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The relationship between gastrointestinal parasitism and trace element with special reference to age, sex, and pregnancy status in sheep

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ABSTRACT

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The relation between gastrointestinal parasitism and their effect on the immune status and trace element deficiency in sheep was investigated. This survey was conducted on 300 sheep, with a focus on sex, age, and pregnancy status. The majority of the sheep were females 225 (75%) and males represent 25% (75). A large majority of the sheep were adults (65.3%), while 34.7% were young age. Fecal samples were examined by direct smear, sedimentation, and floatation techniques. Blood samples were examined to provide a summary of the complete blood count parameters. A substantial 74.3% of the sheep were infested with one or more types of parasites, while 25.65% were free from parasitic infestation. The most common types of parasites identified were nematodes and cestodes, with 30% of the sheep were infested with

nematodes, and 17.65% with cestodes, and 12.7% had multiple infestation with nematodes and cestodes. Protozoal infections were less common (affecting 14% of the sheep) while trematode was not detected in all examined samples. There is a statistically significant differences in sex distribution among the different parasitic infestations. In particular, the combined infestation (nematodes and cestodes) and protozoa infestations were exclusively affecting female sheep. A conclusion for overall results there is strong relationship between gastrointestinal parasitism and trace element deficiency.

1. INTRODUCTION

Sheep are key parts of cultivating in light of less speculation, short creation cycles, becoming quicker and being fit for adjusting to the climate more effectively than steers (1).

Sheep address 6% of the complete red meet delivered in Egypt that is 4,200,000 heads. The demand for sheep meat is increasing daily and our country's production can't meet the demand recently. Every year, a large number of goats and sheep are imported from neighboring countries that have a huge impact on our country's trade balance (2).

Recently, the number of sheep and goats has increased significantly because they are better adapted to the prevailing conditions in addition to being a successful project for small farmers, so raising sheep in the early nineties became the second predominant class of livestock after cows (3).

Sheep can deliver quality corpses on roughage alone, making them fit to better places where grain creation isn't beneficial (4). Sheep compost is significant manure and on the grounds that sheep are brushed on negligible terrains, their droppings are the best way to further develop plant development (5).

Gastrointestinal parasite infestation has been always a major problem for animal health because it causes major economic losses, particularly in the tropical and subtropical

countries (6). A wide variety of gastro-intestinal (GI) helminthes have been implicated in huge morbidity and mortality in small ruminants like goats and sheep. Heavy parasitic burden in these animals is characterized by symptoms like diarrhea, gastritis, stunted growth, poor weight gain, reduced milk production, lack of appetite, and loss of wool and body hairs. Cestodes infestation leads to severe sheep loss in terms of poor performance (7). Gastrointestinal nematode infestations have the highest infestation rate in sheep and goats which affect the survival and productivity of sheep, nematode parasites like Nematodirus species, Trichostrongyloid species, and Haemonchus species are most common (8).

Trace elements are essential to optimize metabolic processes in animals, as they act as cofactors for various important enzymatic reactions (9). These elements are needed normally on a daily basis and the requirements for each element have been carefully estimated for the different species of animals at different stages of growth and production (10). They play significant roles in immunity and gut health (11).

The aim of this work is determination of the relationship between gastrointestinal parasitism and immune status and trace element deficiency in sheep.

2. MATERIALS AND METHODS

2.1: Study area and animals:

This survey was conducted on 300 sheep of different sexes, age, and pregnancy status (Table 1) from different localities in Menoufia governorate (Meleg, Tala, Shibin Elkom, Shanawan and Qwesna) during the period from May 2022 to October 2023.

Table 1: The age, sex, and pregnancy status of sheep under the survey.

Animal status		Number	%
Sex	Male	75	25%
	Female	225	75%
Age	Adult	196	65.3%
	Young	104	43.7%
Pregnancy status (n=225)	Pregnant	198	88%
	Non-pregnant	27	12%
Total		300	

2.2.: Sample collection and preservation according to (12):

2.2.1. Fecal samples:

Fecal samples were collected in the morning time. They were collected immediately after voiding to avoid contamination. About 30 gm of feces was collected from sheep by hand picking method with the help of disposable gloves and it was transferred into sterile vials applying appropriate precautions. The same process was repeated for all fecal samples. Necessary information was noted down in copy like sample number, collection date, sex, etc. then the sample was preserved in 2.5% potassium dichromate helps to maintain the morphology of parasites until examination. storage of fecal samples on refrigeration at (2°C–8°C) for 3-5 days.

2.2.2. Blood samples:

Blood samples were collected from jugular vein after septic precaution. Samples were divided into two parts , one part with anticoagulant for hematological tests (CBC) and the other part without anticoagulant for serum isolation for trace element detection . The sample for hematology were kept under cooling condition until examination and The serum samples were stored frozen at −20°C or lower till examination (12) .

