

Animal Health Research Institute,
Shalatin Regional Lab.

**SOME EPIDEMIOLOGICAL AND
PARASITOLOGICAL STUDIES ON PREVALENCE OF
GASTROINTESTINAL PARASITES OF DROMEDARY
CAMELS AT SHALATIN REGION, RED SEA
GOVERNORATE, EGYPT AND
TRAILS OF TREATMENT**
(With 6 Tables and 3 Plates)

By

O.M. MAHRAN

(Received at 16/6/2006)

بعض الدراسات الوبائية والطفيلية علي مدي انتشار طفيليات الجهاز الهضمي
في الابل وحيدة السنم بمنطقة شلاتين، محافظة البحر الاحمر، مصر
ومحاولة علاجها

عثمان محمد مهران

تم عمل مسح طفيلي على عدد ٥٣٠ جمل من الجنسين ومختلف الاعمار وفصول السنة لاستبيان معدل انتشار طفيليات الجهاز الهضمي في الابل في مدينة شلاتين بمحافظة البحر الاحمر، مصر في الفترة من يناير ٢٠٠٥ حتى ديسمبر ٢٠٠٥ ووجد ان ٧٢,٨٣% من الابل مصابة موزعة كالاتي: بويضات ديدان ٤٥,٦٦% واكياس كوكسيديا ١٠,٩٤% وعدوة مختلطة ١٦,٢٢% وكانت نسبة العدوى ببويضات الديدان الاسطوانية كالاتي: جنس التريكوسترونجيليس اكثر شيوعا ٣٥,٠٦%، الاسوفاجوستومام ١٦,١٥%، التريكيورس. ١٢,٩%، الهيمونكس ١٠,٦٧%، الاوستررجيا ٨,٨٤%، الشابرتيا ٨,٥٣%، النيماتوديرس ٤,٨٧% والاستورنجيليس ١,٨٢% وكانت نسبة الاصابة بالديدان الشريطية المونيزيا ١,٨٢% ونسبة الاصابة بالطفيليات الاولى. اكياس الايميريا كالاتي: ايميريا كاميلاي ٤٨,٦١%، ايميريا دروموداراي ٢٧,٧٨% وايميريا راجاساني ٥,٦%. تم عمل مزرعة من عينات البراز وتم الحصول على الطور اليرقي المعدي الثالث لديدان التريكوسترونجيليس، الاوسترنجيليس، الهيمونكس، والاوستررجيا وكان معدل الاصابة في الاعمار الصغيرة اقل من الكبيرة والاناث اعلى من الذكور. وكانت اعلى اصابة في فصلي الشتاء والربيع وكانت محاولات العلاج بمضادات الديدان المختلفة التي اجريت علي بعض الجمال المصابة اوضحت ان البندازول هو الاكثر تأثيرا وعلي العكس كان الزانيد اقل تأثير.

SUMMARY

A Parasitological survey was carried out on 530 camels of different ages, sex and seasons to clear- up the prevalence of gastrointestinal parasites at Shalatin region, Red Sea Governorate, Egypt in period of Jan. 2005

till Dec. 2005. It was found that 72.83% of the examined camels were positives. Out of positive cases 45.66 % were harbouring helminths eggs, 10.94% coccidian oocysts and 16.22% mixed infection. Prevalence of infection with nematodes eggs: *Trichostrongylus* sp. was the most common parasites detected 35.06%, followed by *Oesophagostomum* sp., 16.15%, *Trichuris* sp., 12.19 %, *Haemonchus* sp., 10.67 %, *Ostertagia* sp., 8.84%, *Chabertia* sp., 8.53%, *Nematodirus* sp., 4.87% and *Strongyloides* sp. 1.82 %. Prevalence of infection with cestodes eggs: *Moniezia* sp. 1.82 % and coccidian oocysts as *Eimeria cameli* oocysts 48.61%, *Eimeria dromedary* oocysts 27.87 and *Eimeria Rajathani* oocysts 5.6%. Coproculture producing third stage larvae of *Trichostrongylus* sp., *Strongyloides* sp., *Haemonchus* sp., and *Ostertagia* SP. The prevalence rate of infection was lower in young ages and higher in older ages. Females tend to be highly affected than males. The highest rate of infection was noticed in winter and spring. Therapeutical trials with different anthelmintic drugs were carried out on some infested camels and concluded that Albendazole was the choice drug in treatment of camel's helminthiosis. Conversely, Zanide was less effective.

