A Cross Sectional Study on Prevalence of *Cephalopina titillator* Infection in Camel (*Camelus dromedaries*) in Dire Dawa Administrative Region, Ethiopia

Arabali Mumed and Amare Eshetu Gemeda

College of Veterinary Medicine, Haramaya University, P.O. Box: 138, Dire Dawa, Ethiopia
Department of Clinical Studies, College of Veterinary Medicine, Haramaya University, P.O. Box: 138, Dire Dawa, Ethiopia

**Abstract:** A cross sectional study was conducted on randomly selected camels (*Camelus dromedaries*) slaughtered at Dire Dawa Municipal enterprise abattoir during the period from November 2013 to July 2014 to determine the prevalence of *Cephalopina titillator* (*C. titillator*) infection and evaluate association between sex, age, body condition and place of origin of camels and *C. titillator* infection. Of 402 camels examined 326 (81.1%; 95% CI: 76.92%-84.81%) camels were infected with *C. titillator* larvae. The prevalence rate of *C. titillator* infestation in camels from three different places of origin including Eror (81.7%; 95% CI: 72.95-88.63%), Shinile (80.5%; 95% CI: 74.09-85.98%) and Villages around Dire Dawa (81.4%; 95% CI: 73.01-88.11%) was not significantly different ($\chi^2$=0.07; p=0.97). No significant difference was observed between the prevalence rates in male (80.9%; 95% CI: 74.49-86.21%) and female (81.3%; 95% CI: 75.43-86.30%) camels ($\chi^2$= 0.01; p=0.91). The prevalence of *C. titillator* infestation was significantly higher in animals of 18-22 (93%; 95% CI: 87.17-96.76%) and 13-17 (83.5%; 95% CI: 75.41-89.75%) years age compared to those of 5-7 (71.4%; 95% CI: 59.38-81.60%) and 8-12 (68.2%; 95% CI: 57.39-77.71%) years old camels ($\chi^2$= 27.30; p=0.00). The prevalence in camels with poor body condition (96.5%; 95% CI: 91.26-99.04%) was significantly higher than in animals with medium (75.1%; 95% CI: 68.69-80.83%) and good body (74.7%; 95% CI: 63.64-83.79%) condition scores ($\chi^2$=30.21; p=0.00). Congestion of Nasopharyngeal cavities and abundant mucous secretion were among gross lesions observed. Further studies on lifecycle and economic impact of *C. titillator* larvae infection were recommended.

**Key words:** *Camelus dromedaries* • Ethiopia • Dire Dawa • Camel myiasis

**INTRODUCTION**

Camels (*Camelus dromedarius*) are vital domestic animal species that are best adapted to harsh environments and fluctuating nutritional conditions of arid, semi-arid and extreme arid areas [1] and are drought-tolerant and survive and flourish by browsing on available browses and shrubs [2]. Roughly two thirds of the world’s camel population is found in the arid areas of Africa, mainly in Somalia, Sudan, Ethiopia and Kenya [3].

In Ethiopia camel’s population is estimated to be over one million [3] including about 316,039 male and 599,479 female camels [4]. The eastern and southern parts of the country are the major areas where camel husbandry is widely practiced [1, 5]. In these parts of Ethiopia camels play a multi-purpose role i.e., 30.79, 21.52, 0.96, 1.73 and 19.07 percent of the camels are kept for milk, transportation, draught purposes, meat and other purposes respectively [4]. With regards to age composition of Ethiopian camel’s population, 25.93% of camel population is under 4 year of age while 74.07% population is above 4 years of age [4].

