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ORIGINAL ARTICLE

Prevalence of Filariasis in camels (*Camelus dromedarius*) in Upper Egypt with special reference to treatment

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Abstract The study aimed to detect the prevalence of camel filariasis in Upper Egypt, the effect of age, sex, season, locality and periodicity of sampling and treatment of infested cases and also determines the diagnostic technique for detection of the parasite. The study carried out on a total number of 350 camels (*Camelus dromedarius*) belonged to different Governorates in Upper Egypt including Assuit, Sohag, Asswan and El-wady El-gaded, by using the following methods for diagnosis of camel filariasis, wet blood film, thin blood film, thick blood film and concentration technique (Knott's technique). From the total number of examined camels (13 out of 350) camels were positive by blood film in percentage of 3.71%. The highest percentage of infection was recorded in El-Wady El-gaded Governorate (10.83%), hot season showed 4.96%, female more susceptible (7.79%) than male (2.56%), local breed more susceptible 5.9% while imported were 0%, samples taken at night time gave (5.59%) while day time 2.41%. 5–10 years old camels more susceptible than others and from clinically suspected camels (106) only 11 camels were positive by blood film while clinically healthy camels 244 only 2 camels were positive by blood film.

Keywords Prevalence · Camels · Filariasis · Diagnosis · Treatment

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Introduction

Camels have not received adequate attention in Egypt so far as their parasitic diseases are concerned, particularly those caused by helminthes. However, helminthes are the major cause of impaired milk and meat production, decline fertility of male and decrease in calving rate of females (Baraka et al. 2000). The numbers of researches on camel are low due to hostile environment in which camel are lives. This is due to non sedentary nature of the herds and constantly moving in search of grazing and water sources.

Concerning the number of camels in Egypt 250,000 (Omran et al. 1984), 267,000 (Abd Elsalam 1993), 133,000 (Mahran 2004). This means that the number of camels in Egypt shows a decline pattern but we are need for camel meat which giving low price protein of animal origin. Filariasis is one of the most important parasitic diseases caused by nematodes with worldwide distribution and affects man, animals and birds (Hashem and Badawy 2008). Haemoparasitic diseases such as dipetalonemiasis have an adverse impact on health, productivity and working activity of camels (Higgin et al. 1992). Camel filariasis can cause a variety of clinical syndromes characterized by localized skin lesions, severe weakness, emaciation, high body temperature and swelling of both scrotum and testis (Abu El-Magd et al. 1988 and Karram et al. 1991). The prevalence rate of infection with *Dipetalonema evansi* was influenced by seasonal variation and the highest infection rate was recorded in summer months and the lowest rate was during winter (Ali 2005). The highest infection rate with Dipetalonema *evansi* in camel was in group aged (4–5 years old) (Borji et al. 2009). The infectivity rate of camel filariasis was higher in female than in male camels (Mahran 2004). The number at mid-night was ten times more than the number at mid-day (Saleh 1976). Camels

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naturally infected with microfilaria showed decreased appetite, emaciation, pale mucous membrane, stiffness in movement and wide gait, and high body temperature (39.4–39.8 °C). Camel infected with dipetalonemiasis can be treated by using ivermectin in a dose of 1 ml/50kgm B.W successfully where the clinical signs were disappeared from all infested cases and blood film was negative microscopically (Agag et al. 1993; Muhammad et al. 2004). Husna et al. (2008) postulated that ivermectin had a rapid filaricidal activity (macrofilaricidal and microfilaricidal) and minimal inflammatory reaction at the site of injection.

Materials and methods

Animals

A total number of 350 camels (*Camelus dromedarius*) 220 from local breed and 130 from imported breed were studied at the period from May 2019 till April, 2020). Their data including Age, sex, locality and the season of study beside time of sampling.

Clinical examination

Complete clinical examination of animals under this study was done (according to Kohler-Rollesfon et al. 2001). General inspection, rectal body temperature, respiratory rate, pulse rate, mucous membrane.

