



## The effects of Gastro-intestinal Parasites on haemato-biochemical parameters of sheep in Kirkuk province, Iraq

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### ABSTRACT

The present study is intended to detect internal parasites in faecal samples of local sheep in Kirkuk province, Iraq, through the period between March and the end of November 2022. where, 130 blood and faecal samples were collected and different laboratory investigations were carried out in the laboratory of the parasite, College of Veterinary Medicine, University of Kirkuk. The result indicated that 110 sheep (84.6%) were infested with gastrointestinal parasites. Most of the cases (64.3%) were mixed parasitic infestations, whereas (40.8%) were single parasitic infestations. at the following frequencies: (47.27%) Nematodes, (30.90%) Protozoa, (14.54%) Trematodes, and (7.27%) Cestodes. Haematological analysis results showed a significant decrease in red blood cell count, haemoglobin concentration, and hematocrit. Normocytic hypochromic anaemia was detected in the infected sheep. A significant increase in leukocyte counts is due to increases in lymphocytes, eosinophils, neutrophils, and monocytes. Results as well indicated a significant decrease in total protein, albumin, However, ALT, AST, and total bilirubin were elevated markedly. It has been concluded that GIT parasites have an adverse negative effect on animal health. Therefore, the rapid diagnosis and treatment of infected animals has become one of the priorities for maintaining the health of diseased animals.

**Keywords:** GIT parasites, Hematological analysis, Iraq, Sheep.

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### INTRODUCTION

Gastrointestinal parasites are organisms that live in the digestive tract of a host organism and obtain their nourishment from the host, these include tapeworms, roundworms, flukes, and protozoa (Morgan *et al.*, 2006; Saleh *et al.*, 2021). These parasites are one of the major issues with small ruminants and cause substantial financial losses, serious health problems, treatment costs, and death (Kadir *et al.*, 2012).

The gastrointestinal parasite infestation is clinically manifested by anaemia, emaciation, and a high mortality rate, all these changes are responsible for complicating an animal's expansion and productivity, which causes the farmer to lose money financially (Blackburn *et al.*, 2011). The most frequently infected gastrointestinal parasites in ruminants are *Haemonchus contortus*, *Ostertagia circumcincta*, and *fasciola hepatica* (Bhowmik *et al.*, 2020). In subclinical forms, the gastrointestinal worms constantly suck blood as *Haemonchus*

*contortus*, causing anaemia, hypoproteinemia, intermandibular oedema, and an alteration in enzymatic activities (Sharma *et al.*, 2014).

Physiological and biochemical measures are sensitivity markers of parasite infestation severity, degree of liver damage, and liver disrupting crucial metabolic processes for the animal's normal health and maximum production. The principal cause of bleeding and significant tissue damage that results in the modification of haematological and biochemical parameters related to gastrointestinal parasites is the migration of larvae parasites in liver and pulmonary tissues (Tariq *et al.*, 2008; Aziz and Mahmoud, 2022). Stressful situations, including weaning, food changes, bad weather, travel, and regrouping, can predispose to gastrointestinal tract (GIT) parasite infestations (Pedreira *et al.*, 2006). All predisposing factors, such as contamination of pasture, temperature, moisture, and the host's habits, have an effect on the prevalence of gastrointestinal helminths (William *et al.*, 2001; Hassan and Abed, 2012).

Nevertheless, there is insufficient information about the relationship between gastrointestinal parasite effects and some haematological and biochemical parameters of the sheep in the majority of Kirkuk province. The current study aimed to estimate the prevalence of gastrointestinal parasites in sheep in Kirkuk province and to evaluate the consequences of gastrointestinal infestation on the hemato-biochemical profile.

## MATERIALS AND METHODS

### Animal and study area

The current study was carried out between March 2022 and November 2022, Faecal and blood samples were randomly collected from a total of 130 local sheep breeds: 20 clinically healthy animals and 110 clinically suspected cases brought to a veterinary teaching hospital and a slaughterhouse from different localities in Kirkuk province, Iraq. Animals are 1-4 years old and of both sexes. Some suspected animals show signs including diarrhoea, weakness, anaemia, and submandibular oedema.

