cows (60 samples)			Sheep (54 samples)			Goats (43 samples)			
		sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Total rates in sheep, cows, and goats
Protozoa	*Eimeria* spp. (Oocyct)	Male	26.315 % (5/19)	35% (21/60)	Male	55.555 % (10/18)	59.259% (32/54)	Male	16.666 % (2/12)	62.790 % (27/43)	50.955 % (80/157)
		Female	39.024 % (16/41)		Female	79.200 % (22/36)		Female	80.645 % (25/31)		
	Buxtonella spp. (cyst)	Male	5.263% (1/19)	5% (3/60)	Male	0%	0%	Male	0%	0%	1.910% (3/157)
		Female	4.878% (2/41)		Female	0%		Female	0%		
	Giardia spp. (Cyst)	Male	0%	3.333 % (2/60)	Male	5.555% (1/18)	7.407 % (4/54)	Male	8.333% (1/12)	9.302% (4/43)	6.369% (10/157)
		Female	4.878% (2/41)		Female	8.333% (3/36)		Female	9.677% (3/31)		
	Balantidium spp. *(Cyst)*	Male	0%	0%	Male	11.111 % (2/18)	14.814% (8/54)	Male	25% (3/12)	32.558 % (14/43)	14.012 % (14/157)
		Female	0%		Female	16.666 % (6/36)		Female	35.483 % (11/31)		

While for cystodes, rates were *Monesia* spp. (9.554%), and Avittelina spp. (2.547%) **(Table 3),**

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Table 3: Prevalence rates of each identified cestodes parasite infection in 157 fecal samples of Cows, Sheep and Goats

		Prevalence rates of identified parasites in different animal species									
Identified parasites		Cows (60 samples)			Sheep (54 samples)			Goats (43 samples)			
		sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Total rates in sheep, cows, and goats
Cestodes	Monesia spp. *(Egg)*	Male	15.789 % (3/19)	8.333 % (5/60)	Male	16.666 % (3/18)	11.11 1% (6/54)	Male	8.333% (1/12)	9.302% (4/43)	9.554% (15/157)
		Femal e	4.878% (2/41)		Femal e	8.333% (3/36)		Femal e	9.677% (3/31)		
	Avittelina spp. *(Egg)*	Male	0%	0%	Male	0%	3.703 % (2/54)	Male	8.333% (1/12)	4.651% (2/43)	2.547% (4/157)
		Femal e	0%		Femal e	5.555% (2/36)		Femal e	3.225% (1/31)		

Nematodes rates were consecutively *Trichostrongylus* spp. (22.292%) followed by *Ostertagia circumbcinata (*14.012%), *Chabertia ovis (*10.828%), *Marshalgia* spp. (8.280%), , *Skrjabinema* spp. (3.184%), *Toxocara* spp. (3.184%), *Haemonchus* spp. (2.547%), and *Bonostomum* spp., *Strongyloid papillosus* , and *Trichuris* spp. were (0.636%) (**Table 4) .**

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Table 4: Prevalence rates of each identified nematodes parasite infection in 157 fecal samples of Cows, Sheep and Goats

		Prevalence rates of identified parasites in different animal species									
Identified parasites		Cows (60 samples)			Sheep (54 samples)			Goats (43 samples)			
		sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Total rates in sheep, cows, and goats
Nematodes	*Trichuris* spp. *(Egg)*	Male	0%	0%	Male	0%	1.851 % (1/54)	Male	0%	0%	0.636% (1/157)
		Female	0%		Female	2.777% (1/36)		Female	0%		
	Strongyloid papillosus (Egg)	Male	0%	0%	Male	0%	1.851 % (1/54)	Male	0%	0%	0.636% (1/157)
		Female	0%		Female	2.777% (1/36)		Female	0%		
	Ostertagia circumbcinata (Egg)	Male	0%	0%	Male	16.666 % (3/18)	24.074% (13/54)	Male	`25% (3/12)	20.930 % (9/43)	14.012 % (22/157)
		Female	0%		Female	27.777 % (10/36)		Female	19.354 % (6/31)		
	Marshalgia spp. *(Egg)*	Male	0%	0%	Male	22.223 % (4/18)	24.074% (13/54)	Male	0%	0%	8.280% (13/157)
		Female	0%		Female	25% (9/36)		Female	0%		
	Chabertia ovis (Egg)	Male	0%	1.666 % (1/60)	Male	16.666 % (3/18)	11.111% 6/54)	Male	16.666 % (2/12)	23.255 % (10/43)	10.828 % (17/157)
		Female	2.439% (1/41		Female	8.333% (3/36))		Female	25.806 % (8/31)		
	Trichostrongylus spp. *(Egg)*	Male	10.526 % (2/19)	13.333% (8/60)	Male	33.333 % (6/18)	29.62 %954/16))	Male	16.666 % (2/12)	25.581 % (11/43)	22.292 %(35/157)
		Female	14.634 % (6/41)		Female	27.777 % (10/36)		Female	29.032 % (9/31)		