Despite the fact that, camels provide lots of socio-economic reward and are the preferred domestic animal species in the ever-changing climate, so far it was neglected by researchers and development planners in the past [6]. However, recent booms in camel trade in the country, pastoralists are shifting herd composition to produce more camels for the market [7].
The camel nasal botfly, *C. titillator* (Diptera: Oestridae), occurs worldwide [8]. It causes nasopharyngeal myiasis in camel and results in camel’s health hazards and severe economic losses in camel industry [9]. The adult fly deposits larvae an obligate parasite of camel in the nasal cavity which is known by parasitizing the animal for a substantial period of time [10], where it causes irritation of the nasal cavity and predisposes camel to bacterial infections and is usually found at post-mortem inspection [8]. It also impairs animal welfare, reduces host physiological functions [11], destroys host tissues and causes significant economic losses through reduction of milk production and losses in terms of weight gain [12].

Prevalence of *C. titillator* has been reported in some parts of Ethiopia [13-16].

Information on prevalence of *C. titillator* is compulsory to design suitable control methods and help for planning development program. However; in Ethiopia there is lack of up-to-date information on the prevalence, risk factors and economic impacts of the *C. titillator* infection. This study was carried out to determine the prevalence and appraise potential risk factors of *C. titillator* infection in camel in Dire Dawa Administrative Region, Ethiopia.

**MATERIALS AND METHODS**

**Study Area and Animals:** The study was conducted in Dire Dawa administrative region which is situated in the eastern part of Ethiopia about 515 km East of Addis Ababa; located between 9°27’ and 9°49’ north latitude and 41°38’ and 42°19’ east longitudes. The rainfall pattern of the area is described as short rainy season from March to May, long rainy season from July to September and dry season extends from October to January. The mean annual temperature of Dire Dawa is about 25.4°C. The average maximum temperature of the administrative region is 31.4°C, while its average minimum temperature is about 18.2°C [17, 18].

A cross sectional study was conducted on randomly selected camels slaughtered at Dire Dawa Municipal enterprise abattoir during the period from November 2013 to July 2014. A total of 402 camels (214 female and 188 male) were examined during the study period. Camels slaughtered in Dire Dawa Municipal enterprise abattoir have been brought for slaughter from different parts of the region including Shinile, Erer and Villages surrounding Dire Dawa town. Camels were categorized into in four age groups: 5-7, 8-12, 13-17 and 18-22 years old based on camel age estimation using rostral dentition [19]. In addition camels were classified in to three groups based on their body condition namely poor, medium and good according to Faye et al. [20].

The heads of the slaughtered camels were separated from the rest of the body and careful gross examination was performed on the nasal cavity, nasopharyngeal area, frontal sinuses and turbinate bones. These structures were carefully inspected for the presence of *C. titillator* larvae and possible gross abnormalities associated with *C. titillator* larvae infestation were also examined. Camel nasal botfly larvae at various stages and sizes were observed, removed and counted.

**Statistical Analysis:** Collected data were entered into Microsoft Excel 2003 spreadsheets (Microsoft Corp., Redmond, WA, USA) and analyzed using SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). The animals were divided into different groups: based on place of origin of camels which are Shinile, Erer and Villages surrounding Dire Dawa town; according to their sex as female and male; age groups that is 5-7, 8-12, 13-17 and 18-22 years old; on the base of body condition score as poor, medium and good body condition groups. A chi-square test was used to examine relations between *C. titillator* larvae infestation status and place of origin, sex, age and body condition score of camels. Parameters recognized as significant in chi-square test analysis were then subjected to logistic regression analysis to investigate the associations between *C. titillator* larvae infestation status and places of origin, sex, age and body condition score of the study animals. Differences were considered significant at values of P<0.05.

**RESULTS**

In the present study, examination of 402 camels 214 female and 188 male camels slaughtered at Dire Dawa municipal enterprise abattoir during the period from November 2013 to July 2014 revealed 326 (81.1%, 95% CI: 76.92%-84.81%) camels were infected with *C. titillator* larvae.