2.3 Fecal analysis for internal parasite according to (13):

Fecal samples were examined physically for color, odor and consistency before being subjected to thorough parasitological examination for internal parasites using standard floatation and sedimentation technique.

2.3.1 Sedimentation technique:

The fecal sample (4 gm) was thoroughly mixed with 10 ml (0.9% saline) in a 250 ml beaker by using tongue depressor blade. The suspension was strained through strainer and two layers of wet gauze into a sedimentation tube, and the material was centrifuged at 1500 rpm. Two layers were obtained. The supernatant was decanted, and a few drops of the sediment were taken and placed on a glass slide. The slide was covered with cover slide and examined for parasites by (×10) objective lens of the microscope and if a parasitic stage was suspected confirmation was made by using (×40) objective (13).

2.3.2 Floatation technique:

Sample of feces (4 gm) was thoroughly mixed with 10 ml (0.9% saline) in a 250 ml beaker by using tongue depressor blade. The suspension was strained through strainer and two layers of wet gauze into a sedimentation tube, and the material was centrifuged at 1500 rpm. Two layers were obtained. The supernatant was decanted, and the sediment was re-suspended with saturated salt solution almost to the top of the tube avoiding overflow. A cover slip

was added to the top of the tube for 20 min, then the cover slip retained to a slide, examined for parasite by (×10) objective lens of the microscope and if a parasitic stage was suspected confirmation was made by using (×40) objective (13).

1. **2.4 Blood and serum analysis according to (13)**:

2.4.1 Hematological analysis: complete blood picture was analyzed including red blood cells (RBCs) count, hemoglobin concentration (Hb g/dl), packed cell volume (PCV %), mean corpuscular volume (MCV fl), mean corpuscular hemoglobin concentration (MCHC g/dl), mean corpuscular hemoglobin (MCH pg), white cell count (WBC), differential leucocytic counts (DLC$\times 10^9$/L) and platelet count (PLT) were estimated with Auto hematology Analyzer (symex xp 300).

2.4.2 Trace elements analysis:

Serum Ca, k, Mg, Cu, Na and Fe concentrations were estimated photometrically using Biochemistry Analyzer (spectrophotometer 5010) .according to instructions of kits manufactures. Furthermore, serum glucose concentrations were analyzed (13).

2.5 Statistical analysis:

Data was collected and entered to the computer using SPSS (Statistical Package for Social Science) program for statistical analysis (version 21; IBM Corporation, Armonk, NY, USA). Quantitative data were shown as mean ± stander deviation (SD), minimum and maximum. Qualitative data were expressed as frequency and percentage (%). Chi- square and Fisher exact tests were used to measure association between qualitative variables. Independent sample *t* test was used to measure significance between 2 sets of quantitative variables. The ANOVA test was used to measure significance among more than 2 sets of quantitative variables. P (probability) value was considered to be of statistical significance if it is ≤ 0.05.

3. RESULTS

3.1 **Parasitic infestation in the examined sheep:**

Table (2) provides a detailed overview of parasitic infestation in a sample of 300 sheep, categorizing the presence and types of parasites. A substantial 74.3% of the sheep in the study were infested with one or more types of parasites, while 25.65% were free from parasitic infection. The most common types of parasites identified in the sheep were nematodes and cestodes, with 30% of the sheep being infected with isolated nematodes, and 17.65% with isolated cestodes. and 12.7% of the sheep had combined nematode + cestode infestation. Protozoal infections were less common, affecting 14% of the sheep, while trematodes were not detected in all the sheep.

Table 2: Parasitic infestation in the examined sheep.

Parasite	**Infestation**	**Positive (no)**	**Positive (%)**
Parasite	(free) Not infected	77	25.7 %
	Infected	223	74.3 %
Type of parasites	Mixed nematode + cestode	38	12.7 %
	Single nematodes	90	30%
	Single cestode	53	17.65 %
	Single protozoa	42	14 %
	Free (not infected)	77	25.65 %
Nematode	+ ve	128	42.7 %
	- ve	172	57.3 %
Cestode	+ ve	91	30.3 %
	- ve	209	69.7 %
Trematode	+ ve	0	0%
	- ve	300	100 %
Protozoa	+ ve	42	14%
	- ve	258	86 %
Total		300	100%

3.2 **Blood and serum analysis:**

The blood picture (CBC) analysis of the examined sheep was summarized in table (3). The infested sheep showed significant reductions in hemoglobin, hematocrit, and red blood cell count and significant elevation of the WBC, lymphocytes, monocytes and eosinophils count ($P<0.05$).

The values were expressed in the mean and standard deviation (SD).