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	Bonostomum spp. *(Egg)*	Male	0%	0%	Male	5.555% (1/18)	1.851 % (1/54)	Male	0%	0%	0.636% (1/157)
		Female	0%		Female	0%		Female	0%		
	Haemonchus spp. *(Egg)*	Male	5.263% (1/19)	6.666 % (4/60)	Male	0%	0%	Male	0%	0%	2.547% (4/157)
		Female	15.789 % (3/41)		Female	0%		Female	0%		
	Skrjabinema spp. *(Egg)*	Male	0%	0%	Male	0%	0%	Male	16.666 % (2/12)	11.627 % (5/43)	3.184% (5/157)
		Female	0%		Female	0%		Female	9.677% (3/31)		
	Toxocara spp. *(Egg)*	Male	0%	0%	Male	11.111 % (2/18)	5.555 % (3/54)	Male	0% (0/12)	4.651% (2/43)	3.184% (5/157)
		Female	0%		Female	2.777% (1/36)		Female	6.451% (2/31)		

The only trematode identified in the study was *Dicrocoelum dendriticum* (1.273%) **(Table 5)**

Table 5: Prevalence rates of each identified trematodes parasite infection in 157 fecal samples of Cows, Sheep and Goats

		Prevalence rates of identified parasites in different animal species									
Identified parasites		Cows (60 samples)			Sheep (54 samples)			Goats (43 samples)			
		sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Sex	Rates %	Total rates %	Total rates in sheep, cows, and goats
Trematodes	Dicrocoelum dendriticum *(Egg)*	Male	0%	3.333 % (2/60)	Male	0%		Male	0%	0%	1.273% (2/157)
		Female	4.878% (2/41)		Female	0%		Female	0%		

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According to the type of infection and their prevalence rates, the rate of single infection between infected samples was the highest at about (29%) and the cow was by far the most with about (60%) followed by goats (30%) and finally sheep (22.7%). Double infection was rated the second with nearly 22.3%) but this time sheep was the highest (29.5%) compare to cows and goats (27.5%) for both. Nearly (18%) of the samples were triple infected and surprisingly goats were the highest with (30%) followed by sheep and cows with (27% and 10%) respectively. About (8%) of samples recorded quadruple infection and sheep recorded (18%), goats (10%), and cows (2.5%). Sheep and goats samples were infected with quintuple infection with nearly (2.5%) for both while no quintuple infection was recorded for cows **(Table 6).**

Table 6: Types of infection and their prevalence rates of identified intestinal parasites in 157 fecal samples of Cows, Sheep and Goats

Types of Infection	No. of Infected Samples		Prevalence (%)	
			Rates %	Total Rates%
Single infection	**Cows**	24	60%	**29.299% (46/157)**
	sheep	10	22.727% %	
	goats	12	30%	
Double infection	**Cows**	11	27.5%	22.292% (35/157)
	sheep	13	29.545%	
	goats	11	27.5%	
Triple infection	**Cows**	4	10%	17.834% (28/157)
	sheep	12	27.272%	
	goats	12	30%	
Quadruple infection	**Cows**	1	2.5%	8.280% (8/157)
	sheep	8	18.181%	
	goats	4	10%	
Quintuple infection	**Cows**	0	0%	1.273% (2/157)
	sheep	1	2.272%	
	goats	1	2.5%	

