Animal Health Research Institute,
Shalatin Regional Lab.

PREVALENCE AND SIGNIFICANCE OF GASTROINTESTINAL PARASITES IN DESERT SHEEP IN THE TRIANGULAR AREA (SHALATIN – ABU- RAMAID-HALAEEB) RED SEA GOVERNORATE, EGYPT AND TRIALS OF TREATMENT

(With 9 Tables, 3 Figures and One Plate)

By
O.M. MAHRAN

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مدي انتشار وأهمية طفيليات الجهاز الهضمي في الاغنام الصحراوية بمنطقة المثلث (شلاتين- أبورماد- حلايب) بمحافظة البحر الاحمر، مصر، ومحاولة علاجها

عثمان محمد مهران

تم عمل مسح طفيلي بمنطقة المثلث (شلاتين-أبورماد- حلايب) محافظة البحر الاحمر ، مصر للتعرف علي طفيليات الجهاز الهضمي التي تصيب الاغنام الصحراوية بهذه المنطقة في الفترة من يناير 2008 الي ديسمبر 2008 حيث شملت هذه الدراسة عدد 982 حيوان من أعمار مختلفة، تم شهريا فحص عينات من البراز وكذلك من مناطق الرعي. أوضحت هذه الدراسة أصابة عدد 670 حيوان بمعدل (68.22 %). وان انواع البويضات المتواجدة هي الهيمونكس ، التريكوسترونجيلس ،الاسوفاجوستوم ما، الاسترونجيليدس ، التيريكيورس ، الاستروتجيا، الشابرتيا، النيماتوديرس، المارشيلجيا مارشالي، المونزيا، الفاشيولا وحويصلات الكوكسيديا بنسب 23.62، 13.34%، 10.38% , 9.36، 8.75 %، 7.33%، 6.41%، 2.34 %، 1.83 %, 3.66%، 6.61% علي التوالي في عينات البرازالمفحوصة. وكانت بويضات الهيمونكس ، التريكوسترونجيلس ، الاسوفاجوستومام ، الاسترونجيليدس ، التيريكيورس هي الاكثر % تواجدا علي مدار العام وخاصة في فصل الشتاء بينما الانواع الاخري من بويضات الديدان الاسطوانية، الشريطية، المفلطحة والاوليات ذات معدل ظهور موسمي. سجلت الاصابة المنفردة نسبة % 48.78 بينما الاصابة المختلطة كانت% 12.72. كان العد الكلي لبويضات الديدان الاسطوانية يترواح من 100-1350 وكان معدل الاصابة أعلي في الحملان مقارنة بالاغنام البالغة وفي فصول الشتاء اعلي من الصيف. أسفرالزرع الطفيلي لبعض عينات البراز وكذلك العيتات الماخوذة من المرعي عن تواجد الطور المعدي الثالث ليرقات كلا من الهيمونكس ، التريكوسترونجيلس ،الاسوفاجوستومام، الاسترونجيليدس والاستروتجيا. وكان للأصابة بهذه الطفيليات تأثير واضح علي صورة الدم حيث كانت هناك

أنيميا التي تتميز بأنخفاض في كريات الدم الحمراء ، الهيموجلوبين وخلل في العد التبايني لكرات الدم البيضاء وكانت محاولات العلاج التي أجريت علي بعض الاغنام المصابة بأستخدام عقار البندازول تاثير واضح في اختفاء بويضات الديدان ، أختفاء الاعراض وتحسن في صحة الحيوانات وزيادة في وزن ها. وتخلص هذه الدراسة الي وضع خطة استراتيجية للعلاج حتى يمكن التحكم في هذه الطفيليات.

SUMMARY

A coprological survey to assess the prevalence of gastro-intestinal parasites infecting sheep in the triangular area (Shalatin – Abu- Ramaid-Halaeeb) Red Sea Governorate, Egypt, was done from January to December 2008; a study was carried out on 982 sheep of different ages. The study involved monthly faecal examinations from sheep, and pasture sampling from communal grazing areas. The sheep-level prevalence of GIT was 670 (68.22%). Eggsof *Haemonchus* sp., *Trichostrongylus* sp., *Oesophagostomum* sp., *Strongyloides* sp., *Trichuris* sp., *Ostertagia* sp., *Chabertia* sp. *Nematodirus* sp., *Marshalgia marshali* sp., *Moniezia* sp., *Fasciola* sp., and *oocysts of Eimeria* were encountered in 23.62%, 13.34%, 10.38%, 9.36%, 8.75%, 7.33%, 6.41%, 2.34%, 1.83%, 3.66 % 6.61% of the faecal samples respectively. However, only *Haemonchus*, *Trichostrongylus*, *Oesophagostomum*, *Strongyloides* and *Trichuris* eggs occurred throughout the year and were common during the winter season than in the summer season. Other nematodes, cestodes, flukes eggs and protozoal infections showed a seasonal pattern in prevalence. Single infections recorded high rate of infection (48.78%), while mixed infection was represented by (%12.72). The mean faecal egg counts (epg) of nematodes ranged from 100-1350 with a high peak of egg production during the winter season. Lambs were more commonly infected and had higher worm counts than adult sheep. Irrespective of the age of sheep, higher worm counts were generally encountered during winter season than in summer season. On coproculture of positive faecal samples and pasture samples from communal grazing area producing third stage larvae in order of prevalence were *Haemonchus* sp., *Trichostrongylus* sp., *Oesophgastomum* sp, *Strogyloides* sp. and *Osteratagia* sp. Pasture larval count and faecal egg counts (epg) peaked towards the end of rainy season, based on conditions of the study area. Hematological values revealed that affected sheep had significantly lower total erythrocytic count, Hemoglobin concentration, packed cell volume, higher lymphocyte and eosinphil count. Affected animals were successfully treated with oral dose of albendazole. Efficacy of the drug was assessed on the basis of absence of parasitic eggs in the faecal sample, clinical improvement and weight gain. Based on this study, it is now possible to explore the possibility of using strategic treatments for the control of parasitic gastroenteritis in this area.