Collected whole blood sample

The blood was drained from jugular vein by using of sterile vacationer system (vacationer tube with EDETA as anti coagulant, sterile needle and jack). Sample was shacked gently in 8 figure manner to mix the anticoagulant with blood (according to Lynch et al. 1969).

Identification, classification of animals into groups and taking the case history and presence of clinical signs of filariasis to facilitate obtaining data, communications with owners and easily to interpret on predisposing factors affecting the infection.

Microscopical examination of blood smears by the following methods

Direct method

a. Wet blood film

Two small drops of blood on clean, dry slide one cm apart from each other, then covered with cover slide and examination by low power (× 10) for detection of motility of microfilariae.

b. Thin blood film

Two thin blood films were prepared, dried, fixed with absolute methanol for 5 min., dried then stained with Geimsa stain 10% for 30 min. excess stain was removed and examination was done by low power then by oil immersion lens (100 ×). According to Coles (1986).

c. Thick blood film

Two drops of blood samples put on clean and dry slide, drops were speeded in a circular manner one cm in diameter then left to dried in room temperature. Dehaemoglubinization by immersion of slide several times on jar filled with distilled water. Then dryness and fixation with absolute methyl alcohol for 3–5 min. Dryness and staining with Geimsa stain 10% for 30 min Examination with low power (10 ×) and oil immersion lens (100 ×).

Concentration technique (Knott's technique): according to Lawrance and Tomas (1987)

One ml of blood with EDETA was mixed thoroughly with 10 ml of 2% formalin in centrifuge tube. The mixture was centrifuged at 1000 rpm. for 2 min., the supernatant fluid was decanted and the sediment was shacked to have a haemogeneous sediment, one drop of 0.1% methylene blue was added to sediment, mixed and transfered some stained sediment to a slide for microscopic examination was done, thin and thick films were prepared from the first sediment, fixed with absolute methyl alcohol, stained with Geimsa stain and examined microscopically.

Results

During the period from May, 2019 till April, 2020 a total number of 350 camels of different ages and localities were examined clinically and microscopically for detection of microfilaria. These camels of different ages, sex and from different Governorates in Upper Egypt also samples were taken in different seasons and the time of sampling was also different.

Clinical signs

Infected camels with filariasis (*Dipetalonema evansi*) showed two forms of the disease the acute form and chronic form. Acute form 6 camels showed high body temperature up to 39.8 °C, loss of appetite, decrease in ruminal motility and camel infected was reluctant to move, male camel showing balanoposthitis and severe orchitis. Chronic form 5 camels showed general debility, emaciation and pale mucous membrane of infected camels.

The only Governorate where filarial infection was recorded in this study was El-wadi El-gaded Governorate in percentage of 10.83%. The highest infection rate (18.75%) in concerning to the age was the middle aged group (5–10 years) in El-wadi El-*gaded* but globally was the oldest group presenting 4% (Fig. 1).

In relationship between sex and percentage of infection we are found that the percentage of infection in female was 12% while in male 10% in El-wadi El-gaded (Fig. 2). In relationship between breed and percentage of infection the percentage of infection in local breed was 5.9% while in imported camels from Sudan was 0% (Fig. 3). In relationship between season and percentage of infection we found that the percentage of infection was 4.96% in hot season while 0.0% in non-hot season. In relationship between time of sampling and percentage of infection we found that the percentage of infection was 2.41% in diurnal while 5.59% in nocturnal. The number of microscopically positive cases (13) in relation to different methods used for blood film preparation (sensitivity of different methods) in wet film was 30.76%, thin film 0.00%, thick film 46.15% and 84.61% in concentration technique). Camel infected with dipetalonemiasis can be treated by using ivermectin in a dose of 1 ml/50kgm B.W successfully where the clinical signs were disappeared from all infested cases and blood film was negative microscopically. The ivermectin had a rapid filaricidal activity (macrofilaricidal and microfilaricidal) and minimal inflammatory reaction at the site of injection and it is combined with anti-inflammatory drug, the time of treatment about 3 months till disappearance of the clinical signs and also the blood film become negative.