Key words: *Epidemiological and Parasitological on gastrointestinal parasites of camels.*

INTRODUCTION

Dromedary camels are important multipurpose animals in different areas of the word including Egypt. They are used for transportation and production of meat, milk and finest silky wool. Gastrointestinal parasitism appears to be a peak problem for the production of camels. Gastrointestinal parasites reduce the feed intake, the efficiency of feed conversion and they are deterring the optimum functions of antibody-producing systems of the infested camels (Soulsby, 1983 and Pathak *et al*, 1993). Furthermore, (Rutogwende and Munyana, 1983) corroborated that helminthiosis was the third most production constraint in dromedaries. Several reports on gastrointestinal parasites of camels in different areas in Egypt (in Delata region and Upper Egypt) have been documented. (Selim and Rahman, 1972; Laila *et al*, 1986; Nafie *et al*, 1992; Nafady *et al*, 1995; Sayed 1997; and El- Salahy and Arafa, 2000). However prevalence of helminthiosis of camels at Shalatin area, which have a high population of camels, appears to be scanty. Therefore the fundamental goals of the present work was to clear-up the prevalence of gastrointestinal helminthes, protozoa present,

seasonal pattern of infestation, identification of third stage larvae of some nematodes and therapeutic trials of some infested cases were done.

MATERIALS and METHODS

Area: The study was undertaken in Shalatin area, Red Sea Governorate, Egypt. This is a desert area occupied the southern part of the eastern desert and is considered one of the southern borders of Egypt. The mean annual temperature in winter and summer ranged between (20°C -22°C) and (41°C -44°C) respectively. The total number of camels in this area is about 67, 000 (Govs, 1998).

Animals: A total of 530 camels of different ages and sex were examined for gastrointestinal parasites infestation during the period of January to December 2005. The camels grazed freely and browsed on ephemeral plants during rainy seasons and were supplemented with green Fodder (barseem). The examined camels had not been given antihelmintics at least one and a half month before collecting the samples. The animals were grouped in to four -age groups of 1 -2, 3 -5, 8 -10 and 12 -15 years.

Collection of faecal samples: The faecal samples were collected directly from the rectum before the animals were dosed at day zero and thereafter at 4, 7, 14, 21, and 28 days intervals, on the days of dosing. Faecal samples were transported in an ice-cooled box and examined within 2h.

Parasitological procedures: Faecal samples were prepared for detection of gastrointestinal helminths and Eimeria oocysts by concentration techniques Margaret and Solss (1980) and Soulsby (1982). Faecal egg count was done using a modification of the McMaster technique to assess the level of infestation, on the day of collecting the samples Reinecke (1983). Identification of helminthes eggs was based on the morphological characteristics as described by Soulsby (1982) and Georgi and Georgi (1990). Eimeria oocysts were identified according to Levine (1985). Samples containing 70 epg or more were incubated at 27°C for 8-15 days Georgi and Georgi (1990) and the infective third stage larvae were morphologically identified Soulsby (1982). The size of the eggs and oocysts were measured using eyepiece micrometer and illustrated photomicrographs.

Therapeutic trials: Camels yielded 500 eggs per gram in their fecal matter and showed the characteristic signs of gastrointestinal upset as diarrhea; emaciation, poor body condition and inappetance were selected and subjected to therapeutic trials. Eighty camels having mixed infection were selected. The selected cases were distributed randomly according

to their ages and sex into four groups (20 cases per each) The camels in groups 1, 2, 3, were drenched with albendazole (10 mg/kg body weight), levamisole (15mg/kg body weight) and zanide (50mg/ 100/kg body weight) respectively. Camel's in-group 4 was unmedicated. Fecal samples of all camels were collected on day 0, 4, 7, 14, 21, and 28 post treatment and EPG were determined.

RESULTS

Out of 530 camels examined for gastrointestinal parasites, 386 (72.83%) were found positive. From these infected animals, 242 (45.66%) were harbouring helminthes eggs, 58 (10.94%) were having coccidian oocysts and 86 (16.23%) were having mixed helminthes and coccidian parasites. Total helminthes infection was 328 (61.89 %) and total coccidian infection was 144 (27.17 %). Table, 1

Table1: Prevalence of helminthes eggs and coccidian infection of the examined camels.

| Total of Ex. Animals | No. of infected cases | | Single infection of helminthes eggs | | Single infection of coccidian oocysts | | Mixed Infection eggs+oocysts) | | Total | | | |
|----------------------|-----------------------|-------|-------------------------------------|-------|---------------------------------------|-------|-------------------------------|-------|------------|-------|-----------|-------|
| | | | | | | | | | Helminthes | | Coccidian | |
| 530 | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | 386 | 72.83 | 242 | 45.66 | 58 | 10.94 | 86 | 16.23 | 328 | 61.89 | 144 | 27.17 |

Table 2: Helminths eggs and their sizes found in faeces of 328 camels in Shalatin region.