Key words: *Gastrointestinal parasites, sheep, Shalatin.*

INTRODUCTION

Sheep populations of the triangular area are approximately 262 thousands(FAO-OIF-WHO, 1995) Despite of these large numbers, the economic benefits to their owners remain marginal due to prevailing diseases, poor nutrition, poor animal production systems and general lack of veterinary care. In the triangular area sheep production is mainly pastural, and in these communities there is a heavy dependence on pastures. Sheep graze these pastures almost continuously, depending on the quantity and quality of available forage. Although rainfall varies seasonally in this region, it could be expected that climatic conditions generally favour the development and survival of the free-living stages of parasites on these pasturelands throughout the year. Sheep constitute a major source of protein for human nutrition in tropical and subtropical regions (Devendra, 1981). However, production levels are low because of factors, which include poor nutrition, poor management, disease and internal parasitism. (Bakunzi and Serumaga-Zake, 2000). Parasitic infestations exert adverse effect on the health and productivity of animals these effects are varied and more pronounced in sheep and goats compared to these seen in other species of livestock. Gastrointestinal parasitism is recognized are the most prominent sheep disease. Sheep infected with gastrointestinal parasites may become ill and even die. Infected sheep either doesn't gain well or lose weight, become lethargic, and may have diarrhea. Sometimes losses occur which are undetected because the signs of parasitism are not obvious. The low production of meat, wool and milk and the costs of anthelminthic treatment are the major factors affecting the livestock production in the world and appear to be a major constraint to efficient sheep production (Torina *et al.*, 2004). The parasite-infected animals increase their metabolic rate and reduce the amount of metabolic energy used for production, as the parasites use their nutrients, damage some vital organs and cause animals to become more susceptible to other pathogenic agents (Sykes *et al.,* 1992) and (Byford *et al.,* 1992). Internal parasites have been shown to reduce food intake and nitrogen retention and accordingly, to reduce growth rates by up to 30%, or more (Meyers, 1991), subclinically affect the whole flock, and losses are unnoticed (Martinez-Gonzalez *et al.*, 1998). The resultant increased infection pressure by gastrointestinal helminths is more serious in small ruminants that suffer more from acute disease, particularly haemonchosis. Chronic helminthosis is more widespread and probably of more significance in all grazing ruminants (Allonby and Urquhart, 1975) because of its insidious effects which reduce weight gains, milk yield, wool production and cases quality, especially in situations where nutrition is poor (Gatongi *et al.*, 1997). In order to disrupt the biological cycle of parasites, these factors have to be integrally analyzed (Martinez-Gonzalez *et al.*, 1998) and (Nginyi *et al.*, 2001). However, no information is available from the semi-arid region of the triangular area which occupied the southern part of eastern desert, Egypt in relation to what are the parasites of importance, at what time of the year and when parasite control measures should best be implemented in sheep in this area. Therefore, the fundamental goal of the present study was to clear-up the prevalence, seasonal dynamics, intensity of gastrointestinal helminths infections in grazing sheep and therapeutic trials of some infected cases in the triangular area which is representative of the semi-arid region of eastern Egypt.

MATERIALS and METHODS

1. Study area:

The area considered in the present study is commonly known as (triangular area) comprising of Shalatin – Abu- Ramaid and Halaeeb. Climatically, this area is further categorized as semi- arid area. This area occupied the southern part of eastern desert and is considered the southern border of Egypt. The mean monthly minimum and maximum temperature vary from 12.4 ± 0.9C in January to 28± 1.2 in July and 17.5±0.6C in January to 40 ±1.9 C in July respectively, the average monthly rainfall ranges from a minimum 26.9± 2.6mm in November to 80 mm in January and the relative humidity from 34% in April to 76.9 %in August. Weather is divided into four well-marked seasons. Cold season (December to March), Hot season (May to July), Monsoon seasons (August to September) and post-monsoon season (October to November) native vegetation is characterized by open patches of grasses and forbs. Climatic data pertaining to maximum, minimum temperature and rainfall were obtained from meteorological station at Shalatin city.

2. Animals:

The study was carried at the triangular area during the period from January 2008 - December 2008. The sheep production cycle in this area is as follows: mating takes place during April and May and lambing takes place during September and October. The lambs are weaned at 45 days and start grazing at around the end of January. Sheep graze throughout the year on natural pasture and browsed on ephemeral plant during rainy seasons and were supplemented with green fodder in dry seasons. Monthly monitoring for gastrointestinal infection of 982 sheep was carried out. For the purpose of analyses; lambs were defined as animals less than 6 months of age. Most flocks were maintained outside and were only brought into paddock during night. The examined sheep had not been given antihelimentics at least two and a half month before collecting the sample.

3- Samples and sampling processing:

3.1 Faecal and blood samples

Faecal samples were collected per rectum in glove, placed in icebox and transported to laboratory. Samples were collected on the last week of every month for one calendar year (January –December 2008). Faecal samples were processed for detection of gastrointestinal helminths and *Eimeria* oocysts by concentration techniques (sedimentation and floatation) (Soulsby, 1982). *Dictyocaulus filaria* larvae were quantitatively determined by Baermann's technique. Faecal egg count was done using a modification of the McMaster technique to Asses the level of infestation, on the day of collecting the samples (Maff, 1986). Identification of helminthes eggs was based on the morphological characteristics previously described by (Soulsby, 1982) and (Georgi and Georgi, 1990). *Eimeria* oocysts were identified according to (Levine, 1985). Whole blood samples were taken in EDTA coated vacutainer tubes, from the jugular vein for the determination of packed cell volume (PCV), hemoglobin (Hb) and differential leukocyte count (DlC) as per the methods of (Feldman *et al.,* 2000)

3.2 Coporcultural studies:

For identifying the trichostrongylid genera, a representative number of positive faecal samples were pooled on equal quantities and used for coporoculture in a climatic room temperature at 27ºC and 95% r. h for 2 weeks.). (Maff, 1986). The resulting larvae (L3) were enumerated and identified to genus or species level based on size and morphology (Soulsby, 1982) and (Georgi and Georgi, 1990).