Discussion

Concerning the clinical signs of camels filariasis which were observed on microfilaria infected camels were high body temperature up to 39.8°c, loss of appetite, decrease in ruminal motility, camels were reluctant to move also camels were suffering from severe orchitis and

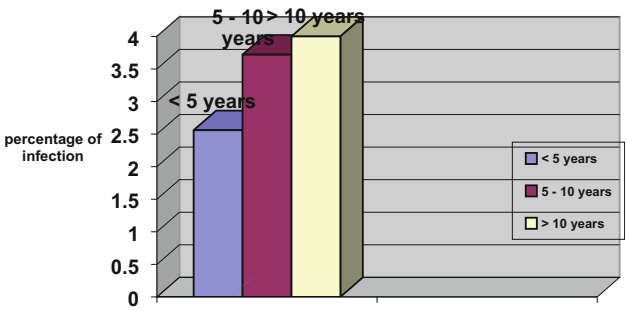

Fig. 1 Showing the relationship between age and percentage of infection using blood film

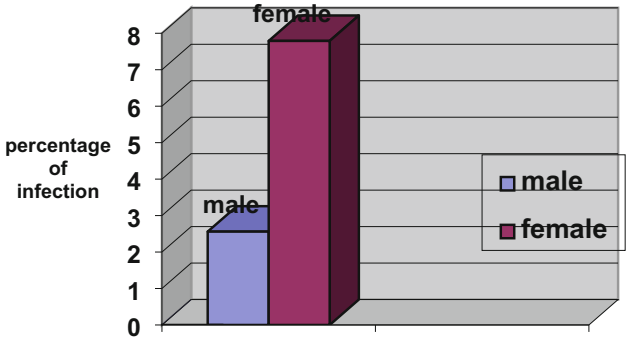

Fig. 2 Showing relationship between sex and percentage of infection rate sing blood film

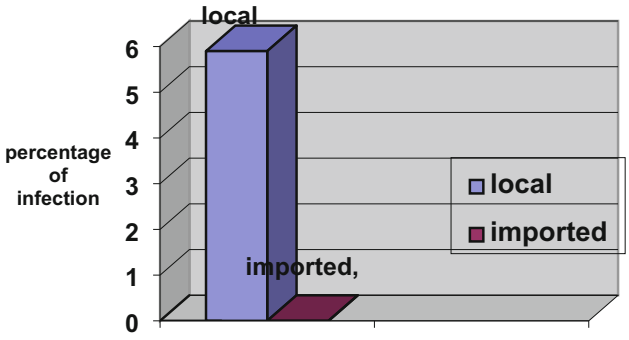

Fig. 3 Showing relationship between breed and percentage of infection rate in examined camels by using of blood film

balanoposthitis in case of acute camel filariasis as shown in Figs. 4 and 5, but in chronic form of camel filariasis, camels were suffering from general debility, emaciation as shown in Fig. 6. Hard ticks were present on camel in both acute and chronic form of camel filariasis. These clinical signs which observed in the current study for camel filariasis come in agreement with the clinical signs observed by several investigators El-Magawry (1983), Abuel-Magd et al. (1988), Karram et al. (1991), Agag et al (1993), Abu El-Ela (2004) and Ali (2005). These agreement might be

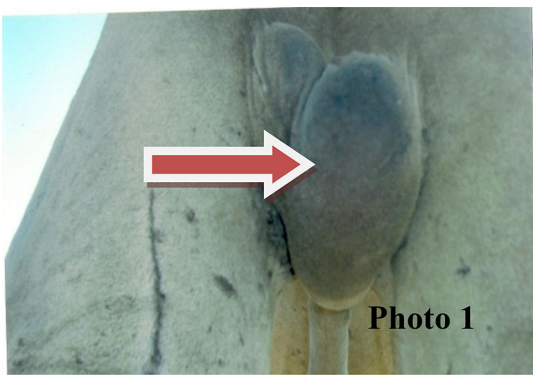

Fig. 4 Showing edematous swelling in right testis of camel infested with microfilaria