Table 3: Complete blood picture of the blood samples of the examined sheep**.**

Blood parameters	Parasitic infestation		t-test	P value
	-Ve (N=77)	+ve (N=223)		
Hb (g/dL)	10.8±1.91	9.19±1.86	6.71	<0.001
HCT (%)	29.7±4.19	27±4	4.61	<0.001
RBCS (x 10^5/mL)	10.3±1.73	9.34±1.66	4.46	<0.001
MCV (fl)	30.7±3.23	28.1±3.68	5.88	<0.001
MCH (Pg)	11.1±1.18	9.27±0.91	12.9	<0.001
MCHC (g/dl)	33.2±1.40	32.7±1.45	2.27	0.025
RDW (%)	18.06±2.14	15.6±4.97	5.92	<0.001
Platelets (x 10^3/ml)	314±88	296±68	1.57	0.118
WBCS (x 10^3/ml)	6.12±1.38	10.2±2.95	-16.3	<0.001
Neutrophils (cells/ml)	1947±550	1942±521	0.074	0.941
Lymphocytes (cells/ml)	2.95±0.83	5.83±1.21	-22.9	<0.001
Monocytes (cells/ml)	217±115	258±108	-2.71	0.008
Eosinophils (cells/ml)	365±202	586±298	-7.21	<0.001

Table (4) provides the serum levels of important electrolytes, iron (Fe), and glucose in a sample of 300 sheep. The results showed that parasitic infestations significantly reduced the serum levels of various electrolytes, iron, and glucose in sheep (P<0.05).

Table 4: Trace elements and glucose levels in the serum samples of the examined sheep.

Serum parameters	Parasitic infestation		t-test	P value
	-Ve (N=77)	+Ve (N=223)		
Ca (mmol/l)	2.24±0.31	1.98±0.33	6.15	<0.001
Na (mmol/l)	143±12.6	90.5±19.8	27.1	<0.001
K (mmol/l)	3.54±0.50	2.78±0.42	11.7	<0.001
Mg (mmol/l)	0.80±0.13	0.77±0.09	1.72	0.087
Cu (µmol/l)	14.6±6.94	9.15±1.92	6.79	<0.001
Fe (µmol/l)	25.2±3.60	16.7±1.26	20.2	<0.001
Glucose (mmol/l)	3.68±0.79	2.61±0.49	11.1	<0.001

3.3 **The effect of sex, age and pregnancy status on the parasitic infestation of sheep:**

The effect of sex, age, and pregnancy of the parasitic infection in sheep was summarized in table (5). The data showed a significant effect of the sex on parasitic infestation in sheep. A large majority of the non-parasitized sheep were male (85.7%), while most of the parasitized sheep were female (96.0%) (P<0.05). There is a marked effect of the pregnancy status on sheep. A very

low percentage (2.6%) of non-parasitized sheep were pregnant, while 87.9% of parasitized sheep were pregnant (P<0.05). The age distribution also differs significantly between parasitized and non-parasitized sheep. Most of the non-parasitized sheep were young (84.4%), while the majority of parasitized sheep are adults (82.5%) (P<0.05).

Table 5: Effect of the sex, age and pregnancy state between examined sheep.

		Parasite			
		No infestation N=77	**Infestation N=223**	**Chi-Square Test**	**P-value)**
Sex	**Male**	66 (85.7%)	9 (4.0%)	203	P<0.001
	Female	11 (14.3%)	214 (96.0%)		
Pregnancy (n=225)	**Pregnant**	2 (18.2%)	196 (91.6%)	53.3	P<0.001
	non-pregnant	9 (81.8%)	18 (8.4%)		
Age	**Adult**	12 (15.6%)	184 (82.5%)	113	P<0.001
	Young	65 (84.4%)	39 (17.5%)		

3.4 **The effect of sex, age and pregnancy status on the type of parasitic infestation of sheep:**

There is a statistically significant difference in the effect of sex on the type of the parasitic infestation in sheep (Table 6). In particular, the combined (nematode + cestode) infestation and protozoal infestations exclusively affected female sheep. Males were more commonly affected with nematode and cestode infestations, but the prevalence of infestation in males was still lower when compared with females (P<0.05). Pregnancy state did not show significant difference among the different types of parasitic infestation (P>0.05). Age is significantly associated with the type of parasitic infestation. Combined (nematode + cestode) and cestode infestations were more prevalent in adult sheep (P<0.05).

Table 6: The effect of sex, age and pregnancy status on parasitic infestation in sheep.