3.3 Pasture samples and larval counts:

Pasture samples were collected in order to determine the monthly amount of infective nematode larvae available for grazing sheep. Herbage samples were collected according to the method described by Taylor (1939). Grazing area was traversed a, w, shape route stopping every 5-10 m and small wisps weighing 200 g were picked by hand/scissor and placed in gauze bag. Pasture samples were collected from grazing area on the last week of every month for one year (January - December 2008). Recovery and isolation of larvae using the soaking procedure and Baermann method followed the description of (Hansen and Perry, 1994). Each sample in a gauze bag (pores size: 1.5 mm × 1.5 mm) was immersed in water in a bucket to which 1 ml of Polargric dishwashing soap had been added, taking care that the bag does not touch the bottom of the bucket. During the first 3 h, the bags were lifted several times above the bucket and the water drained back into the bucket. After further soaking overnight, the bags were removed and rinsed with fresh tap water into the bucket. The contents of the buckets were left to sediment for 1 h and the supernatant decanted to 500 ml. The sediment was sieved through a standard kitchen tea strainer to remove large grass particles and made into a volume of about 1000 ml, which was poured into a Baermann apparatus without a screen and left to stand for 1 h. Between 30 and 40 ml of the sedimented material trapped at the bottom of the rubber tubing in the Baermann apparatus was then collected into a test tube and left to cool at 4 °C for 1 h. The supernatant was further reduced to 10 ml. Two 1 ml aliquot samples were then randomly taken from the 10 ml sample after thorough mixing and examined under a stero microscope. All larvae observed in this sample were removed using a 200-µl pipette, stained with iodine and examined with the aid of a compound microscope. All the L3 nematode parasitic larvae were identified to genus level based on tail length and cuticle morphology and counted. The washed grass samples were air dried for 30 days at room temperature and then weighed.

The number of larvae per kg of herbage (Krecek and Maingi, 2004), The number of larvae recovered from each of the 200 g samples was determined by multiplying the total number counted in the two 1 ml aliquots of the 10 ml samples by 5. Ten millilitres was the total volume of larval suspension obtained from each of the 200 g seeded grass samples. The estimated number of larvae recovered from 1 kg of dry grass was calculated using the formula. Estimated number of larvae recovered from 1 Kg dry grass sample

(X)= Number of larvae counted in 200 g sample x1000

Dry weight of the200g grass sample

3.4 Therapeutic trials:

Salvage treatments were carried out for animals that showed clinical sings of helminthosis e.g. diarrhea, weight loss, odema, and anemia, ect. and yielded (>500 EPG) were selected and subjected to therapeutic trials at the end of the rainy/early dry season (December-February) and the end of dry/early rainy season October-November. 120 sheep having mixed infection ranging from 6-9 months in age with an average weight of 29.35 Kg were selected, On day zero, the sheep were blocked by sex and allocated, within sex, to two groups according to a completely randomized design. Group A, consisted of 100 animals to be treated and 20 animals in-group B (untreated control). Treated animals were drenched with albendazole (Systamex, Wellcome) at a dose rate of 10 mg/kg body weight, while the controls remained untreated, being given only placebo of sterile water. Only female animals were used because of the tendency of the owners to sell the males at any earlier age than females. The eggs per gram (EPG) of the faecal material from individual sheep of both groups were counted before the animals were dosed at zero days and thereafter at 4, 7, 14, 21, 28 and 42 days post treatment. Individual body weights were recorded for all sheep immediately before the treatment commenced and then at 21, 28, 42, and 70 days intervals until termination of the treatment and comparison between treated and control group was made.

RESULTS

The Meteorological data (rainfall, relative humidity, minimum and maximum temperature of the study area) are shown in Figure 1.

Table 1 summarizes the percentage of infection with gastrointestinal parasites in sheep, during the study period. Of the 982 examined sheep, 670 (68.22%) were found positive for various parasites.

When the general prevalence was analysed by age, it was observed that sheep ≥12 months old had higher prevalence rate of gastrointestinal parasites, sheep between 1-3 years of age were having moderate higher prevalence rate and sheep over 3 years of age had low prevalence rate (Table 2).

Of the 982 sheep examined, 670 (68.22%) were found positive for various parasites either singly or in mixed infection, Multiple infections were125 (12.72%). far less common than was infections with a single parasitic type 480 (48.5%). The most frequently observed parasite in this population was *Haemonchus* sp. (23.94%), *Trichostrongylus* sp. (13.15%), followed by *Oesophagostomum* sp. (10.52), *Strongyloides* sp. (9.49%) and *Trichuris* sp. (8.87%), and others with minor percentages (Table 3).

Table 4 showing the monthly variation of gastrointestinal parasitic species identified through egg morphology in the examined sheep. Egg of *Haemonchus* sp., was superior during the months of December (39.6%) January (36.63%), February (34.4%), March (29.76%), April (28.0%), and November (25.84%), in comparison to the prevalence of months October (16.0%), September (13.51%), May (12.67%), June (10.76%), August (10.6%)and July (9.67%), egg of *Trichostrongylus* sp. meaningful differences were observed between the prevalence during the month of January (19.8%), December (18.81), March (17.82) and the rest of the months of the year. Egg of *Oesophagostomum* sp. and *Strongyloide* sp. represents prevalence rates 17.82%, 15%, 14.28%, 10.97% and 16.83%, 13.97%, 13%, and 9.75%, respectively in January, December, and March, other helminths eggs showing seasonal pattern of prevalence.