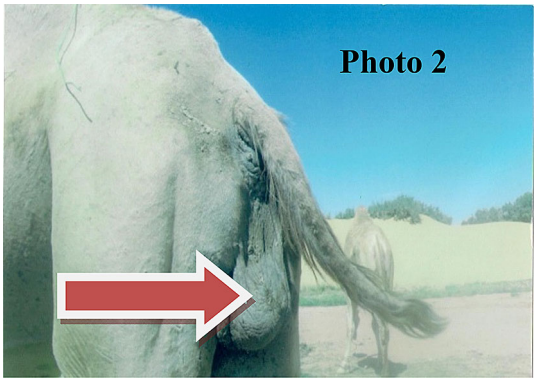

Fig. 5 Showing edematous swelling in both right and left testes of camel infested with microfilaria

Fig. 6 Showing severe emaciation in camel infested with microfilaria

due to the organs affected by the parasites in the current study were the same organs affected in camels studied by these investigators mainly testis and prepuce.It is noticed that 11 out of 13 positive cases (microscopically positive and clinically suspected) were infested with hard ticks with no observation for lakes and mosquitoes population in the area of positive cases (El-Wady El-Gaded governorate) This observation agreed with the results obtained by Ramadan (1982) who stated that the microfilariae were isolated from mouth parts and body cavity of hard ticks

Fig. 7 Showing balanoposthitis in camel infested with microfilaria

which were collected from microfilaria infected camels (Figs. 7, 8).

Camel filariasis is one of the most important diseases affecting camels in Upper Egypt caused by *Dipetalonema evansi* giving clinical signs which reflected on the reproductive performance of camel, working capacity and productive efficiency. This study revealed that the infection is concentrated in El-Wady El-Gaded governorate this may be due to presence of vector transmitting the disease which mainly hard ticks that was present on all suspected and actually infected camels in a heavy manner (microscopically positive and clinically ill) and other predisposing factors such as fluctuation of temperature in day and night, rearing, breeding and management systems which applied on camel population in this area. On the other hand, there is no infection was noticed in the governorates which located on the course of River Nile these results may be due to good sanitation, careful rearing, well feeding, solitary breeding, breeding purpose (fattening) and periodic administration of antitthelmintic drugs specially those affecting *Dipetalonema evansi* (ivermectin) to control external parasites (mange and ticks) and internal parasites (pulmonary and gastrointestinal parasites). The prevalence rate of camel filariasis in this study forms 3.71% globally (13 out of 350 examined camels) but all affected cases were in El-Wady EL-Gaded governorate which forms about 34.28% from the examined camels this means that the prevalence rate in El-wady El-gaded governorate was 10.83% but other governorates showing no infection. Similar results were reported by several researchers Arafa (2002), Abu El-Ela (2004) and Ali (2005) from geographical distribution point of view. Many researchers agreed with prevalence rate obtained in the current study El-Magawry (1983), Manaa (1990), Karram et al. (1991) and Mahran (2004). On the other hands some investigators

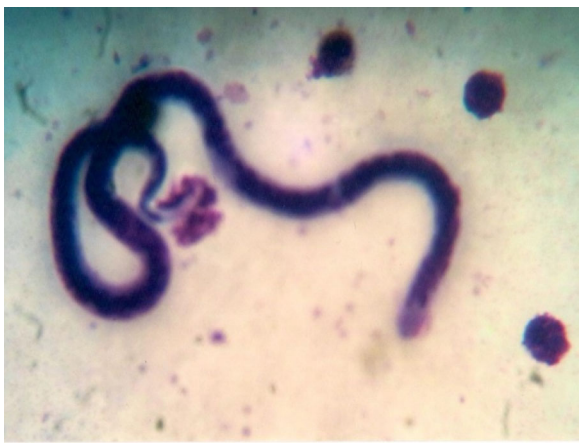

Fig. 8 Blood film stained with Geimsa stain showing microfilaria (× 1000 magnification)

record relatively high prevalence rate Ramadan (1982), Arafa (2002), Ali (2005) and Abd El-Gawad (2008).