### Faecal examination

Fresh faecal samples were collected and examined separately for detection of intestinal parasites (eggs, oocysts, and/or trophozoites) using a concentration approach by using a sugar/salt solution and sedimentation protocol to investigate the faecal specimens (Zajac and Conboy, 2006).

### Blood analysis

Ten milliliters of blood were drained from each animal via jugular vein puncture, and 2.5 milliliters of blood mixed with EDTA are used for blood analysis including TRBc, HB, PCV, DLC, MCV, MCH, MCHC, and DLC counts using a (CBC device; SWE Lab, Germany). Moreover, DLC count was applied using Giemsa-stained blood smears, according to Coles *et al.*, (1986).

### Serum's biochemical tests

The remaining blood was placed in a gel tube and used for serum separation for biochemistry tests, including total protein (Biolabo. France), total bilirubin (Biolabo-Maizy Company, France), and ALT and AST Randex (United Kingdom). depending on the methods shown by Tietiz (1999).

### Statistical Analysis

Statistical analysis was applied using SPSS (Independent sample t-test), However, statistically significant data was determined at the P value  $\leq 0.05$  (IBM-SPSS, 2012).

## RESULTS

### Infestation Rate

This study investigated the gastrointestinal parasite in sheep in Kirkuk province, Iraq, and detected two genera of Trematodes, one genera of Cestodes, eight genera of Nematodes, and one genera of Protozoa. The infestation rate of gastrointestinal parasites was 84.6% in sheep (Fig. 1). Of these, 64.3% were mixed infestations (Fig. 2).

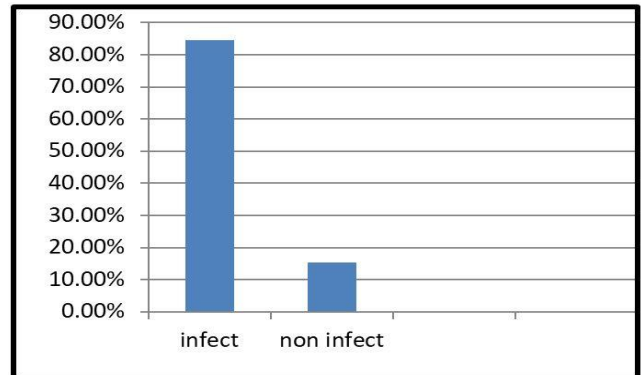


Fig.1: Percentage of infected and non-infected sheep with gastrointestinal parasites

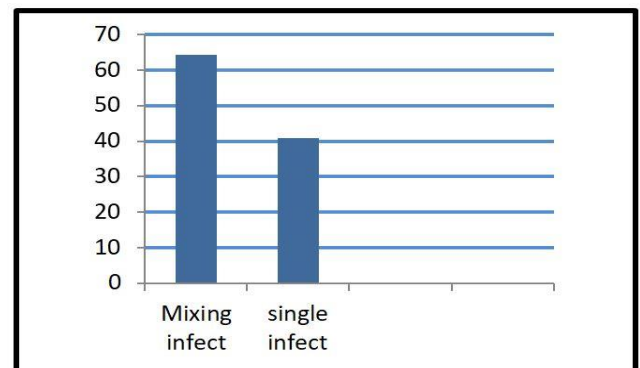


Fig.2: Single and mixed infestation rate of GI parasites in sheep.

The overall infestation rate caused by Nematode species (47.27%) was higher compared to Protozoan, Trematode, and Cestode infestations. Among species-specific gastrointestinal parasites (*H. controtus*, *Ostertagia* spp., *Nematodirus* spp., *Tristrongylus* spp., *Chabertia ovina*, *Cooperia* spp., *Marshallagia marshalli*, *Skrjabinema ovi*, *Fasciola* spp., *Paraphistomum cervi*, and *Moniezia* spp.), *Eimeria* spp. was the most frequent parasite recorded (30.9%) in young sheep (table 1). The third most prevalent gastrointestinal parasite infestation was Trematodes, which included *Fasilia* spp. and *Paraphistomum cervi*, at (14.54%) in adult sheep. On the other hand, the lowest infestation observed among species was that of Cestodes (*Monezia* spp.), which recorded (7.27% (Fig. 3). The current study investigated two new species of Nematodes, which include *Cooperia* and *Skrjabinema ovie* eggs, in the faeces of local infected sheep.

Table 1: Infestation rates of gastrointestinal sheep in Kirkuk province.