Faecal egg counts (FE C):

The counts ranged from100-1350 EBG with a high load during the months of (December -April). The prevalence of *Haemonchus*, *Trichostrongylus* and *Osphagostomum* spp. infection were high throughout the periodof study, but the intensity varied in different seasons. FEC increased during the winter season (December-April). There was a high difference in FEC among age groups, the mean faecal egg counts for lambs and adults showed a similar pattern over the study period. But those from the lambs were generally higher than those from adults. On a few occasions, i.e.‘May – August, the lambs and adult sheep had almost similar mean faecal egg count output (FEC), for the majority of the months. The mean FEC for Lambs were below 1500 EPG. The times when the mean FEC exceeded 1800 EPG were (December -April). The Adults had mean FEC generally below 1000 EPG in all months except December and January The lowest mean FEC of less than 300EPGfor both groups of sheep were recorded form June-August and lambs had the highest overall FEC.

Coporocultural studies:

Identification of the larvae (according to their length of the tail, sheath and number of intestinal cells) (Table 5).

Table 6. showing the infective larvae harvested from pooled coprocultures were from the following genera *Heamonchus* (27.5%), *Tricohstrongylus* (18.3 %), *Strongyloides* (13.33%) *Oesophagostomum* (6.67%) and *Ostertagia* (4.16%) in decreasing order of prevalence.

Pasture larval counts:

The results of mean larval recoveries from herbage taken from the grazing area are shown in figure 3. The amount of infective larvae on pasture followed the rainfall pattern and was more or less similar to the pattern of FEC. The peak of pasture larvae count occurred in (December- April). Whereas infective larvae on pasture were very low to virtually zero on communal grazing area at the last part of dry season (June-August) when the number of larvae was slightly elevated in grazing area where egg positive animals had grazed. The common infective nematode larvae identified were those. *Haemonchus* sp. *Trichostrongylus* sp., *Oesophagostomum* spp, *Strongyloides* sp and *Ostertagia* sp. in the order of decreasing abundance, respectively. These results showed that there were highly significant effects of time (month of sampling on the total number of infective larvae recorded but there were no significant difference between the different sites where herbage samples were taken.

Therapeutic trials:

Nematode eggs recovered during the study were identified as *Heamonchus* sp., *Trichostrongylus* sp., *Oesophagostomum* sp., *Strongyloid* sp., *Trichuris* sp., *Ostertagia*, *Chabertia* sp., *Nematodirus* sp. eggs. On day 0, faecal egg counts were high for both groups. In albendazole -treated sheep, faecal egg counts decreased to 0 by day 7 for all types of nematode eggs. The percentage reductions in faecal egg counts from albendazole -treated sheep, compared to control animals, for all types of eggs, were >90% on day 4 and 100% from days 7–14, except for *Trichuris* sp. on days 7 (99.7%) and 14(99.9%). On day 21, in the albendazole -treated group, low faecal egg counts were detected in two animals for *Trichostrongyles* and *Trichuris* spp., respectively; thus, percentage reductions were 100% for *Heamonchus* sp., *Oesophagostomum* sp., *Strongyloides* sp., *Ostertagia* sp., *Chabertia* sp. and *Nematodirus* sp. 99.8% and 99.1% for *Trichostrongyles* and *Trichuris* sp., respectively.

Fig. 1: Meteorological data

Figure 1: Meteorological data

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Table 1: Prevalence of helminths eggs and coccidian infection of sheep

Total no. Of ex. Animals	No. Of infected cases		Single infection of helminths eggs		Single infection of coccidian		Mixed infection		Total			
									Helminths		Coccidian	
982	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	670	68.22	480	48.87	65	6.61	125	12.72	605	61.6	190	19.34

Table 2: Relationship of age to prevalence of gastrointestinal parasites in (982) sheep.

Months	Under 1year old			1-3 years old			Above 3 years old			All ages groups		
	Exam No.	Infected No.	%	Exam. No.	Infected No.	%	Exam. No.	Infected No.	%	Exam. No.	Infected No.	%
January	37	35	94.59	40	34	85	24	18	75	101	87	86.14
February	34	29	85.29	39	32	82	20	13	65	93	74	79.56
March	29	24	82.75	37	28	75.67	18	11	61.11	84	63	75
April	23	19	82.6	40	30	75	19	10	52.63	82	59	71.95
May	22	18	81.81	31	22	70.96	18	8	44.44	71	48	67.6
June	16	9	56.25	30	15	50	19	6	31.57	65	30	46.15
July	16	7	43.75	29	11	37.93	17	5	29.41	62	23	37
August	18	7	38.88	28	10	35.71	20	7	35	66	24	36.36
September	19	13	68.42	34	22	64.7	21	7	33.33	74	42	56.76
October	20	15	75	39	28	71.79	22	12	54.54	81	55	67.9
November	24	20	83.33	42	34	80.95	23	16	69.56	89	70	78.65
December	43	38	88.37	46	39	84.78	25	18	72	114	95	83.33
Total	301	234	77.74	435	305	70.11	246	131	53.25	982	670	68.22

Table 3: Prevalence of individual parasites in sheep in the triangular area

Parasites	No.(%) infected Sheep (982)
A-nematodes	
Haemonchus sp.	232(23.62)
Trichostrongylus sp	131(13.34)
Oesophagostomum sp.	102(10.38)
Strongyloids sp	92(9.36)
Trichuris sp	86(8.75)
Ostertagia sp	72(7.33)
Chabertia sp	63(6.41)
Nematodirus sp.	23(2.34)
Marshalgia marshali sp.	18(1.83)
B-Cestodes	36(3.66)
Moniezia sp	
C-Flukes	18(1.83)
Fasciola sp.	
D-Protozoa	65(6.61)
Eimeria sp.	