Contrary, high prevalence rates were recorded in other countries by other authors Oryan et al. (2008) in Iran, Pathak et al. (1998) in India and El-Amin et al. (1993) in Sudan. These high prevalence rates might be due to weather which affect mosquitoes population, number of camel examined, some of these investigator operated their studies in summer months and others examined camels postmortem (in Abattoirs). Concerning the prevalence rate obtained by El-Amin et al. (1993) 50% this is considered an exceptional case that was recorded in an outbreak and the number was low (14 examined camels).

Concerning age susceptibility to camel filariasis we will found that the infection rate of camel filariasis was influenced by age, the highest infection rate was relatively high in age group (5–10) years specially in El-wadi El-gaded governorate which gave all the positive cases microscopically forming 18.75% (6 out of 32 examined camels) This was may be due to presence of some predisposing factors affecting the infection in this age group such as hard working, age of breeding and low immunity due to stress factors specially in female (pregnancy, parturition and lactation) consequently more exposure to infection in presence of vector.

The lowest infection rate in age group was present in ages less than 5 years 2.56% (1 out of 39 examined camels) which take special care from owners, may kept indoor with relatively low exposure to vectors and the animals of this age group possessing relatively high passive immunity for previous reasons this age group had low liability to be infected to camel filariasis. The infection rate in old aged group (more than 10 years) is low due to relative resistance arises from acquired immunity. Similar results were obtained by another investigators Rahbarri and Bazargani (1995) who recorded that there is a significant inverse relationship between age of camel and prevalence rate of camel filariasis (Fig. 1), Pathak et al (1998) who mentioned that high prevalence rate of camel filariasis in aged group (6–9) years, Arafa (2002) was reported that the prevalence rate of camel filaiasis was decreased in camel more than 15 years old, Mahran (2004) who postulated that the infectivity rate of filariasis of camel was affected by age and the high percentage in group aged (6–12) years, Ali (2005) who stated that the low prevalence rate in group aged less than 5 years (6.25%), middle age (5–12)years was 16.9% and more than 12 years was 3.44% and contrary Borji et al. (2009) who said that the high prevalence rate was in group age (4–5) years. Contrary, Abd El-Gawad (2008) stated that the prevalence rate was 5.88% (2 out of 34 examined camels) in group aged more than 5 years but in group aged less than 5 years was 14.29% (1 out of 7 examined camels) this may be due to little number of examined camels.

Concerning the effect of sex and it's influences on the infection rate with camel filariasis as shown in (Fig. 2) which revealed that 7 out of 273 examined male camels were infected with *Dipetalonema evansi* (2.56%) while 6 out of 77 examined female camel (7.79%) were infected with *Dipetalonema evansi* This meant that the infection rate in female was higher than that of male this is may be attributed to more stress on female during pregnancy, parturition and lactation (hormonal changes) also she camel kept for breeding was more exposed to vectors consequently to the infection but camels kept for fattening and racing receiving a special cares from the owner. Similar results obtained by Mahran (2004) who said that infectivity rate of camel filariasis was higher in female than that of male and Borji et al. (2009) who recorded that camel filariasis is was higher in female than that in male population.