| Helminthes eggs | Single infection | | Mixed inf. | | Total Of | | Size of egg |
|----------------------|------------------|-------|------------|-------|----------|-------|-----------------|
| | No. | % | No. | % | No. | % | |
| A-Nematodes | | | | | | | |
| Trichostrongylus sp. | 43 | 13.10 | 72 | 21.95 | 115 | 35.06 | M. 78X37.5μ |
| Oesophagostomum sp. | 18 | 5.48 | 35 | 10.67 | 53 | 16.15 | M. 69.9X47.5μ |
| Trichuris sp. | 11 | 3.35 | 29 | 8.84 | 40 | 12.19 | M. 65.5X29.5μ |
| Haemonchus sp | 9 | 2.74 | 26 | 7.92 | 35 | 10.67 | M. 70.4X38.7μ |
| Ostertagia sp. | 8 | 2.34 | 21 | 6.40 | 29 | 8.84 | M. 61.5X38.3μ |
| Chabertia sp | 6 | 1.82 | 19 | 5.79 | 28 | 8.53 | M. 89X52μ |
| Nematodirus sp | 6 | 1.82 | 10 | 3.04 | 16 | 4.87 | M. 249.5X110.8μ |
| Strongyloides sp. | 2 | 0.60 | 4 | 1.21 | 6 | 1.82 | M. 69 ×25μ |
| B- Cestodes | | | | | | | |
| Moniezia sp. | 4 | 1.21 | 2 | 0.60 | 6 | 1.82 | M. 77.9-67.8μ |

M=mean

Details distribution of the coprologically positive infesting camels was illustrated on. Table, 2 and the most predominant parasites were Trichostrongylus SP., followed by oesophagostomum sp., Trichirus sp., and Haemonchus SP.

Table 3: Infective third stage larvae of some Nematodes of camels obtained from faecal culture.

| Nematode larvae | Total length | | Length of the tail sheath | | Morphological feature |
|----------------------|--------------|----------|---------------------------|--------|--|
| | Rang | Mean | Range | Mean | |
| Trichostrongylus sp. | 679.3-690.6μ | 684.9μ | 22.6-33.5μ | 28.05μ | Short, tail end with tiny tubercle |
| Strongyloides sp. | 524-672μ | 598μ | - | - | Caudal extremity of larva is truncated. |
| Haemonchus sp. | 745-862μ | 8.03.5μ | 82-112μ | 97μ | Sheath kinked at the tip of tail, |
| Ostertagia sp. | 795.5-875μ | 835.2.5μ | 31-56.8μ | 43.9μ | Triangular shape. Tail of the sheath taper slowly to end in blunt end. |

Table 4: Size of Eimeria sp. (coccidian oocysts) found in the faeces of camels (n=144)

| E cameli | | | E dromedarii | | | E. rajasthanii | | | Mixed inf. | | Total Coccidian | | | | | |
|----------|-------|-----------------|--------------|-------|-----------------|----------------|-----|---------------|------------|-------|-----------------|-------|--------------|-------|---------------|-------|
| No. | % | Size | No. | % | Size | No. | % | Size | No. | % | E.cameli | | E.dromedarii | | E.rajasthanii | |
| 70 | 48.61 | Mean 68.5X72.9μ | 40 | 27.78 | Mean 27.6X21.2μ | 8 | 5.6 | Mean 39.5X26μ | 26 | 18.05 | No | % | No | % | No | % |
| | | | | | | | | | | | 96 | 66.67 | 68 | 45.83 | 34 | 23.61 |

Table 5: Effect of age, sex and seasons of infested camels on rate of infection with gastrointestinal parasites.

| Factors | Examined camels | | |
|------------------------------|-----------------|----------|-------|
| | Total | Infested | % |
| Total | 530 | 386 | 72.83 |
| Age susceptibility | | | |
| 1-2 year | 80 | 34 | 42.5 |
| 3-5 year | 144 | 96 | 66.67 |
| 8-10year | 173 | 136 | 78.61 |
| 12-15 year | 133 | 120 | 90.22 |
| Sex susceptibility | | | |
| Male | 235 | 150 | 63.83 |
| Female | 295 | 236 | 80 |
| Seasonal distribution | | | |
| Winter | 185 | 151 | 81.62 |
| Spring | 125 | 97 | 77.6 |
| Summer | 105 | 66 | 62.85 |
| Autumn | 115 | 72 | 62.60 |

Old age groups had a higher prevalence rate of infection than younger. Female animals showed higher rate of infection than males and the higher rate of infection was in winter and spring.

Table 6: Therapeutic trials of some infected camels with gastrointestinal Helminthes.

| Group | No. Of treated camels | Drug | Dose | Eggs per gram of faeces before and after treatment | | | | | |
|-------|-----------------------|----------------|-------------------------|--|--------|-------|--------|-------|--------|
| | | | | 0 | 4 | 7 | 14 | 21 | 28 |
| 1 | 20 | Albendazole 5% | 10 mg/kg body weight | 670.9 | 140.13 | 0 | 0 | 0 | 25.7 |
| 2 | 20 | Levamisole HCL | 15 mg/kg body weight | 790.23 | 180.16 | 49.23 | 5.23 | 8.25 | 35.16 |
| 3 | 20 | Zanide | 50 mg/100kg body weight | 665.8 | 165.2 | 30 | 0 | 14.2 | 32.3 |
| 4 | 20 | Unmedicated | | 675.25 | 527.23 | 735.9 | 795.36 | 632.9 | 639.23 |