* Total numbers and total percentage of animals' exceed expected values owing to multiple parasitisms

Table 4: Mean monthly prevalence of gastrointestinal parasites in 982 Sheep.

Parasites	Jan No.(%)	Feb No.(%)	Mar No.(%)	Apr No.(%)	May No.(%)	Jun No.(%)	Jul No.(%)	Aug No.(%)	Sep No.(%)	Oct No.(%)	Nov No.(%)	Dec No. (%)
A-nematodes												
Haemonchus sp	37(36.63)	32(34.4)	25(29.76)	23(28.0)	9(12.67)	7(10.76)	6(9.67)	7(10.6)	10(13.51)	13(16.0)	23(25.84)	40(39.6)
Trichostrongylus sp.	20(19.8)	18(17.82)	14(16.67)	10(12.19)	5(7.0)	4(6.51)	3(4.83)	5(7.57)	8(10.81)	10(12.34)	15(16.85)	19(18.81)
Oesophagostomum sp.	18(17.82)	14(15.0)	12(14.28)	9(1097)	3(4.22)	2(3.0)	2(3.22)	3(4.54)	4(5.4)	6(7.4)	11(12.35)	19(18.81)
Strongyloids sp	17(16.83)	13(13.97)	11(13.0)	8(9.75)	4(5.63)	1(1.53)	1(1.61)	1(1.51)	3(4.0)	8(9.87)	10(11.23)	16(15.84)
Trichuris sp	16(15.84)	12(12.90)	10(11.9)	8(9.75)	2(2.81)	0	0	1(1.51)	2(2.7)	7(8.64)	11(12.35)	17(16.83)
Ostertagia sp	14(13.86)	11(11.82)	8(9.52)	4(4.87)	2(2.81)	0	0	1(1.51)	4(5.4)	6(7.4)	9(10.11)	13(12.87)
Chabertia sp	13(12.87)	9(9.67)	7(8.33)	4(4.87)	2(2.81)	0	0	0	2(2.7)	4(4.93)	8(8.98)	14(13.86)
Nematodirus sp.	7(6.93)	3(3.22)	2(2.38)	1(1.21)	1(1.4)	0	0	0	0	0	2(2.24)	7(6.93)
Marshalgia marshal sp	4(3.96)	3(3.22)	2(2.38)	1(1.21)	1(1.4)	0	0	0	1(1.35)	1(1.23)	2(2.24)	3(2.97)
B-Cestodes	6(5.94)	4(4.3)	3(3.57)	2(2.43)	2(2.81)	1(1.53)	1(1.61)	3(4.54)	2(2.7)	2(2.46)	3(3.37)	7(6.93)
Moniezia sp												
C-Flukes	3(2.97)	3(3.22)	2(2.38)	1(1.21)	1(1.4)	0	0	0	1(1.35)	1(1.23)	2(2.24)	4(3.96)
Fasciola sp.												
D-Protozoa	15(14.85)	11(11.82)	6(7.14)	4(4.87)	0	0	0	0	3(4.0)	4(4.93)	8(8.98)	14(13.86)
Eimeria sp.												
Total	101	93	84	82	71	65	62	66	74	81	89	101

Fig. 2: Nematode egg counts (EPG) in desert sheep (averaged over ne year).

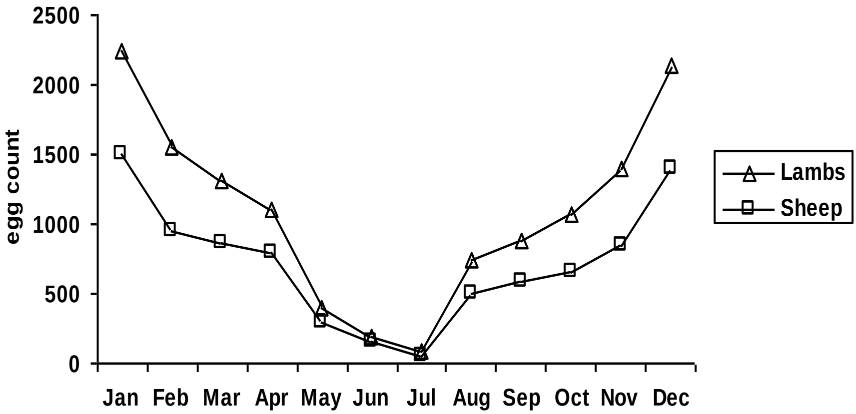

Table 5: Identification of Infective third stage larvae obtained from faecal culture.

Nematode larvae	Total length (microns)		Length of the tail sheath (microns)		Morphological feature
	Rang	Mean	Range	Mean	
Haemonchus sp.	630-720	675	119-146	132.5	Medium caudal sheath and sheath kinked at the tip of tail.
Trichostrongylus sp.	590-650.	620	72- 108	90	Short caudal sheath with tiny tubercle on tip of tail.
Oesphagostomum sp.	780- 910	845	135 -144	207	Long caudal sheath and Intestinal cells covered coarse granules
Strongyloides sp.	520-690	605			Absence of a sheath and truncated tail
Osteatgia sp.	788-833	810.5	88-120	104	Short caudal sheath and triangular shape

Table 6: Prevalence of different species of gastrointestinal nematode through faecal culture (n=120).

Species	No. of positive animals	%
Haemonchus sp.	33	27.5
Trichostrongylus sp.	22	18.33
Oesophagastomum sp.	16	13.33
Strongyloides sp.	8	6.67
	5	4.16

Fig. 3: Mean larval counts from herbage samples collected from the study area.