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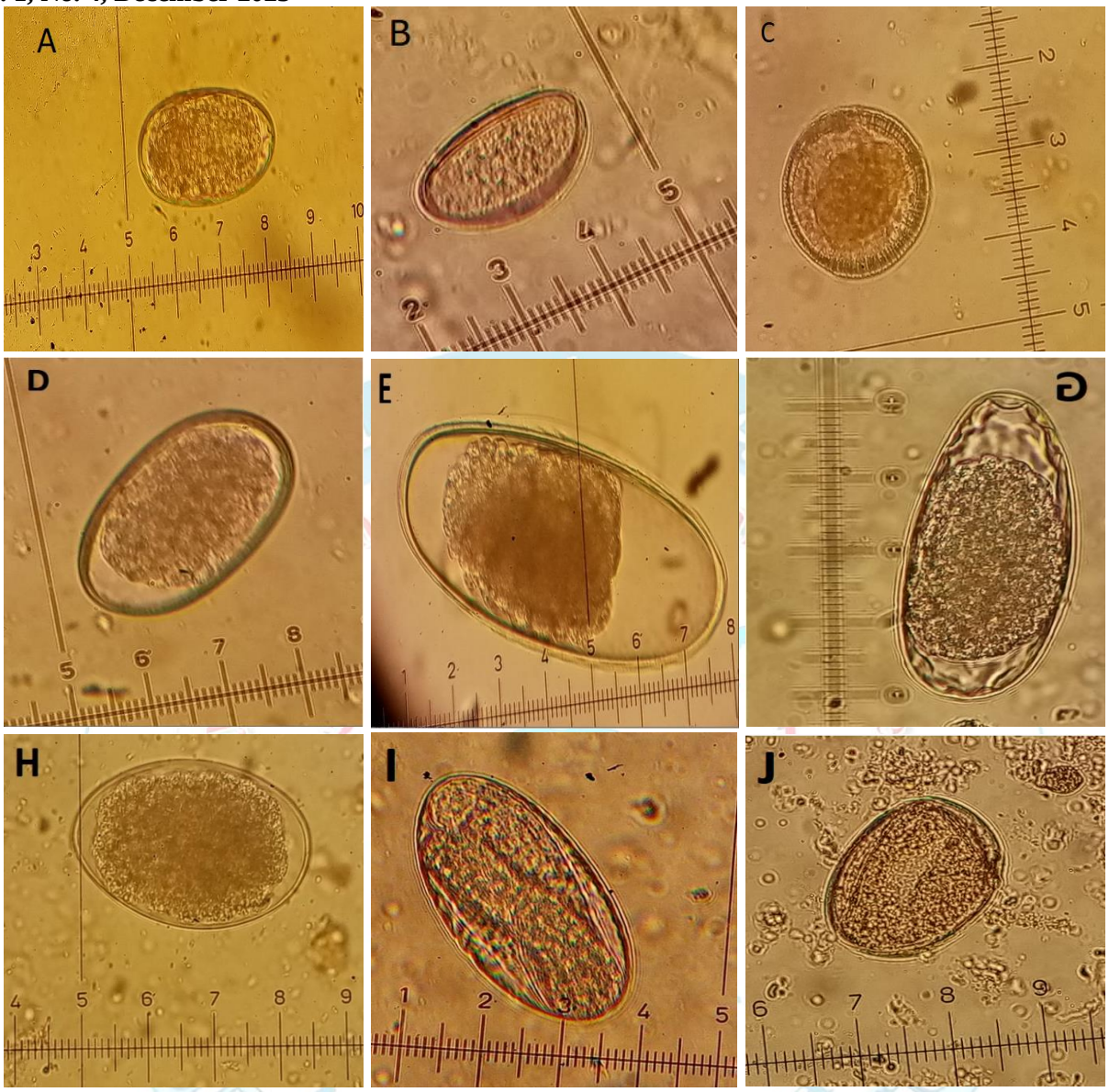

Figure-1: Nematodes parasites in cows, sheep, and goats: (A) *Haemonchus contortus* egg. (B) *Skrjabinama* spp. Egg. (C) *Toxocara* spp. egg. (D) *Bonostomum* spp. egg. (E) *Marshalgia* spp. egg. (F) *Trichuris ovis* egg. (G) *Trichostrongylus* spp. egg. (H) *Ostertagia circumcinata* egg. (I) Chaberta spp. egg. (J) *Strongyloid papilosus* egg.