Parameters		**Nematode + Cestode N=38**	**Nematode N=90**	**Cestode N=53**	**Protozoa N=42**
Sex	**Male**	0 (0%)	8 (8.9%)	1 (1.9%)	0 (0%)
	Female	38 (100%)	82 (91.1%)	52 (98.1%)	42 (100%)
Pregnancy	**Pregnant**	38 (100%)	73 (89%)	48 (92.3%)	37 (88.1%)

on-pregnant	0 (0%)	9 ([illegible])	4 (7.7%)	1 (1.9%)	(P = 0.180)
Adult	33 (86.8%)	70 (77.8%)	51 (96.2%)	30 (71.4%)	X^2 = 12.3
Young	5 (13.2%)	20 (22.2%)	2 (3.8%)	12 (28.6%)	(P = 0.006)

WBCS (x 10^3/mL)	5.16±0.39	11.9±1.80	5.38±0.21	11.6±1.40	42
Neutrophils (cells/ml)	2048±603	2111±507	1678±560	1816±80.1	10
Lymphocytes (cells/ml)	5.79±0.70	5.14±1.13	7.21±0.88	5.60±0.39	59
Monocytes (cells/ml)	187±107	215±64	269±107	400±89	62
Eosinophils (cells/ml)	688±326	386±123	1000±274	400±105	20

1. The effect of the type of parasitic infestation of sheep on the blood picture of the affected sheep

The effect of the type of parasitic infestation on the complete blood picture (CBC) of the sheep infected with four different types of parasitic infestations was summarized in table (7). The results showed that different types of parasitic infestations in sheep significantly affect various CBC parameters. Combined nematode and cestode infections have the most profound effects, leading to reduced hemoglobin, hematocrit, and RBC counts. Cestode and isolated protozoa infections appear to cause less severe alterations in these parameters (P<0.05).

Table 7: The complete blood picture of sheep infested with different types of helminths.

ers	Nematode + Cestode N=38	Nematode N=90	Cestode N=53	Protozoa N=42	F	P-value
	7.57±0.39	8.33±0.89	10.8±2.43	10.3±0.46	69.5	<0.001
	22.7±0.52	25.8±2.5	29.2±4.19	31.8±0.65	99.8	<0.001
L)	7.60±0.23	9.01±1.30	9.56±1.71	11.3±0.47	69.4	<0.001
	30.6±2.47	28.2±3.01	27.8±5.44	26.01±0.42	12.3	<0.001
	9.31±0.50	8.95±0.62	10.3±0.91	8.53±0.37	72.7	<0.001
	32.3±0.39	32.2±0.79	34.5±1.81	32.08±0.56	64.9	<0.001
	13.6±0.78	13.1±0.74	23.2±5.07	13.04±0.31	209	<0.001
mL)	242±21	247±25	344±24	390±49	294	<0.001

2. The effect of the type of parasitic infestation of sheep on the trace elements and glucose in serum of the affected sheep:

The serum electrolyte levels, iron (Fe), and glucose concentrations in sheep infected with different types of parasites were illustrated in table (8). Sheep infected with protozoa tend to show lower levels of key electrolytes and nutrients such as calcium, magnesium and glucose and higher levels of sodium and potassium than other infestations (P<0.05). The sheep infested with cestodes had the highest copper concentration and the lowest iron levels (P<0.05).

Table 8: The serum electrolytes, Fe and glucose levels of the sheep with different types of parasitic infestations.

Serum parameters	Nematode + Cestode N=38	Nematode N=90	Cestode N=53	Protozoa N=42	F	P-value
Ca (mmol/L)	2.14± 0.20	2.12± 0.31	2.0± 0.17	1.52 ±0.15	65.7	<0.001
Na (mmol/L)	85.4± 13.8	87±10.1	72.7 ±6.14	125± 3.82	267	<0.001
K (mmol/L)	2.68± 0.24	2.85± 0.26	2.36 ±0.45	3.27 ±0.15	74.8	<0.001
Mg (mmol/L)	0.84± 0.07	0.75± 0.11	0.80 ±0.05	0.72 ±0.06	18.9	<0.001
Cu (µmol/L)	8.58± 0.78	7.62± 1.11	11.7 ±1.39	9.69 ±0.41	177	<0.001
Fe (µmol/L)	17.3± 1.12	17.4± 0.67	15.6 ±1.44	16.1 ±0.57	52	<0.001
Glucose (mmol/L)	2.92± 0.48	2.84± 0.49	2.33 ±0.17	2.16 ±0.17	45.4	<0.001

4. Discussion

Helminthiasis, particularly parasitic gastro-enteritis, poses a severe health risk and limits small ruminant productivity due to morbidity, mortality, treatment costs, and control efforts (14). These types of infections are typically spread by ingestion of infective eggs/oocysts or larvae or through skin penetration (1). The aim of this survey to find a correlation between the parasitic infestation and trace element with special reference to sex, age, and the pregnancy status of the examined sheep.