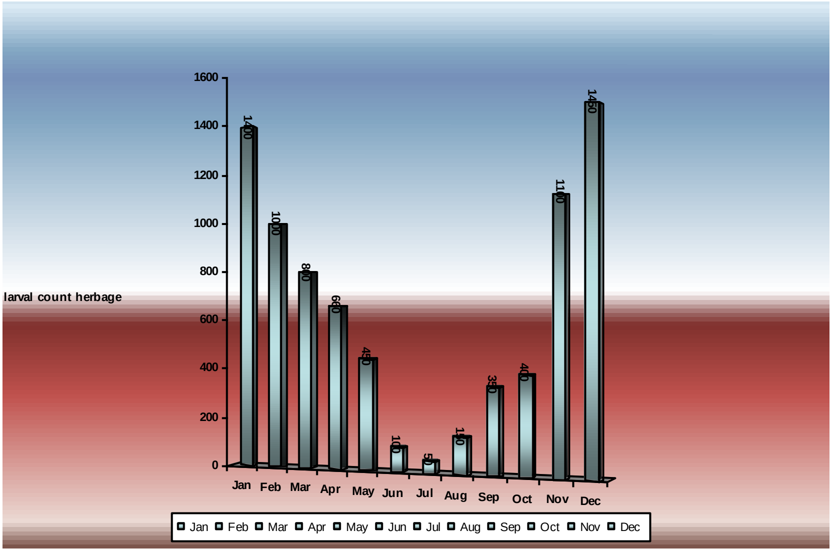

Table 7: Blood parameters of sheep infected with gastrointestinal parasites

Parameters	control	infected
TEC×10*6/ µL	7.87±0.33	5.86±0.22
T WC×10*3/µL	6.91±0.44	5.18±0.23
PCV%	30.0±1.2	22.1±0.26
HB gm/dl	11.42±36	8.77±0.41
Eosinophil %	2.6±21	5.2±0.80
Neutrophil %	40±1.52	49.8±2.65
Lymphocyte%	56±1.71	41.7±2.20

Table 8: Therapeutic trials of some sheep naturally infected with gastrointestinal nematodes

Animal group	No. of treated animals	EPG pre treatement	EPG post treatment						Drug effect
			4	7	14	21	28	42	
A	100	1300	180	40	-ve	-ve	-ve	- ve	100%
B	20 (untreated)	1000	1115	1130	1180	1100	1300	1450	0

Table 9: Body weight in kg of sheep before and after treatment.

Animal group	Weight pre/kg treatment	Weight/kg 21day post treatment	Weight 28 days post treatment	Weight 42 days post treatment	Weight 70 days post treatment
A	29.355	30.682	31.220	33.124	35.531
B	30.125	29.50	28.125	27.35	25.124

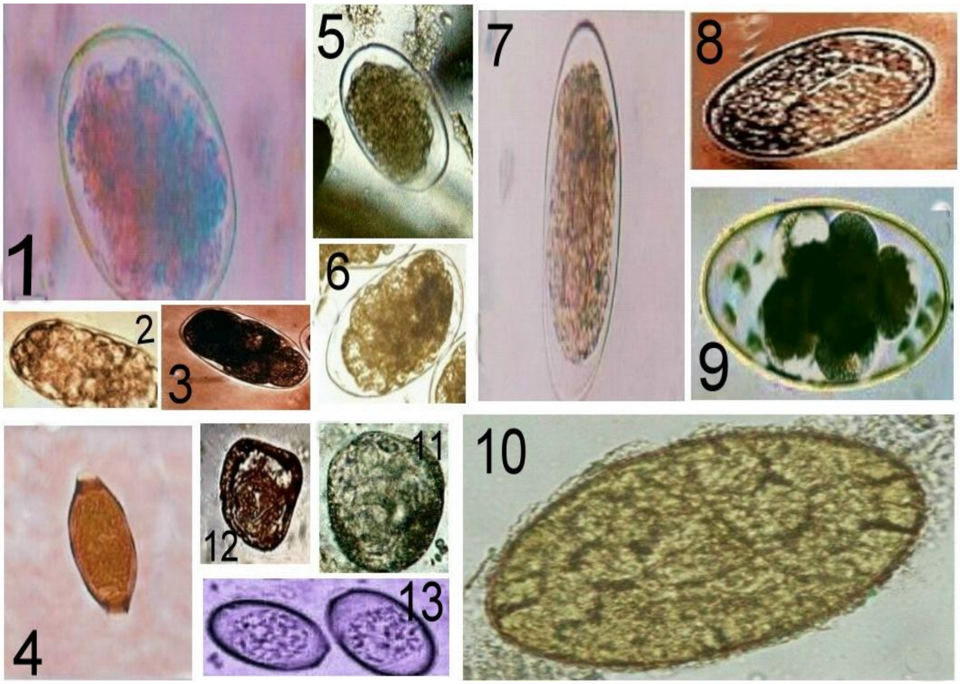

Plate1: Photomicrographs of different species of gastrointestinal parasites in desert sheep.