The prevalence rate of *C. titillator* larvae infection of 402 camels slaughtered in Dire Dawa Municipal enterprise abattoir based on place of origin of camels is summarized in Table 1. *C. titillator* larvae infection was detected in camels from all three places of origin of camels at prevalence rate of 81.7% (95% CI: 72.95-88.63%) at Erer, 80.5% (95% CI: 74.09-85.98%) at Shinile and 81.4% (95% CI: 73.01-88.11) at Villages around Dire Dawa.
Table 1: The prevalence of C. titillator larvae by place of origin of camels

<table>
<thead>
<tr>
<th>Place of origin</th>
<th>Total examined</th>
<th>No. of infested camels (%)</th>
<th>95% CI</th>
<th>χ² (p-value)</th>
<th>OR (95% CI for OR)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erer</td>
<td>104</td>
<td>85(81.7)</td>
<td>72.95-86.63</td>
<td>0.07(0.97)</td>
<td>1.18(0.41-1.76)</td>
<td>0.63</td>
</tr>
<tr>
<td>Shinile</td>
<td>185</td>
<td>149(80.5)</td>
<td>74.09-85.94</td>
<td>1</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Villages around Dire Dawa</td>
<td>113</td>
<td>92(81.4)</td>
<td>73.01-88.11</td>
<td>1.12(1.04-4.59)</td>
<td>0.73</td>
<td></td>
</tr>
</tbody>
</table>

OR: odds ratio; CI: confidence interval; *: Reference category

Table 2: The prevalence of C. titillator larvae by age of camels

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Total examined</th>
<th>No. of infected camels (%)</th>
<th>95% CI</th>
<th>χ² (p-value)</th>
<th>OR (95% CI for OR)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-7</td>
<td>70</td>
<td>50(71.4)</td>
<td>59.38-81.60</td>
<td>27.30(0.0)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8-12</td>
<td>88</td>
<td>60(68.2)</td>
<td>57.39-77.71</td>
<td>0.85(0.1-1.76)</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>13-17</td>
<td>115</td>
<td>96(83.5)</td>
<td>75.41-89.75</td>
<td>2.18(1.04-4.59)</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>18-22</td>
<td>129</td>
<td>120(93)</td>
<td>87.17-96.76</td>
<td>3.60(1.45-8.99)</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

OR: odds ratio; CI: confidence interval; *: Reference category

Table 3: The prevalence of C. titillator larvae by sex and body condition score of camels

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Camels examined</th>
<th>No. of infected camels (%)</th>
<th>95% CI</th>
<th>χ² (p-value)</th>
<th>OR (95% CI for OR)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>188</td>
<td>152(80.9)</td>
<td>74.49-86.21</td>
<td>0.014(0.91)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>214</td>
<td>174(81.3)</td>
<td>75.43-86.30</td>
<td>0.80(0.46-1.40)</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Body Condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>114</td>
<td>110(96.5)</td>
<td>91.26-99.04</td>
<td>30.21(0.0)</td>
<td>6.30(1.98-20.04)</td>
<td>0.002</td>
</tr>
<tr>
<td>Medium</td>
<td>209</td>
<td>157(75.1)</td>
<td>68.69-80.83</td>
<td>0.89(0.48-1.65)</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>79</td>
<td>59(74.7)</td>
<td>63.64-83.79</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OR: odds ratio; CI: confidence interval; *: Reference category

There was no statistically significant difference ($\chi^2=0.07$; p=0.97) variations detected in prevalence among the three places of origin of camels slaughtered at Dire Dawa municipal enterprise. The minimum and maximum numbers of C. titillator larvae counted were 5 and 70 respectively.

Prevalence of C. titillator larvae infection among different age groups of camels was also computed (Table 2). Adult camels of 18-22 and 13-17 years of age had a significantly higher ($\chi^2 = 27.30; p=0.00$) prevalence (93%; 95%CI: 87.17-96.76%) and (83.5%; 95%CI: 75.41-89.75%) of C. titillator larvae infection respectively as compared to young camels (5-7 years of age) (71.4%; 95%CI: 59.38-81.60%). Logistic regression revealed that camels of 18-22 years old were more likely to be infected with C. titillator larvae than those of 5-7 years old (OR= 3.60; 95% CI: 1.45-8.99%; p=0.01). Moreover, camels of 13-17 years of age were more likely to be infected with C. titillator larvae than those of 5-7 years old (OR= 2.18; 95% CI: 1.04-4.59%; p=0.04). However, camels under 5 years of age were not included in this study.