This study revealed 74.3% of the prevalence of gastrointestinal parasites among Sheep. The prevalence of parasitic infections in ruminants varies across the world. It is thought that the prevalence of gastrointestinal parasites is considerably influenced because the grazing behavior of small ruminants as grazing behavior may increase the risk of infection among them. Other reasons may be overcrowding, lack of rotational grazing, and climatic and seasonal factors may also influence the survival and development of parasites outside the host. As warm and moist may favor a good environment for larvae of parasites which can lead high infection rate in small ruminants. The prevalence of gastrointestinal parasites in sheep in this study was 74.3 % which agrees with previous reports done by (15) who reported 84.3%, 80%, prevalence from sheep from Gechi districts, Dang Nepal. Sheep seem to be more

suspected of gastrointestinal parasites because they graze closer to the ground consuming shorter and more nutritious vegetation. This type of behavior increases their exposure to parasite larvae to get contact (16). Also, higher prevalence was made by researchers like (17, 18, 19, 1) who reported 100%, 99.9%, 91.32%, and 89.3% prevalence in sheep higher prevalence of GI parasites was determined by (20**)**, however, (21) recorded lower prevalence. Variable results of GI parasites might be due to environmental conditions. In dry conditions, the prevalence of GI parasites was reported lower (22) as compared to wet condition (23). However, year-round grazing of livestock in contaminated pasture is responsible for persistent infection of GI parasites (24).

The results showed that the incidence of gastrointestinal infestation increase by age of sheep (adult 65.3 % and young 34.7 %). Results regarding age-wise prevalence are in line with those of **(**14 , 25) and disagree with (26) who found there were no significant differences between age groups. Adult sheep are getting more infected with parasites as compared to young ones. Parasitic infections can be seen more in adults than young. This may be because of grazing on greater pasture contaminated with flocks and various stress factors like daily travel, gestation, and climate .Young animals are less infected because they rely mostly on milk for nutrition; they are less susceptible to parasite infestations. The prevalence rate can be low in young because of the possibility that adverse environmental conditions for the establishment and growth of most helminths and protozoan species that are blamed for the decrease in the infection of gastrointestinal helminths (14 , 25). Other reports showed that the prevalence of helminths infestation was significantly higher ($p<0.05$) in young (49.41%) than adult sheep (33.91%). It was explained that the younger sheep are more prone to nematode infestation than their older counterparts (26). This may be because there may be less development of immunity or maybe more susceptibility in lambs against infections .This variation might be due to the low level of immunity in young stock as compared to older animals or persistent exposure to parasites

during grazing in the contaminated areas. It has been reported that weaned lambs and yearlings were more prone to parasitic infection while a significant immunity develops with age.

Regarding to the sex-wise prevalence, this survey showed that majority of incidence of gastrointestinal parasites occur in females. These results are in line with those of (27, 28, 29) and not in line with those of (30 , 26). Sex-wise prevalence seems to be higher in females than males **(**29, 27), they reported that females have more infections than males because of some factors like pregnancy, stress, lactation, etc. Sex-wise prevalence seems to be higher in females because females are brought on by stress and an immune-compromised immune system during pregnancy, parturient paresis and lactation, level of hormones prolactin and progesterone also made females more susceptible to infections. Females have higher prevalence might be due to stress and hormonal changes during pregnancy and lactation period. Availability of insufficient diet and enhanced grazing during these periods may also increase the chances of infection (28). On the other hand, there are some reports about the more prevalence of gastrointestinal parasites in male than in females. This might be because male sheep and female sheep were allowed to graze together in the same pasture ground, giving them an equal chance to become infected, another reason may be females were more resistance to infection than males after puberty, although there are no differences before puberty **(**26). Moreover, it has been reported that both sexes are equally susceptible to GI parasitic infection. Hormonal changes in both sexes are responsible for severity of parasitic infection e.g. males are more prone to parasitic infection due to androgen while in female estrogens stimulate the immune response which increases the resistance against infection (30).

The effect of the sex on the type of infestation was studied. There is a statistically significant difference in sex distribution among the different parasitic types. In particular, the combined nematode and cestode and protozoa infestations exclusively affected female sheep. Males were more commonly found with nematode and cestode infestations, but the

distribution of males is still lower compared to females (P<0.05). Females have more infections than males because of some factors like pregnancy, stress, lactation, etc. sex-wise prevalence seems to be higher in females because females are brought on by stress and an immune-compromised immune system during pregnancy, parturient paresis and lactation, level of hormones prolactin and progesterone also made females more susceptible to infections.

Gastrointestinal infestations affect the immune status of the sheep. Animals deficient in Fe are less immune to parasites than animals having an adequate amount of Fe. Lambs having Fe deficiency showed higher fecal egg counts, less immune response and lower vitamin B12 production than the lambs provided with higher amount of Fe, provide the correlation of Cu level in blood with the burden of parasitic infection *(Trichostrongylus axei and T. colubriformis)* of sheep showed inverse relationship Similarly, lower levels of serum Zn and Cu were reported in sheep population infected with *Trichostrongylus sp.*(1,32,33). Copper concentration in sheep having parasitic load was found to be lower than in sheep free from parasites (34,35). Adequate levels of trace element in animals maintain the functions of the immune system which ultimately reduces the chances of parasitic infection (36). Trace elements like Ca, Na, K, Cu, Fe in serum had insignificant association with the burden of GI parasites (37). Higher levels of Cu and Fe in sheep did not show any reduction in burden of *H. contortus* **(**38). Natural grazing system, animals containing higher level of Zn and Cu showed low level of parasitic burden (39). The results of the present study provide useful data on the trace element profile of flora of the study district to provide preventive management strategy against GI parasites for the grazing sheep population. However, it is not a final conclusion that the higher level of Cu is the only responsible factors for lower EPG because there is a possibility that the grazing forages may contain some elements which are effective against GI parasites.