Fig. 1: *Trichostrongylus* sp. egg X10
Fig. 2: *Haemonchus* sp. egg x10
Fig. 3: *Oesphagostomum* sp. egg X10
Fig. 4: *Trichurius* sp. egg X10
Fig. 5&6: *Chabertia* sp. eggX10
Fig. 7: *Ostertagia* sp. egg X10
Fig. 8: *Strongyloides* sp. eggX10
Fig. 9: *Nematodirus* sp.X egg
Fig. 10: *Fasciold* sp. eggs X10
Fig. 11&12: *Moniezia* X25 eggX10
Fig. 13: *Eimeria* sp .oocyst X25

DISCUSSION

The prevalence study of gastrointestinal parasite infections in sheep is important and requires knowledge of the environmental and management of the animal production in which the parasites reach their maximum development, the fluctuation of parasite egg or larval excretion recorded here was associated with seasonal, pluvial and temperature change. Probably these fluctuations are due to a disparity in the distribution of eggs, oocysts in the faeces, different degrees of pathogenicity among nematodes and physiological status of the sheep. Parasitic infections are generally chronic in adult sheep although there are individuals with a higher susceptibility, which may be hereditary. The overall prevalence of gastrointestinal parasites in sheep was 68.22 %. El-Sayed (1997) at Dakahlia province, reported a general prevalence of gastrointestinal parasitic infection 65 8% and 66.26 in sheep. The prevalence obtained through this study differs from that reported by El-Akabawy (1987) in Kalubia province and Mirza and Razzak (1998) in Pakistain, and (Nwosu *et al.,* 2007) who assessed general prevalence of 100%, 80.5%, and 71.69% respectively. On the contrary, Kedees in Sinia (1990) and Bastaurous, *et al.* (2001) in Assiut Governorate who encountered sheep gastrointestinal parasitic general prevalence of 37.9% and 43.1%respectively. Incidence of infection varies widely from region to region, from season to season besides the ages of the animals, and veterinary care (Bekele, 2002). Single infections were the most common situations discovered, and multiple parasitisms were less commonly detected. These results agree with El-Sayed (1997) and Mirza and Razzak (1998) and (Al-Gaabary *et al.,* 2007) Therefore, the control in the most of the parasitized sheep could be done with a single drug. The recovery of gastrointestinal helminths from sheep of different age groups showed that in the triangular area, which is considered as a semi-arid area, infection has occurred as early as the first months of age. Waller (1997) observed that lambs and kids in the cold season shed eggs in faeces by 3-weeks of ages, this fact could explained by the husbandry system used, lambs follow their dams to the pasture from birth and be infected as soon as they begin to eat grass. 670 samples out of 982 sheep examined were positive for gastrointestinal parasites, and egg output ranged from 100-1350 EPG. The encountered gastrointestinal helminth eggs were (*H. contortus, trichostrongylus*, *Oesophagostmum*, *Strongyloid*es *Trichuris, Ostertagia*, *Chabertia* and *Nematodirus*, *Marshalgia marshali, Fasciola*, *Moniezia* spp., and oocysts of *Eimeria.* The gastrointestinal parasite population in this study were similar to those described by. El-Sayed (1997) at Dakhila province in Kalubia province, Mirza and Razzak (1998) in Pakistain, and (Pedreira *et al.,* 2006). Several studies carried on other countries showed that climatic conditions favour the appearance and development of many parasites with direct life cycle, and enhance the coexistence of several parasite species simultaneously infecting the animals (Pedreira *et al.,* 2006). *H. contortus* sp. (23.49%) was found to be the most prevalent GI parasite of sheep in this semi-arid region, this parasite represented more than 50% of faecal egg counts and was greatest in sheep under one year old age which coincides with other research findings of El-Akabawy (1987), El-Sayed (1997) at Dakhila, (Silva *et al.,* 1998) and (Al-Gaabary *et al.,* 2007). This result can be explained by the low resistance of younger animals to this species (Huntley *et al.,* 1992), or by the capacity of the larvae to survive in hot weather (Levine, 1963), or by their high biotic potential (Silva *et al.,* 1998). Another very common parasite found in the evaluated sheep was *Trichostrongylus* sp. (13.15%) which shows that these species were the main gastrointestinal parasite found in these pets, mostly in younger animals, (Chaudary *et al.,* 2007) and (Al-Gaabary *et al.,* 2007), probably because of their capacity to resist high temperatures as free living larvae (Soulsby, 1982). *Oesophagostomum* spp. were found in 10.52% of infected sheep and increased, as the animals got older. These observations were also demonstrated by Jacquiet *et al.* (1992), Silva *et al.* (1998) and Pedreira *et al.* (2006). *Strongyloid* sp. represented (9.49%) and present only in 8-9 months– old age sheep. higher prevalence rates were recorded by Kedees (1990) (13.7%) and by Wymannet *et al.* (2008) in Mali who found that *Strongyloides papillosus* in age class 0-1 month, prevalence of 39%, 2-3 months: 59%, 5-6 months: 42%. The presence of the parasite in the age under one year only may be due to no colostrum or transplacental transmission or due to adverse weather of the region causing low availability of larvae in pasture (Silva *et al.,* 1998). *Trichuirs* sp. was low and represented (8.87%). Similar results were obtained by Theodoropoulos *et al.* (1998) and were higher than that found by Kedees (1990) who reported, 1.2%. *Ostertagia*. sp., *Chabertia* sp., *Nematodirus* sp., and, *Marshalgia marshali* sp. being occasionally recorded with minor percentage, coincides with other research findings (El-Sayed, 1997; Walter, 1998; Bastaurous, *et al.* 2001; Pedreira *et al.,* 2006 and Sissay *et al.* 2007). The average percentage of sheep showed some degree of infection by *Eimeria* spp. was 6.70%. Nahed *et al.* (2003) reported that most sheep hosted light or moderate *Eimeria* spp. cysts infections (54.8 ± 11.0% and 19.2 ± 6.3% respectively), while severe infections were rare (7.7 ± 8.9%). The rate of infection with *Monieza* spp. in this study was 6.7%, this is nearly similar with the result obtained by El-Sayed (1997) and Wymannet *et al.* (2008) and lower than that reported by Lioyd and Soulsby (1987) in South Eastern Pennsylvania and north Marylans, U S A (9%) and (10%). *Fasciola* spp. was (1.84%), the low prevalence rates might be attributed to the incomplete elimination of *Fasciola* infection by sub-therapeutic doses, which lead to sub clinical picture with low egg output (Ghazy, 1987) and Abdo-Rabo (1991). Looss (1896) observed that heavy infected animals with *Fasciola* may be passing eggs in a considerable number up to 7-10 weeks but thereafter counts can not be associated with the degree of infestation and may below in heavy infection. Observation on faecal egg count of preliminary data shows that the maximum peak of egg production was during the winter period, these results agree with the results obtained by Torina *et al.