NO.	GIT species	NO: of animals infected	%
1.	(Nematode)		(47.27) %
	<i>Ostertagi circum</i>	18	16.36 %
	<i>Haemonchus controtus</i>	10	9.09 %
	Nematodirus spp.	7	6.36 %
	Tristrongylus spp.	6	5.45 %
	<i>Chabertia ovina</i>	4	3.63 %
	<i>Marshallagia marshalli</i>	4	3.63 %
	Cooperia spp.	2	1.81%
	<i>Skrjabinema ovis</i>	1	0.90%
2.	(Cestodes)	8	(7.27) %
3.	(Trematoda)		(14.54) %
	Fasciolla spp.	10	9.09 %
	<i>Paraphistmum cervi</i>	6	5.45 %
4.	(Protozoan)	34	(30.90) %
Total	Eimeria spp.	110	84.6%

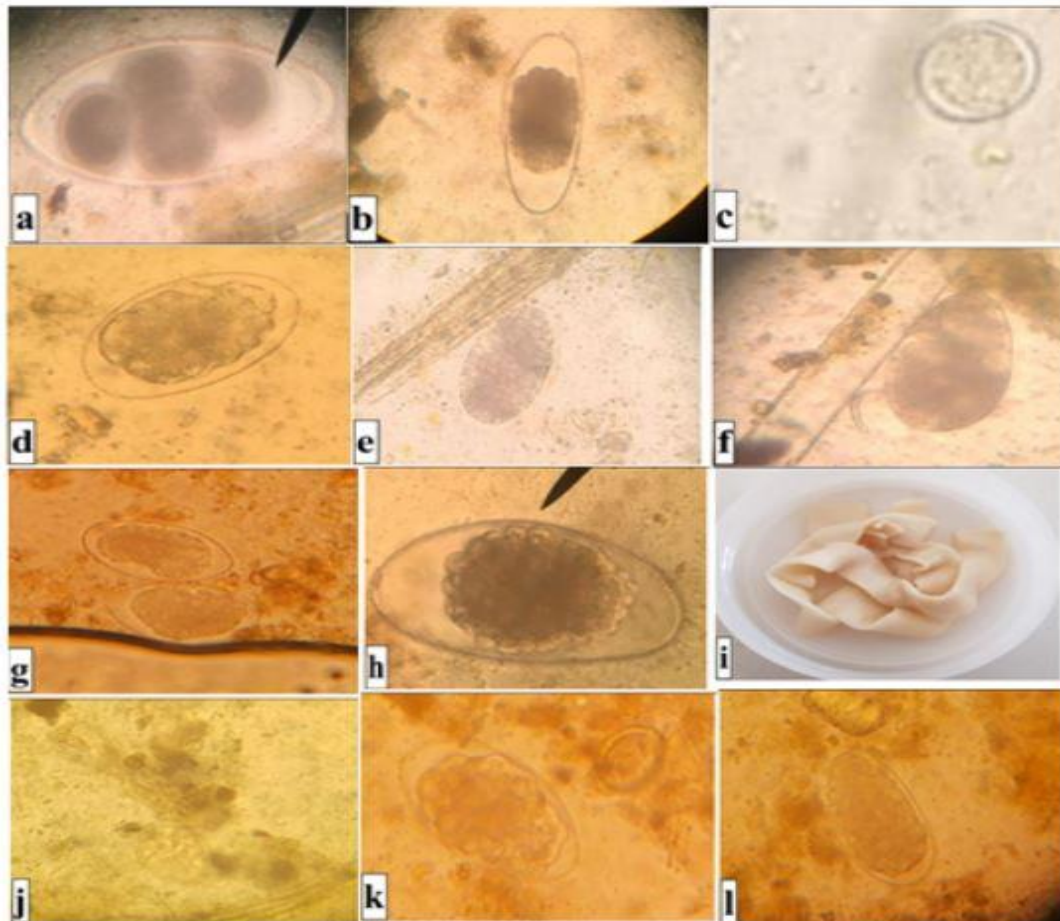


Fig.3: a. *Nematodirus* spp. ovum 40X, b. *Trigortongloid* spp. ovum 40X, c. *Eimeria* spp. Oocyst 40X. d. *Ostertagia* spp. ovum 40X, e. *Fasciola* spp. ovum 40X, f. *Chabertia* spp. ovum 40X, g. *Skrjabinema* spp. ovum 40X, h. *Marshallagia marshalli* ovum 40X, i. *Monezis* spp. (adult), j. *Paramphistomum cervi* ovum 40X, k. *H.controtus* ovum 40X, l. *Cooprea* spp. ovum 40X.