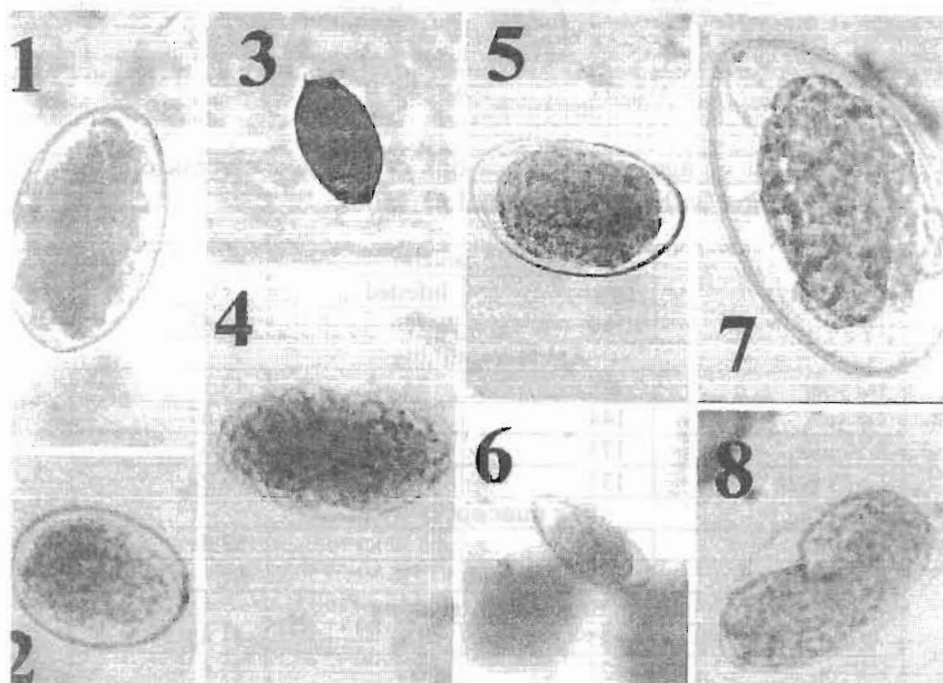


Plate 1: Different species of nematodes and cestode eggs of camel

- Fig. 1: Trichostrongylus sp. egg x10 Fig. 2: Oesophagostomum sp. egg x10
 Fig. 3: Trichuris sp. egg x10 Fig. 4: Haemonchus sp. egg x10
 Fig. 5: Chabertia sp. egg x10 Fig. 6: Ostertagia sp. egg x10
 Fig. 7: Nematodirus sp. egg x10 Fig. 8: Strongyloides sp. egg x10

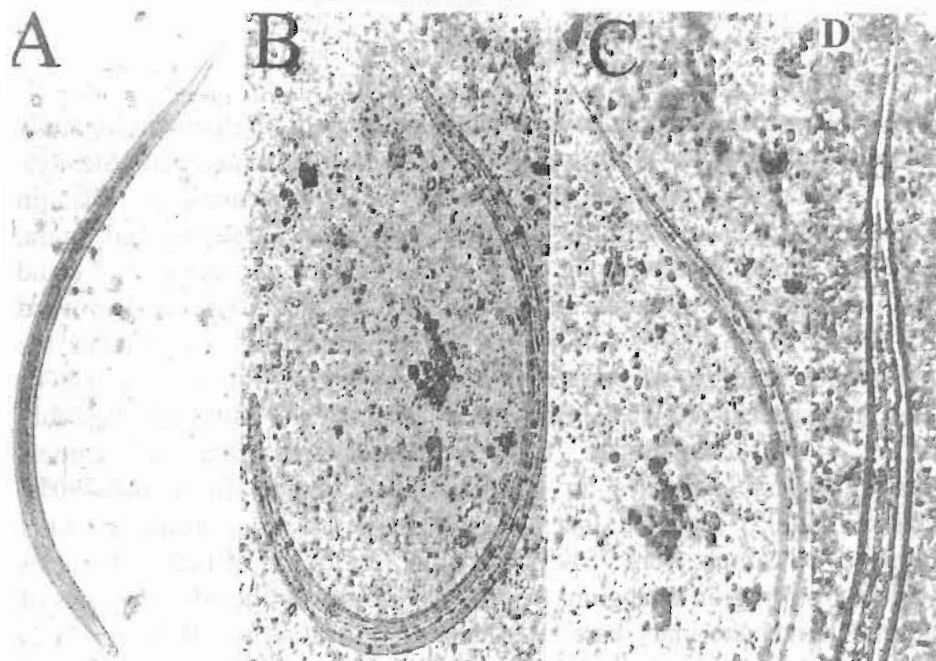


Plate 2: Third stage larvae of gastrointestinal nematodes of camels

Fig. A: *Trichostrongylus* sp. larva x10 **Fig. B:** *Strongyloides* sp. Larva x10
Fig. C: Tail of *Haemonchus* sp. larva x10 **Fig. D:** Tail of *Ostertagia* sp. larva x10