Contrary Oryan et al. (2008) recorded that the prevalence rates of camel filariasis were higher in male than that in female population This may be attributed to little number of examined female on the other hand Rahbari and Bazarjani (1995) recorded that camel filariasis not influenced by sex. If we took the breed in our consideration, we will found the presentable status where local breed gave the higher incidence of infection in its population 5.9% (13 out of 220 examined camels) were infected but the imported breed gave no positive cases. This may be due to anthelmintic drugs (especially ivermectin) while local breed was exposed to vector and other predisposing factors especially in El-Wady El-Gaded governorate.

The relationship between season and infection rate the current study revealed that there was relation between season and prevalence rate of camel filariasis The highest infection rate 4.96% (13 out of 262 examined camel) was seen in hot season (from March to Sep.) This relatively low prevalence rate in comparison to other investigators may be due to relatively high number of examined camel in this period was in governorates on River Nile which gave no infection. on the other hand non hot season showed no infection this may due to absence of factors affecting the infection (low temperature, decrease in number of mosquitoes and ticks, good nutrition and the animal in non hot season usually indoor where there are a good nursing and careful management), Similar results were obtained by Ramadan (1982) who said that the prevalence rate of camel filariasis was 14.3% from March to September (Spring and Summer) but 4.9% between October to December (Autumn and Winter), Mahran (2004) who reported that the highest infection rate with camel filariasis was in Summer season but the lowest rate was in Winter and Ali (2005) who postulated that the infection rate was high in Summer

months where the infection rate was 17.7% but in Winter the infection rate was 5%. Contrary, Borji et al (2009) recorded that the highest rate of camel filriasis in Iran was in autumn season this might be due to difference in geography and environmental conditions.

The number of microscopically positive cases for camel filariasis in relation to the number of blood samples taken at day and night moreover the samples taken at night gave more positive cases in spite of the number of blood samples collected during day was higher than that of night this may be due to nocturnal periodicity of *Dipetalonema evansi* microfilairae where 8 of 143 examined blood samples (5.59%)which taken at night were positive but 5 out of 207 examined blood samples (2.4%) taken at day were positive This meant that the chance to find the parasite is doubled in case of nocturnal sampling than that of diurnal sampling.

Concerning the sample periodicity, the current study agreed with Saleh (1976) who said that the highest mean value of microfilariae/ml at mid-night (1583.5/ml) but at mid-day (151.4/ml) This meant (1/10) in relation to night consequently the chance for detection of microfilariae in blood samples collected at nights 10 times higher than that of samples collected at day and El-Amin et al (1993) mentioned that there was a biphasic periodicity pattern for microfilariaemiae and high concentration at 8.00 pm and between 4 and 6 am. These results differed with that recorded by Karram et al. (1991) who showed that the presence of microfilairae in camel's blood not affected by day and night but affected by the febrile condition. This nocturnal behavior of microfilariae may be attributed to chemo tactic substances present in the larvae of *Dipetalonema evansi* which affected by day and night, the percentage of microscopically positive in relation to clinical picture of examined camels where 11 microscopically positive cases out of 106 clinically suspected cases forming 10.38% and only 2 microscopically positive cases out of 244 clinically healthy camels This meant that the clinical picture express about the infection of camel filariasis. Presence of two positive samples from clinically healthy camels may be attributed to recent or light infection with no harmful effect on the camel clinically. The number of microscopically positive cases in relation to different methods used for blood film preparation (sensitivity of different methods) where the highest sensitivity 84.61% (11out of 13) was in blood sample prepared by concentration technique, thick film showed 46.15% (6 out of 14) and wet film showed 30.76% (4 out of 13) but thin film failed to detect microfilaria in camel's blood.

Conclusion

This meant that the concentration technique is the best method for detection of microfilariae in camel's blood. From our results we are recommend the prophylactic dose from ivermectin should be given for suspected cases to prevent spreading of infection.

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Availability of data and materials The data used in this manuscript is publicly available.

Code availability The code will be made available under request to the corresponding author.

Declarations

Conflict of interest The author declares that they have no conflict of interests.

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