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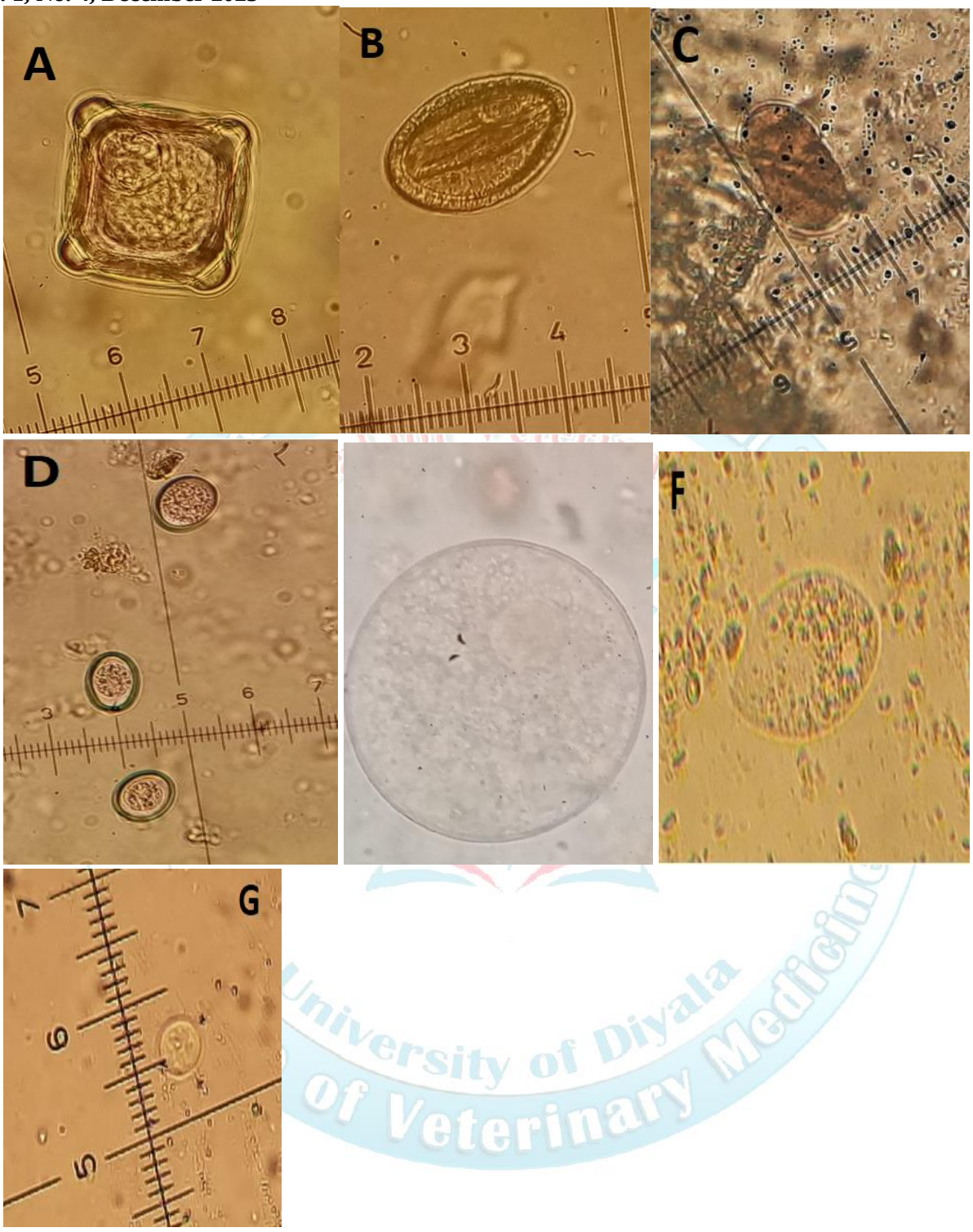