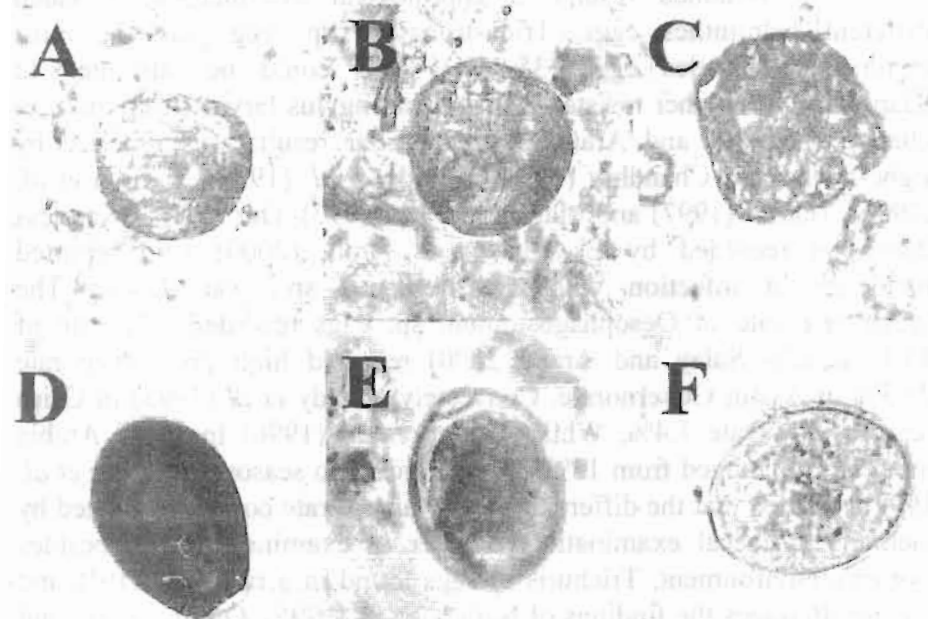


Plate 3: *Moniezia* sp. and Coccidian Oocysts of the infected camels

Fig. A, B, and C: *Moniezia* SP. X20 **Fig. D:** Oocyst of *E. cameli* x10
Fig. E: Oocyst of *E. dromedarii* x40 **Fig. F:** Oocyst of *E. Rajasthani* X40

DISCUSSION

The current study revealed that 72.83% of the parasitologically examined camels (n= 530) were infested with gastrointestinal parasites. This indicated a problem in dromedary camels rearing in Shalatin region. (Nafie *et al.* 1992) at North of Sinia and (El Salahy and Arafa, 2000) in Assiut, Governorate reported high prevalence rates 79.7% and 82.7 respectively, moderate prevalence rates of infection were recorded by Sayed *et al.* (1997) in Assiut Governorate, 54%. In Sudan the prevalence rates of infection reached up to 89% (Arzoun *et al.* 1984). The published results of El- Bihari and Kawasmeh (1980) and Magzoub, *et al.* (1997) concluded that the prevalence rates of camels gastrointestinal parasites in Saudi Arabia ranged from 60%-90%. (Bekele, 2002) reported that the prevalence rates of gastrointestinal parasites in camels were 75% in Ethiopia. Incidence of infection varies widely from region to region, from season to season besides the ages of animals, and veterinary care (Higgins, 1986). Moreover Bekele (2002) added that the contradictions in the prevalence of gastrointestinal parasites might be due to the difference in sampling period of the year and duration of the study.

The obtained results of coprological examinations revealed different helminthes eggs. *Trichostrongylus* sp. egg was the most common nematodes eggs (35.06%). This could be attributed to adaptation and higher resistance of *trichostrongylus* larvae to the hot dry climate (El-Salay and Arafa, 2000). Similar results was reported by Egbe-Nwiyi and Chandhry (1994), Nafady *et al.* (1995), Haroun *et al.* (1996), Hamid (1997) and Magzoub *et al.* (1997). Our results were less than that recorded by El-Salahy and Arafa (2000) who reported incidence of infection with *trichostrongylus* sp., was 45.3%. The prevalence rate of *Oesophagostomum* sp. eggs recorded in a rate of 16.15%. (El- Salay and Arafa, 2000) reported high prevalence rate 25.3% in Assiut Governorate. Conversely Nafady *et al.* (1995) in Cairo reported low rate 1.4%. While Haroun *et al.* (1996) In Saudi Arabia reported rate ranged from 12%-20% according to seasons. (Kayum *et al.* 1992) reported that the difference in prevalence rate could be affected by methods of faecal examination, number of examined animal besides hygienic environment. *Trichuris* sp.eggs found in a rate of 12.19% and this result agrees the findings of Nafady *et al.* (1995). On the other hand our results were less than those obtained by El-Salahy and arafa (2000) who reported 25.3% and higher than that reported by Abdal-Aal and