### Hematological results

The results of the current study indicated a significant decrease in RBC count, HB concentration, and PCV, which reflected a microcytic hypochromic type of anaemia, On the other hand, leukocytosis showed an obvious increase with a differential cell count of neutrophils, lymphocytes, eosinophils, and monocytes (table 2).

### Biochemical analysis

The current study showed a variation in the biochemical profiles in the infected sheep (table 2). There was a significantly lower value in albumin and total protein than in healthy animals. On the other hand, the current study recorded elevated ALT, AST, and total bilirubin values.

Table 2: Hematological and -biochemical parameters of sheep infested with GIT parasites and healthy sheep.

Parameters		Infested	Non-Infested	T-test	P-value	
1	Erythrocyte values	Hb (g)	6.74 ± 1.09	11.3 ± 1.07	3.598	0.021*
		HCT %	14.5 ± 3.16	25.92 ± 3.80	4.687	0.012*
		TEC (x10 <sup>6</sup> /cumm)	6.228 ± 0.45	8.54 ± 0.30	3.858	0.018*
		TLC (x10 <sup>3</sup> /cumm)	61.4 ± 8.45	7.74 ± 0.88	3.917	0.012*
2	RBC index	MCV (fl)	27.2 ± 2.17	31.8 ± 1.43	3.147	0.039*
		MCH (pg)	6.9 ± 0.97	10.12 ± 0.76	3.487	0.031*
		MCHC(g/dl)	21.6 ± 2.80	31.26 ± 0.70	3.887	0.011*
3	DLC	Neutrophils (%)	12.114 ± 1.45	4.02 ± 0.97	4.657	0.012
		Lymphocytes (%)	73.24 ± 7.09	6.2 ± 1.36	4.687	0.009*
		Monocytes (%)	10.6 ± 1.44	2.62 ± 0.39	4.947	0.004
		Eosinophils (%)	10.18 ± 1.95	0.81 ± 0.13	5.687	0.010*
4	Biochemical parameters	Total protein (g/dl)	4.84 ± 0.46	6.44 ± 0.25	2.997	0.041*
		Albumin(g/dl)	0.928 ± 0.22	2.622 ± 0.19	3.687	0.023
		Total bilirubin	1.39 ± 0.19	0.906 ± 0.07	2.847	0.049
		ALT	23.2 ± 3.92	11.75 ± 1.70	3.687	0.014*
		AST	88.16 ± 8.85	76 ± 4.83	2.947	0.043

Values are mean ± standard error of mean. \* (P<0.05).

### DISCUSSION

The coprological examination of gastrointestinal parasitic infestations showed that the infestation rate of GIT parasites was 84.6% in sheep, this percentage is higher than that found by (Hassan and Barzinji, 2018) who recorded 82.35% in Kirkuk, and Fadle et al., (2011) who showed (75.1%) in Baghdad while the result agreed with a study in Diyala (86.7%) by Minnat (2014).

The present study indicates the highest infestation rate with Nematodes spp. (47.27%), which is less than that encountered by (AL-Robaiee et al., 2019) who recorded (58.8%) in Kirkuk province, and higher than the results of (Jwher et al., 2021) who recorded (30.73%) in Mosul. Among species-specific gastrointestinal parasites (*H.controtus*, *Ostertagia* spp., *Nematodirus* spp., *Tristrongylus* spp., *Chabertia ovina*, *Cooperia* spp., *Marshallagia marshalli*, *Skrjabinema ovi*, *Fasciola* spp., *Paraphistomum cervi* and *Moniezia* spp.), *Eimeria* spp. was the second and most frequently recorded parasite recorded in young