* (2004) whereas in other countries winter is a period of hypobiosis. The mean FEC in sheep (Lambs and adults sheep) was above 420 EPG for most months, with distinct peaks of infection occurring during the cold times of the year, especially during the months of December, January, February, March and April. The highest EPG, with the highest percentages of H. *cotortus* L3 in faecal cultures, were found during the winter season. This concurs with studies in other countries which showed that climatic conditions were an important factor in determining levels of infection and the high biotic potential of H. *cotortus* results in this parasite rapidly assuming dominance at times when environmental conditions on pasture are favourable (Jithendran and Bhat, 1999; Torina *et al.*, 2004 and Nwosu *et al.*, 2007). The Coporculture of positive faecal samples revealed that H. *contortus* was the dominant species, representing between 50% and 65% of the EPG throughout the entire study period. The percentage of this parasite was greatest during the time of the highest faecal egg counts. *Trichostrongylus* sp. was the next most prevalent species (20%–28%) during the study period. Others, including (*Oesophagostomum*, *Strongyloid* and *Osteratigia,* spp. in order of dominance were found in varying percentages, but together only comprised 3%–16% of the total amount of infective larvae. Individually, these latter genera never comprised more than 3% of the total amount of infective larvae on any occasion. The findings from faecal examination were reflected in the recovery of infective larvae from pasture samples. High levels of pasture contamination with L3 were associated with environmental conditions and this was especially evident during the winter seasons (December-April). Low numbers of larvae were generally recovered from pasture during the intervening dry periods. The results also showed that *Haemonchus* was the most abundant nematode genus on pasture throughout the study period. This is probably related to the high fecundity of H. *contoratus* which means that it is likely to be recovered from pasture in higher numbers than larvae of other genera (Menkir *et al.,* 2007). This study showed that *Haemonchus* spp. might play important role in the aetiology of parasitic gastroenteritis syndrome of sheep than was previously thought. H *contortus* sp. was recovered in higher proportions than *Trichostrongylus* sp. in the majority of months because of its capacity to resist high temperatures as free-living larvae (Soulsby, 1982). The effect of animal age on faecal egg counts was highly observed, mixed infection occurred as early as the first months of life, similar to this investigation, host age has been reported elsewhere under the same climatic condition to have a clear influence on the worm-egg output. The young sheep generally had higher mean EPG than the adult sheep, particularly during the dry seasons, short rains and the latter part of the long rainy season, It is generally recognized that sheep under 1 year of age are more susceptible to parasite infection than adults. Sheep of 1-3 years-old hosts presented moderate EPG. Low prevalence rates of EPC were recorded in over 3 years old sheep. The apparent lack of regulation in egg output of the adult sheep (when they are approaching over 3 years of age) is likely to be due to a failure of their naturally acquired immune responses to parasitism, because of the inadequate nutritional status which is a feature of small ruminant in semi-arid area. These findings are in agreement with Al-Gaabaray *et al.* (2007). In Malaysia, Dorny *et al.* (1995) and Colditz *et al.* (1996), who found a relationship between age and reduction of eggs passed in faeces. (Jacquiet *et al.,* 1995) in the semi-desert climate of Mauritania reported that the climate is a more important risk factor in gastrointestinal parasite infection than age. The seasonal variation of general prevalence of gastrointestinal parasites was established when differences were found between the different months of the year for *H. contortus, Trichostrongylus, Oesophagostomum.and Strongyloid* spp. This coincides with (Torina, *et al.,* 2004) who also found seasonal distribution differences for these species hence it may suppose that the differences observed in this study may obey climatic conditions (rainfall, humidity and temperature). The present investigation revealed a clear reduction in HB, TEC and PCV values in infected sheep than non-infected sheep. The eosinophil and neutrophil values of infected sheep were higher than non- infected sheep. On the contrary, lymphocyte value was lower in infected sheep than the non- infected sheep; similar results were reported by (Maiti *et al.,* 1999). The lowering in the HB and TEC values might be due to the blood sucking activity of some immature parasites or hemorrhages caused due to their deep penetration into mucosa and. submucosa (Soulsby, 1982). Increased eosinophil value indicated helminths infection (Georgi and Georgi, 1990). The present therapeutical trials demonstrate that the administration of one oral dose of "Albendazole" to infected sheep is beneficial in clinical improvement and an increase in weight on the sheep. This confirms the results obtained by Tawfik *et al.* (1986). Bakunzi and Serumaga Zake (2000) and Joshi *et al.* (2001) reported the same effect of "Albendazole" against gastrointestinal parasites.

In conclusion this study showed a well-defined seasonal prevalence of GI parasites infections of sheep in this semi-arid region of Eastern Egypt. The study confirmed that the weather conditions of the wet seasons are favourable for GI parasite transmission in sheep, but less so during the dry season. Thus, in the semi-arid areas of Eastern Egypt, the daily maximum temperature does not appear to be a major limiting environmental factor for the development and survival of the eggs and larvae of GI parasite. Rather, rainfall and moisture status seem to have the most important effect. However, further studies on the ecology of the free-living stages of the GI parasites of sheep are required in this region to make unequivocal judgments on this matter. Our study also showed that *H. contortus* is economically the most important parasite of sheep in this region. This information will form the foundation for developing epidemiologically based control strategies for gastrointestinal parasites of sheep that are appropriate for small-holder farmers located in semi-arid areas of Eastern Egypt.

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