Sahlab (1998) who recorded 1% in Suez Canal. *Haemonchus* sp. eggs was recorded in 10.86% of infected camels. This result is nearly similar with that recorded by El-Salahy and Arafa (2000) and higher with finding of Abdal-Aal and Sahlab (1998) who reported (5%). It is one of the most pathogenic nematodes parasite specially when found in large number in young animals (Soulsby, 1982). *Ostertiga* sp. eggs were found in 8.84% of infected camels. This result agrees with that recorded by El-Salahy and Arafa (2000) while this parasite was not recorded by Nafady *et al.* (1995) in Cairo and Abdal-Aal and Sahlab (1998) in Suez Canal. *Cabreratia* sp. eggs were recorded in 8.53% of infected camels our results were less than that reported by El-Salahy and Arafa (2000) who recorded 17.3% while this parasite was not detected by Nafady *et al.*, (1995) in Cairo camels. *Nematodirus* sp. eggs were recorded in 4.87% of infected camels a relatively similar rate of infection were recorded by Abdal-Aal and Sahlab (1998) and El-Salahy and Arafa (2000). On the other hand our results were lower than that recorded by Haroun *et al.* (1996) who found that *Nematodirus* sp. eggs ranged between 20-50% while this parasite was not detected in Cairo camels by Nafady *et al.* (1995). *Strongyloides* sp. eggs were found in 1.82% of infected camels and this result is less than that recorded by Woldemeskel (2001), who recorded infestation ranged between 5.5 –14.2%.

Moneiza sp. eggs were found in 1.82% of infected animals. Our results were less than that reported by Nafie *et al.* (1992), Nafday *et al.* (1995) and El-Salahy and Arafa (2000) who recorded 6.1%, 4.1% and 6.6% respectively. Difference in prevalence may be attributed to the activity of oribatid mites in different region (El-Salahy and Arafa, 2000).

The infective third stage larvae obtained from faecal culture was facilitating the identification of some gastrointestinal nematodes eggs, which are similar in shape and size. The infective larvae obtained from faecal culture belong to four genera. Our results more or less coincided with the results, which were obtained by Magzoub *et al.* (1997). And El-Salahy and Arafa (2000)

Concerning the prevalence rate of coccidian oocysts in camels. The present work clarified that three species of *Eimeria* oocysts were recoded *E. cameli*, *E. dromedarii* and *E. rajasthani*, which represent 48.61%, 27.78% and 5.6%. In India *E. cameli*, *E. dromedarii* and *E. rajasthani* occurred in the rates 11.8%, 9.3% and 4.0% of camels respectively (Gill, 1979). In Saudi Arabia (Kasim *et al.* 1985) found oocysts of *E. cameli* (19%), *E. dromedarii* (42%) and *E. rajasthani* (22%). (Nagwa, 1997) in Egypt found *E. rajasthani* (36.7%), *E. bactriani*

(35.1%), *E. dromedarii* (2.9%) and *E. cameli* (2.4%). The present prevalence of infection was more or less similar to that reported by Dubey and Pande (1963), Gill (1976), Sayed *et al.* (1997) and El-Salahy and Arafa (2000) who reported 24%, 24.4%, 25% and 27.4% respectively. But higher than those obtained by Kawasmeh and Elbihari (1983) 14% and much lower than that reported by Kasim *et al.* (1985), Hussein *et al.* (1987) and Nagwa (1997) who reported (40%, 40.6% and 40% respectively. The difference in prevalence rate of infection may be due to the age of the animals and environmental conditions.

Concerning the relationship between the age of the examined camels and the rate of infection. The present work revealed that the prevalence rate of infections among the different age groups showed difference; it was lowest in young age 42.5% and increased with age to reach the highest rate in oldest dromedaries 90.22%. These results coincided with the report of Rutagewende and Munyua (1983), Partani *et al.* (1996) and Bekele (2002). This may attributed to, in endemic area, the young animals first acquires passively immunity in the colostrums of the dams (Urquart *et al.*, 1996), or may be due to acquired immunity through continued exposure in adult dromedaries (Bekele, 2002).

Concerning the sex susceptibility. It was noticed that females' animals showed higher rate of infection than males, 77.6% and 64.8% respectively, the obtained results were in agreement with those previously reported by Higgins (1986) and Bekele (2002). The reason was suggested by Bekele (2001), who indicated that stress of lactation and pregnancy might be prohibiting the immunity in adult females.

The seasonal influence on gastrointestinal parasitic infestation of camels was clear. The highest rate of infection was in winter and spring 81.62% and 77.6% respectively. This result was supported by Pathak *et al.* (1993), Partani *et al.* (1996), Magzoub *et al.* (2000), Zekele and Bekele (2001) and Bekele (2002). The major factor, which plays a role in raising the rate of infection in winter, is a favorable climatic condition, that allows the development of larval stage in the external environment, and facilitates resumption arrested development of larvae within the host. The shed of the ova continues through out all seasons but lower rates of infection in dry months. It can be deduced that lower moisture level in dry seasons is generally not favorable for larval development (Bekele, 2002) and this may interrupt the lower rate infection in summer seasons.