sheep (30.9%). This finding is similar to that by AL-Robaiee et al. (2019) who reported (31.8%) in Kirkuk, while they disagreed with Hassan and Barzinji, (2018) who reported only 18% in Kirkuk province. The third highest gastrointestinal parasite prevalence rate was Trematodes parasites, which included *Fasciola hepatica* and *Paraphistomum cervi*, with 14.54% in adult sheep. This result was agreed with Pinilla et al., (2019) who recorded (16.06%) in sheep in the Colombian area, and discordant with the study by Jwher et al., (2021) who recorded (9.09%) in Mosul. On the other hand, the species with the lowest infestation of gastrointestinal parasites observed was Cestode (*Monezia* spp.), which recorded 7.27%. This result agrees with a study by Pinilla et al., (2019) who recorded 7.2% of *Monezia* spp. in sheep, while discouraging AL-Robaiee et al., (2019) who reported 3.5%, and disagreeing with Kumar et al., (2015) who reported about 20%. This variation could result from the differences between our study and other research attributed to differences in the number of involved animals, the period of sample collection, diagnostic



techniques, anti-helminthic drug resistance, the immunity of infected animals, and the virulence of infective parasites, as well as temperature and humidity (Amana and Alkhaled, 2023).

The coprological examination of gastrointestinal parasitic infestations showed that the infestation rate of GIT parasites was 84.6% in sheep, this percentage is higher than that found by Hassan and Barzinji, (2018) who recorded 82.35% in Kirkuk, and Fadle *et al.*, (2011) who showed (75.1%) in Baghdad while the result agreed with a study in Diyala (86.7%) by Minnat (2014).

Haematological characteristics are an important tool that can be used as an aid to monitor the health status and production abilities of farm animals (Mohammed and Abass, 2021). The present study revealed a reduction in hematocrit, haemoglobin, and erythrocyte count, which may result from haemorrhages induced by different parasites and acute blood loss from sucking activities, and these results are consistent with a study by Yesuf *et al.*, (2020), and another study by (Aziz and Mahmoud., 2022) who showed severe anaemia in sheep infected with gastrointestinal parasites due to a decrease in packed cell volume and red blood cell count parameters. The total leukocyte count was found to be significantly elevated in infected animals, and the increase was mainly due to a greater count of eosinophils and lymphocytes (Aziz and Mahmoud, 2022). Who observed a significant increase in WBC and decrease in Hb, RBCc, and PCV ratios, which are due to alternative animals Eosinophilia and high lymphocyte levels are related to the cell's phagocytic activity, which results in the degradation of parasite debris and particulate matter as a consequence of chronic cases and cell-mediated immunity, and these results agreed with other earlier studies by (Awad *et al.*, 2016).

Our result showed significant reduction in erythrocyte indices rate of infected animals, these variation in erythrocyte indices indicated normal cell hypochromic anemia and liver problems, this result is constituent with that reported by Nayak, *et al.*, (2021) who observe decreases in MCH and MCHC due to anemia occurrence of parasitic infected animals.

The current study showed a variation in the biochemical profiles in the infected sheep, there was a significantly lower value in albumin and total protein than in healthy animals. The reduced levels of total protein concentration and albumin, found in this study agree with previous research by Awad *et al.*, (2016) The low protein level in gastrointestinal

parasitism is attributable to higher plasma loss via the parasite-infected intestines, this loss is mostly caused by the considerable loss of albumin, which is smaller and more fluidity-sensitive (Morgan *et al.*, 2006), the loss of large amounts of serum protein resulting from the damage to liver tissue caused by fasciolosis (Nasreldin and Ranas, 2020).

The study recorded an increase in ALT, AST, and total bilirubin due to the release of intracellular enzymes into the circulation, which may raise their blood level. This is caused by damage to cell walls and hepatic tissue caused by reactive oxygen species that liver fluke may release. This is in agreement with Hodzic *et al.*, (2013). On the other hand, elevated total bilirubin was frequent in chronic and advanced conditions of infected animals; this is coordinated with Guerra *et al.*, (2021), who showed increasing total bilirubin concentrations related to acute liver disease, which is considered a monitoring of chronic liver disease.

## CONCLUSION

It was found from the current study that infestation with GIT parasites in the province of Kirkuk, Iraq, has a high percentage in sheep, and therefore, taking preventive measures and following along with the use of preventive treatments has become an imperative necessity.

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## Authors' contribution

All the participant authors revised the article and contributed in developing the content.

## Competing interes

There is no conflict of interests of any sort between authors or elsewhere.

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