From the results of this survey, it could be concluded that, there was higher prevalence of

the parasitic infestation in females more than males. Moreover, the infestation prevalence increases with age and pregnancy. Gastrointestinal infestation affects the blood parameters and the level of trace elements which indicate that it could have a serious effect on the immune status of the animals.

5.CONCLUSIONS

- Gastrointestinal parasitism affect badly on the general health and production of sheep.
- There is strong relationship between gastrointestinal parasitism and some trace element deficiency.
- Macro- and micro-minerals play important effect on sheep health.
- Parasitized sheep have more chances to suffer from micro or /and macro minerals.
- There is strong relationship between parasitic infestation and minerals deficiency.
- The government should be carefully help in make perfect vaccination program to prevent more parasitic infestation in more areas.
- Farmers should be interested in good management of animal areas and animal feed.
- Farmers should provide a complete healthy diet for sheep rich in minerals to prevent chance of nutritional deficiency that lead to decrease immunity leading to more chance for parasitic infestation

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4.

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proofreading the article, etc.).

Authors' declarations

Publication consent

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Data and material availability:

All data of this study is provided.

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Authors' contributions.

K.M.S: Conceptualization, Formal Analysis, Investigation, Supervision, Resources, Writing – original draft

A.R.S: Data collection, Formal Analysis, Project administration, Resources, Writing – review and editing.

M.M.Z: Conceptualization, Data curation, Formal Analysis, Resources, Supervision, , Writing – review and editing.

7.REFERENCES

1. **Ibrahim , M. M., Ghamdi, M., & Gahmdi, M. (2008).** Helminths community of veterinary importance of livestock in relation to some ecological and biological factors. Turkiye Parazitol Derg, 32(1), 42–47.
2. **El-Hanafy, A. A. and M. J. B. i. A. H. El-Saadani (2009).** "Fingerprinting of FecB gene in five Egyptian sheep breeds." **25**(3-4): 205-212.
3. **Nwosu, O. (2019).** A systematic review of the impact of minerals on pregnant sheep and goats and their offspring in the African continent, University of Pretoria.
4. **Vohra, S., Singh, S., & Sangwan, A. K. (2020).** Epidemiology of gastrointestinal helminths of sheep in aeolian plains of Haryana. Journal of Animal Research, 10(1), 47–52.

5. **Gompo, T. R., Shah, R., Tiwari, I., & Gurung, Y. B. (2021).** Sero-epidemiology and associated risk factors of brucellosis among sheep and goat population in the south western Nepal: A comparative study. BMC Veterinary Research, 17, 1–10.
6. **Bah**, **M., & Keita, S. (2022).** Prevalence of Gastrointestinal Parasites in Small Ruminants in Jarra East District, the Gambia. Middle East Journal of Agriculture Research, 11(02), 511–518.
7. **Hussain, M., I. Khan, M. Siddiqui, M. Farooq and N. Ahmad (2004).** Prevalence of cestodes and comparative efficacy of various anthelmintics in Rambouillet sheep. Int. J. Agric. Biol. 6(6): 1128-1131.
8. **Dhital , V. P. (2006).** Prevalence of gastrointestinal parasites in goats at the IAAS livestock farm and Manglapur VDC-2, Chitwan. The Blue Cross, 8, 122. DOMESTICATED ANIMALS (7th edition). EWP.
9. **Erdoğan et al.,(2002)** S. Erdoğan, Y. Ergün, Z. Erdoğan, T. Kontaş Some mineral substance levels in serum of sheep and goat grazing in Hatay region Turkish J. Vet. Animal Sci., 26 (2002), pp. 177-182.
10. **Lee, J., S. Knowles and G. J. S. N. W. C. I. Judson (2002).** "Trace element and vitamin nutrition of grazing sheep." 285-311.
11. **Rizwan, H. Abbas, M.S. Sajid, M.I. Rashid, M.K. Jones (2021)**Preventive management of the parasitic diseases through trace elements R.Z. Abbas, A. Ahmad (Eds.), Veterinary Pathobiology and Public Health, Unique Scientific Publishers, Pakistan (2021), pp. 190-202, 10.47278/book.vpph/2021.016 .
12. **SOULSBY.E.J.L. (2012).** HELMINTHS ARTHROPODS AND PROTOZOA OF DOMESTICATED ANIMALS (7th edition). EWP.
13. **Garcia LS and Bruckner D A(2001) :**Diagnostic medical parasitology. ASM Press. Washington,DC .
14. **Nwosu, C. O., Madu, P. P., & Richards, W. S. (2007).** Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-

arid zone of north-eastern Nigeria. Veterinary Parasitology, 144(1–2), 118–124.