Concerning the efficacy of some anthelmintic drugs against natural infection with gastrointestinal parasites. The obtained results

revealed that reduction in the egg per gram in three treatments groups in comparison to the unmedicated group. On the 4th day of treatment the difference was not clear, while in the 7th day of treatment all anthelmintic showed reduction in the epg counts and remained low for the 21st days. On 7–21days albendazole caused the most rapid fall in the epg values compared with the other treatment groups and this may refer to the efficiency of albendazol as the choice drug. On the 28 days there was not a high difference in the epg counts of various treatment groups. Camels of the treatment groups showed improvement in their health and the clinical sings disappeared. These results agree with those with reported by Lodha *et al.* (1977), Mukhwana and Mitema (1997), Bakunzi and Serumaga-Zake (2000) and Joshi *et al.* (2001).

The present study concluded that gastrointestinal parasitic infestation is considered as one of the major problems in camels in Shalatin area and control of the gastrointestinal parasites is urgent to increase the productively of camels.

REFERENCES

- Abdel-Aal and Sahlab, A.A.M. (1998):* Studies on the helminths parasites of camel in Suez Canal. 8th Sci. Con. Fac. Vet. Med. Assiut University Symposium, 361–373.
- Arzoun, I.H.; Hussein, H.S. and Hussein, M.F. (1984):* The pathogenesis of experimental *Haemounchus longistipes* infection in camels Vet. Parasitology, 54:117-128.
- Bakunzi, E.R. and Serumaga-Zake, P.A.E. (2000):* The effect of strategic anthelmintic treatment on internal parasites in communally grazed sheep in a semi-arid area as reflected in the faecal nematode egg connt. Tropical Animal Health and production. 32 (5) 295 –302.
- Bekele, T. (2001):* Studies on *Cepalopinia titllator*, the cause of (Sengale) in camels (*Camelus dromedaries*) in semi- arid areas of Somali state, Ethipoia. Trop. Anim. Helth. Prod. 33, 5, 489-500.
- Bekele, T. (2002):* Epidemiological studies on gastrointestinal helminthes in dromedaries (*camelus dromedaries*) in semiarid land of eastern Ethiopia: Veterinary Parasitology 105, 2, 139-152.
- Dybey, J.P. and Pande, B.P. (1963):* *Eimeria Rajasthani* in N. SP. From the Indian Camels (*Camelus dromedarius*) Current Science. 32, 273-274.

- Egbe-Nwiyi, T.N. and Chandhry, S.U. (1994):* Studies on prevalence of camel helminthiosis in arid zone of Borno state of Nigeria. Pakistan Vet. J. 14. 20-23.
- El-Bihari, S. and Kawasmeh, Z.A. (1980):* Occurrence and seasonal variations of some gastrointestinal Helminth. Proc. Saudi Biol. Soc., 4: 297-304.
- El Salaby, M.M. and Arafa, M.I. (2000):* Parasitological studies of some gastrointestinal parasites of camels in Assuit Governorate with special reference to zoonotic nematodes: Assiut Vet. Med. J. 43, 87, 280-294.
- Gerogi, J.R. and Gerogi, M.F. (1990):* Parasitology for Veterinarians 5th Ed W. B. Saunders company. Harcourt Brace Jovanovich Inc.
- Gill, H.I. (1976):* Eimeria in camels. Indian Veterinary Journal 53, 897-900.
- Govs, (1998):* Technical veterinary report 1998, General organization of veterinary service, Cairo, Egypt.
- Hamid, Y.M. (1997):* Gastrointestinal parasites in Gassim region, Saudi Arabia. Indian Veterinary Journal 74: 373 -376.
- Haroun, E.M.; Mahmoud, O.; M. Magzoub, M.; Abdel Hamid, Y. and Omer, O.H. (1996):* The hematological and biochemical effects of the gastrointestinal nematodes prevalent in camels (Camelus dromedaries) in central Saudi Arabia: Vet. Res. Comm., 20, 255 -264.
- Higgins, A. (1986):* The camels in Health and Disease, Baillere Tindall, London, Philadelphia, Toronto.
- Hussein, H.S.; Kasim, A.A. and Shawa Y.R. (1987):* The prevalence and pathology of Eimeria infections in camels in Saudi Arabia. J. Comp. Path., 97: 193-297.
- Joshi, S.P.; Pathak, K.M.L.; Pareek, R.K. and Kapoor, M. (2001):* Chemotherapeutic trials of some antihelmintics against naturally occurring gastrointestinal nematodes of camels: Journal of camel practice and research. 8, 1, 47-49.
- Kasim, A.A.; Hussein, H.S. and El-Shawa, Y.R. (1985):* Coccidiosis in camels (Camelus dromedaries) in Saudi Arabia J. Protozool, 23, 202-203.
- Kawasmeh, Z.A. and El. Bihari, S. (1983):* Eimeria cameli description and prevalence in the eastern province of Saudi Arabia. Cornell Veterinarian, 72: 58-66.