Figure-2: Cestodes, Trematodes, and Protozoa parasites in cows, sheep, and goats : (A) *Monesia spp.* egg. (B) *Avitellina* spp. Egg. (C) *Dicrocoelum dendriticum* spp. egg. (D) *Eimeria* spp. oocyst. (E) *Buxtonella* spp. cyst. (F) *Balantidium spp.* trophozoite. (G) *Giardia spp*. Cyst.

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Discussion

Gastrointestinal parasitism is a worldwide health problem in sheep, goats, and cows productivity. The study recorded a high prevalence of gastrointestinal parasite GIPs infection in sheep, goats, and cattle in the investigated area. It was conducted between, April to July 2021 the most favorable months for the development of GIPs in this area. The total rate of prevalence of gastrointestinal parasites GIPs in our study was (78.98%). Protozoan oocysts and helminth egg numbers that developed inside the host animals may vary according to the parasite species, degree of host susceptibility, and the health, and immune status of the animals (4, 19). Parasites might cause severe diseases in some species of animals more than others according to the susceptibility to these diseases for example; sheep are more susceptible to some kinds of parasites while others demonstrate some resistance to these worms (13). As the ingestion of contaminated food is the most significant route of parasitic infection, the possible way of infection might be due to grazing on open pastures (20).

The agro-climatic conditions especially humidity, temperature, and grazing might be a good supporter of the transmission of GI parasites. Management and rearing practices as well as the geographic distribution of the study area might cause variations in infection rates between kinds of animals (2, 6, 9, 20). Additionally, age, breed, sex; deworming processes, and genetic resistance also play a role (2). These factors play a contributing role in the existence of the infective stages, favoring the development of the reproductive cycles and the viability of eggs and larvae, which, in turn, depend on the seasonality, the age, and the immune status of the host (3)and variation in sampling periods and diagnostic methods (19,21). In a study conducted in Mazandaran/Iran, the infection with GIPs in cows was relatively lower in winter compared to other seasons (9).

The total rate of prevalence of GIPs in our study was (78.98%) nearly the same as a study conducted in Kirkuk province by (22) with (79%). Both Garmian and Kirkuk are located in the same geographical area with almost the same environmental conditions throughout the whole year. This fact can be the most acceptable reason for the similarity in results of both studies. In the current study, the findings demonstrated high GI parasitic infection in sheep (74.07%). This finding was similar to other studies in AL-Sulaymaniyah (19) with (78.15%) and in Baghdad (75.1%) (23) and higher than AL-Zandee in Garmiyan the same investigated area with about (48%) (13).In cows, our study showed a (66.66%) infection rate which agreed with another study conducted in the Sulaumaniyah province of Iraq which recorded (60.46%). In a research conducted by (9) it was found that the rate of infection was 34.58% in cows however they were given a broad-

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spectrum anthelmintic. The overall prevalence in goats was relatively high (93.023%) compare to the other two kinds of sheep and cattle (74.07% and 66.66%) respectively. Differences in rates of infection within the period of the study may be interpreted as consequences of the diversity in host susceptibilities as well as the influence of climatic conditions as some helminths are found to be more susceptible to climatic conditions than others (13, 24).

Regarding the sex of animals, the overall prevalence rates were higher in females than males in all three species, sheep (48%/33%), goats (67%/25%), and cow (45%/21%). These results were similar to the study conducted in the same area by (13) with a rate of infection in sheep and goats females (47.13%) compared to (42.43%) in males. This finding was consistent with (19) found with female sheep (80%) and male sheep (75.92%). (9) reported nearly the same rate of infection in males and females. And disagreeing with the findings by (6) which found infection in males more than females (88.23%/85.33%) in sheep and (82.75%/81.25%) in goats. Females are more susceptible than males due to the existence of some conditions in females like pregnancy, pre-parturient period, and stress which can affect the immune status and increase rates of infection (13).