15. **Rana, G. (2018).** Gastro-Intestinal Parasites of Sheep (Ovis aries Linnaeus, 1758) in Laxmipur VDC, Dang, Nepal [PhD Thesis]. Department of Zoology.
16. **Pandey, V. S., Ndao, M., & Kumar, V. (1994).** Seasonal. prevalence of gastrointestinal nematodes in communal land goats from the highveld of Zimbabwe. Veterinary Parasitology, 51(3–4), 241–248.
17. **Pedreira, J., Paz-Silva, A., Sánchez-Andrade, R., Suarez, J. L., Arias, M., Lomba, C., Diaz, P., Lopez, C., Díez-Baños, P., & Morrondo, P. (2006).** Prevalences of gastrointestinal parasites in sheep and parasite-control practices in NW Spain. Preventive Veterinary Medicine, 75(1–2), 56–62.
18. **Almalaik, A. H. A., Bashar, A. E., & Abakar, A. D. (2008).** Prevalence and dynamics of some gastrointestinal parasites of sheep and goats in Tulus area based on postmortem examination. Asian Journal of Animal and Veterinary Advances, 3(6), 390–399.
19. **Mulugeta, T., Geremew, B., & Molalegne, B. (2010).** Prevalence of gastrointestinal parasites of sheep and goats in and around Bedelle, South-Western Ethiopia. Internet Journal of Veterinary Medicine, 8(2).N. Kumar, T.K. Rao, A. Varghese, V.S. Rathor Internal parasite management in grazing livestock.
20. **Gadahi, J. A., Arshed, M. J., Ali, Q., Javaid, S. B., & Shah, S. I. (2009b).** Prevalence of gastrointestinal parasites of sheep and goat in and around Rawalpindi and Islamabad, Pakistan. Veterinary World, 2(2), 51.
21. **Rizwan, H.M, M.S. Sajid, H. Abbas, M.F. Qamar, Q. Akram and M. Maqbool (2019a).** Epidemiology and Control of Congo Fever in Sacrificial Animals of Pakistan. Vet. Sci. Res. 01 (02): 18- 24.
22. **Khan, M.N., M.S. Sajid, M.K. Khan, Z. Iqbal, and A. Hussain (2010).** Gastrointestinal helminthiasis: prevalence and associated determinants in domestic

ruminants of district Toba Tek Singh, Punjab, Pakistan. Parasitol. Res. 107: 787-794

23. **Radostits, C.C. Gay, D.C. Blood, F.W (2007).** Hinchliff Veterinary Medicine. A Text Book for the Diseases of Cattle, Sheep, Pigs, Goats and Horses (tenth ed.), Bailliere Tindall, London (2007).
24. **Kumar et al.,(2013)** N. Kumar, T.K. Rao, A. Varghese, V.S. Rat hor Internal parasite management in grazing livestock.
25. **Singh, V., Varshney, P., Dash, S. K., & Lal, H. P. (2013a).** Prevalence of gastrointestinal parasites in sheep and goats in and around Mathura, India. Veterinary World, 6(5), 260.
26. **Dappawar, M. K., Khillare, B. S., Narladkar, B. W., & Bhangale, G. N. (2018).** Prevalence of gastrointestinal parasites in small ruminants in Udgir area of Marathwada. Journal of Entomology Zoological Studies, 6(4), 672–676.
27. **Dabasa, G., Shanko, T., Zewdei, W., Jilo, K., Gurmesa, G., & Abdela, N. (2017).** Prevalence of small ruminant gastrointestinal parasites infections and associated risk factors in selected districts of Bale zone, south eastern Ethiopia. Journal of Parasitology and Vector Biology, 9(6), 81–88.
28. **Raza, M.A., Murtaza, S., Bachaya, H.A., Dasatger, G., Hussain, A., (2009)**. Point prevalence of Haemonchosis in sheep and goats slaughtered at Multan abattoir. The Journal of Animal and Plant Sciences, 19: 158-159.
29. **Islam, M. S., Hossain, M. S., Dey, A. R., Alim, M. A., Akter, S., & Alam, M. Z. (2017).** Epidemiology of gastrointestinal parasites of small ruminants in Mymensingh, Bangladesh. Journal of Advanced Veterinary and Animal Research, 4(4), 356–362.
30. **Urquhart, G.M., J. Armour, J.L. Duncan, and F.W. Jennings (1996).** Veterinary Parasitology. 2 nd Ed. The Faculty of Veterinary Medicine, The University of Glasgow, Scotland. p. 131-133.