- Kayum, A.; Afzal, M. and Salman, R. (1992):* Gastrointestinal parasites in racing camel: prevalence and evaluation of different methods of faecal examination. Proc. 1st Camel Conf. 85–87.
- Laila, S.A.; Abdell-All, Th.S. and Mourad I.M. (1986):* Influence of gastrointestinal parasites on some biochemical constituents of blood serum of camels. Assiut Vet. Med. J. 16 (32): 210–217.
- Levine, N.D. (1985):* Veterinary Protozoology (1st Ed.). Iowa State University Press, Ames.
- Lodha, K.R.; Raisinghani, P.M. and Karwasra, R.S. (1977):* Chemotherapeutic trials of some of some anthelmintic against helminth parasites in camels. Indian J. Anim. sci. 47 (10): 677–682.
- Magzoub, M.; Omer, O.H. and Haroun, E.M. (1997):* Gastrointestinal parasites of dromedary camels in Gassim region, Saudi Arabia: Indian. Vet. J. 74, 373–376.
- Magzoub, M.; Omer, O.H.; Haroun, E.M. and Mahmoud, O.M. (2000):* Effect of season on gastrointestinal nematode infection in Saudi Arabian camels (*Camelus dromedaries*): Journal of Camel Practice and Research. 1, 107–108.
- Margaret, W. and Solss, B.S. (1980):* Veterinary Clinical Parasitology, Iowa State University Press, and Ames, Iowa.
- Mukhwana, E.J. and Mitema, E.S. (1997):* Comparative efficacy of three anthelmintic against mixed gastrointestinal nematode infections in camels: Trop. Anim. Hlth. Prod. 29: 99–101.
- Mukhwana, E.J. and Mitema E.S. (1997):* Comparative efficacy of three anthelmintics against mixed gastrointestinal nematode infection in camels. Tropical Anm. Hlth. Prod. 29: 99–101.
- Nafady, A.A.; Osman, A.H.; Doghain, R.E.; El-Mady, M.M. and El-Gayish A. (1995):* Preliminary pathology studies on parastic helminths in camel,s intestine. 3rd Sci. Cong., Egypt Soc Cattle Dis., Assiut, Egypt 5,2, 123–133.
- Nafie, Th.S.; Hassan, M.G.; Amal, M.; El-Nahala and El-Sayed, R.F. (1992):* Incidence and effect of some gastrointestinal parasitic infestation on camels at North of Sinia Assiut Vet. Med. J., 27 (54): 137–147.
- Nagwa, G.M. (1997):* A study on Eimeria species infecting camels (*Camelus dromedarius*) in Egypt. Vet. Med. J., 45, 4, 499–509.

- Pariani, A.K.; Kumer, D.; Man hor, G.S. and Bhan, A.K. (1996):* Eipedimology of gastrointestinal nematodes of camel (*Camelus dromedaries*) at Bikamer Razasthan Indian .J .Vet. Parasitol. 10 (1) 23- 32.
- Pathak, K.M.L.; Arora, J.K. and Kapoor, M. (1993):* Occurrence and seasonal variation of gastrointestinal nematodes of the dromedary *Camelus dromedaries* in Rajasthan State of India. Indian J. of Animal Sci., 63, 1, 30-31.
- Reinecke, R.K. (1983):* Veterinary helminthology, (Butterworth Publisher, Durban/ Pretoria), 321-331.
- Rutagwende, T. and Munyua, W.K. (1983):* The effect of panacur (fenbedazole) on nematode parasites of camels under nomadic conditions in Northern Kenya. Bulletin of animals' heath and production in Africa, 33, 63-73.
- Sayed, A.S.; Sadiq, A.H.; Ali, A.A. and Ismail M.N. (1997):* Clinical and laboratory investigation on diarrhoea in camels in association with stress factors. 4th Cong. Sc. Egyptian Society for cattle disease.
- Selim, M. K. and Rahman, M. S. (1972):* Enteric nematodes of camels in Egypt. Egypt. J. Vet. Sci. 9(1): 75- 80.
- Soulsby, E.J.L. (1982):* Helminth, Arthropods and Protozoa of Domesticated Animals. 7ed. The English language book Society Balliere, Tindall and Cassel. London.
- Urquhart, G.M.; Armour, J.; Duncan, J.L.; Dunn, A.M. and Jennings, F.W. (1996):* Veterinary Parasitology, 2nd ed., Blackwell Sience.
- Woldwsmeskel, M.; Issa, A.; Mersie, A. and Potgieter, L.N.D. (2001):* Investigation of parasitic diseases of one-humped camels (*camelus dromedaries*) in Eastern Ethiopia. Journal of Camel Practice and Research, 8, 1, 77-81.
- Zekele, M. and Bekele, T. (2001):* Effect of Seasons on the productivity of camels (*Camelus dromedaries*) and the prevalence of the major parasites in eastern Ethiopia. Trop. Hlth. Prod. 33: 321-329