Single infestation with gastrointestinal parasites was slightly higher than double and triple infestation as rated (29.72%, 22.29%, and 17.83%) respectively. The total rate of mixed infection in this study was (71.71%) which was similar to other research like (13) which recorded (76.17%) for mixed and (23.83%) for single infection. The study disagreed with research conducted in AL-Sulaymaniyah by (19) in which the rate of single infection was higher than mixed infection (66.46%/ 20.16%). This issue is related to the fact that any infestation with a single kind of parasite might lead to a greater chance of more infections (20).

The rate of protozoan infection in our study and especially *eimeria* was 50.95% which was lower than another study from Sulaymaniyah which was (58.14%) (4). Infection with *eimeria* can occur in any period of life and higher excretion of oocysts in young animals (3). *Eimeria* spp. infection in goats and cattle in Kirkuk's study was the highest among other GIPs prevalence rate with (42.2% and 22.2%) and in our study also *Eimeria* was the highest with about (62.7% and 35%) in goats and cows respectively. In another study species of *Eimeria* were found in nearly 31% (13). *Buxtonella* spp. recorded the second higher infection rate in cows between protozoan infections with about (5%) which was lower than a study conducted by (4). The prevalence of coccidiosis in goats (62.79%) in the study was higher than in sheep (59.25%) and cattle (35%). These findings resemble other studies like (6). This can be related to the fact that goats acquired a lower level of

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immunity to gastrointestinal parasites, especially coccidiosis compared to sheep (6). Infection with Giardia in our study was 10/157 samples (6.369%) which is ab abother important protozoa that affect both human and animals and compose a serious zoonotic illness for both (25).

The rate of nematodes in cows was lower than the other two animals and between all kinds of nematodes found in the results, only three species were found in cows. *Trichostrongylus* recorded the highest with (13.33%), followed by *haemonchus* (6.66%), then *chabertia* with only one case from a cow. In another study, it was found that the rate of nematodes was 18.60% (4). In a study conducted by (13) in the same geographical area in 2016, *Mrashallagia marshalli* was by far the most circulated and recorded species among other parasites (sheep 48% and goats (41%), while in our study this parasite was relatively lower with about 24.07% in sheep and 8.28% in goats. *Marshallagia* species are typical abomasal parasites that spread around the world and reported different prevalence rates from 0.72% to 84% in domestic animals (13). Low prevalence of *trichuris* spp. ad *stongyloid papillposus* (0.63%) observed in this study were similar to those obtained by (22). Nematodes prefer humid tropical environments for the development of various species of nematodes (22). Nematodes eggs can survive and withstand drought and adverse conditions which can cause a higher prevalence of these kinds of these worms (24). A high number of flocks and a high stocking rate with longer grazing periods as well as better climatic conditions for the nematode eggs to hatch to be transmitted to new hosts could also contribute to higher infection intensity (26, 27).

Moniezia spp. rate was low in sheep, goats, and cattle which recorded nearly the same for all three kinds which were 9.5 % overall. This low proportion resembles a similar observation in Sulaimaniyah (4). This cestode is seasonal peaks of infection occur in periods of greater activity of intermediate hosts, namely in spring and autumn (27).The rate of trematode parasites in the study was very low as these parasites have a very complex life cycle and required freshwater snails as an intermediate host as part of their life cycle. Snails are highly affected by increased temperature and this can act on the abundance of trematodes followed by reducing their population (13).

Conclusion

The result of the study showed that different gastrointestinal parasites were presence in cow, sheep, and goats in Garmian Administration area, Iraqi Kurdistan Region. Applying sustainable control strategies like well-planned programs for the proper use of de-wormers, evaluation of the cost of parasitism, and implementing appropriate management procedures can lead to reducing the level of contamination on pasture, a decrease in production losses, and more

significantly decline the possibility of anthelmintic resistance. We recommend that more studies to be conducted on the intestinal endoparasites that infect different field animals and identifying the most important ones in the region. In addition, work on cleaning and sterilizing the animal shelter with insecticides by the animal breeder. Finally, using effective medicines to kill internal parasites or using vaccinations periodically in order to raise the animal's immunity.

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