31. **Abdellall, T.S. (1991).** Haematological and biochemical studies on the efficacy of synanthic againts gastrointestinal parasites in sheep. Assiut Vet. Med. J. 24 (48): 197-203 Aypak, S.U., S.
32. **Hucker D.A., and W.K. Yong (1986).** Effects of concurrent copper deficiency and gastrointestinal nematodiasis on circulating copper and protein levels, liver copper and bodyweight in sheep. Vet. Parasitol. 19: 67-76
33. **Silva, R.M., J.M. Ferreıra-Neto, and I.B.M. Sampaıo (1978).** The influence of diet and gastrointestinal parasites on serum copper and zinc in sheep (Abst). Arq. Esc. Vet. Univ. Minas Gerais. 30: 261-74.
34. **Ishag, H.I., I.G. Ibrahim, A.M. Shamat, A. Aisha, and S.H. Eisa (2014).** Mineral profile of sheep and goats grazed natural pasture in Nyala locality, Western Sudan. J. Agric. Vet. Sci. 15: 53-61.
35. **Ortolani, E., D. Knox, F. Jakson, R. Coop, N.F. Suttle, M. Anke, D. Meissner, and C.F. Mills (1993)**. Abomasum parasitism lowers liver Cu status and influences the CuXMOXS antagonism in lambs. Trace element in man and animals. TEMA 8: Proc 8 thIntl. Symp. on Trace Elements in Man and Anim. pp: 331-332.
36. **McClure S.J. (2008).** How minerals may influence the development and expression of immunity to endoparasites in livestock. Parasite immunol. 30: 89-100
37. **Aypak, H. Voyvoda, G Güven, E.D. Fidan, G. Tosun, M. Gültekin, E. Şimşek, and A.G. Güler, (2016).** Comparative analysis of serum mineral levels and parasite load in goats naturally infected with gastrointestinal nematodes. Turkiye. Parazitol. Derg. 40: 141-6.
38. **Schafer, M.L.R. Leal, M.B. Molento, (2015)** A.R. Aires, M.M.M.F. Duarte, F.B. Carvalho, A.A. Tonin, L. Schmidt, E.M.M. Flores, R.T. Franca, T.H. Grando, A.P. Minho, A. Krause, A.Q. Antoniazzi, S.T.A. Lopes **(2015).**
39. **López-Rodríguez, G., Zaragoza-Bastida, A., Reyes-Guerrero, D. E., Olmedo-Juárez, A., Valladares-Carranza, B., Vega-Castillo, L. F., & Rivero-Perez, N.**

(2023). Coffee Pulp: A Natural Alternative for Control of Resistant Nematodes in Small Ruminants. Pathogens, 12(1), 124.

تؤكد النتائج على وجود علاقة قوية بين الإصابة الطفيلية ونقص العناصر النادرة، مما ينعكس سلبًا على مناعة الأغنام. توصي الدراسة بضرورة اتخاذ تدابير وقائية وعلاجية للحد من تأثير الطفيليات وتعزيز صحة الأغنام.

الكلمات المفتاحية: الديدان الخيطية، الديدان الشريطية، العناصر النادرة، الأغنام

علاقة الإصابة الطفيلية للقناة الهضمية مع العمر، الجنس والعشر فى الأغنام

الملخص العربى

تلعب تربية الأغنام دورًا هامًا في حياة المربين، إلا أن إصابتها بطفيليات الجهاز الهضمي تشكل تهديدًا يتطلب دراسة معمقة. تهدف هذه الدراسة إلى تحليل العلاقة بين العدوى الطفيلية، الحالة المناعية، والنقص الغذائي للعناصر النادرة في الأغنام. أُجريت الدراسة في محافظة المنوفية بمناطق مختلفة، شملت 300 خروفًا من الجنسين، مع الأخذ في الاعتبار العمر والحمل، خلال الفترة من مايو 2022 حتى أكتوبر 2023.

أظهرت النتائج أن 74.3% من الأغنام مصابة بطفيليات، بينما 25.65% خالية من العدوى. أكثر الطفيليات شيوعًا كانت الديدان الخيطية (30%)، تليها الديدان الشريطية (17.65%)، بينما أصيب 12.7% من الأغنام بكلا النوعين. لوحظ أن الذكور يمثلون غالبية الأغنام غير المصابة (85.7%)، في حين أن معظم المصابات كن إناثًا (96%). كما سجلت الأغنام المصابة انخفاضًا في مستويات الهيموجلوبين والهيماتوكريت وكريات الدم الحمراء، مقابل ارتفاع في كريات الدم البيضاء والخلايا المناعية.

كذلك، أثرت العدوى الطفيلية على مستويات المعادن والعناصر الغذائية، حيث سجل انخفاض في الكالسيوم، المغنيسيوم، الحديد، والجلوكوز، مقابل ارتفاع في الصوديوم والبوتاسيوم. أظهرت الدراسة أن الإصابة بالديدان الشريطية كانت مصحوبة بأعلى تركيز للنحاس وأدنى مستويات الحديد.