Out of 188 male and 214 female camels examined 80.9% (95%CI: 74.49-86.21%) and 81.3% (95%CI: 75.43-86.30%) were infected by C. titillator larvae respectively. Prevalence of C. titillator larvae infection among different sex and body condition score groups of camels is given Table 3. There was no statistically significant ($\chi^2=0.01$; p=0.91) variation detected between different sex groups of camels.

The prevalence of C. titillator larvae infestation of camels of different body condition scores is also summarized in Table 3. The prevalence of C. titillator larvae infestation was significantly highest ($\chi^2=30.21; p=0.00$) in camels of poor (96.5%; 95%CI: 91.26-99.04%) body condition compared to medium (75.1%; 95%CI: 68.69-80.83%) and good (74.1%; 95%CI: 63.64-83.79%) body condition scores. Logistic regression revealed that camels of poor body condition were more likely to be infected with C. titillator larvae than those of good body condition (OR= 6.30; 95% CI: 1.98-20.04; p=0.002).

With regard to gross pathological findings nasopharyngeal cavities were congested and abundant mucous secretion was observed. The mucous membrane was swollen, hemorrhagic and pus filled nodules were noted. Occasionally ulcer like lesions and thick and bad stench secretion were also observed.

**DISCUSSION**

In this study, out of 402 camels 326 (81.1%, 95%CI: 76.92%-84.81%) were infected with C. titillator.
larvae. This level of *C. titillator* larvae infestation in camels observed in current study area is comparable with previous study by Melaku and Feseha [14], who reported that 83.3% camels were infected with *C. titillator* larvae but it is higher than the reports of Bekele [15] 71.1% in Jijiga and Regassa, *et al*. [21], who reported that 68.6% and 61.9% in Borana and Metahara respectively but is lower than 100% [13] and 99.3% [16] camels are harboring *C. titillator* larvae in Ethiopia. Furthermore, a *C. titillator* larva infection prevalence in camels in several countries is also high including 79% in Libya [22], 85.7% in Morocco [23] and 80.72% and 58.1% in Iran [24, 25] respectively. These variations in the prevalence of *C. titillator* infestation might be due to the different management practices and environmental conditions that exist in these areas.

No significant ($\chi^2=0.07; p=0.97$) difference was noted based on places of origin of camels studied with prevalence of the *C. titillator* infection in camel from Erer (81.7%), Shinile (80.5%) and Villages around Dire Dawa (81.4%). In this study, *C. titillator* infection was significantly high in older camels ($\chi^2 = 27.30; p=0.00$) with prevalence of 93% in camels of 18-22 and 83.5% in camels of 13-17 years age old compared with the younger ones (5-7 years of age) (71.4%). This observation agrees with [15, 22, 24 and 25] who all reported that the prevalence of *C. titillator* larvae infestation was lower in younger camels and significantly higher in older camels. It was also documented that older camels may be more tolerant of flies and allow the deposition of egg around the nostrils; while the younger camels actively seek to prevent the flies settling around the nostrils [15, 224].

The infection rate of *C. titillator* was not statistically significantly different among males (80.9%) and female (81.3%) camels. Shakerian, *et al*. [24], in Iran reported that no significant difference was observed among Males (76.8%) and females (86%) camels infected by *C. titillator* larva, which is in accordance with current study. On the other hand Oryan, *et al*. [25] (males 65.0%; female 45.6%) and El-Rahman [22] (males 65.0%; female 45.6%) have reported that the rate of infestation was significantly higher in males than in female camels, the causes of these variations could be due to differences of management practice of nomads of current and their study areas.

The prevalence rate of *C. titillator* infection was significantly higher in camels with poor (96.5%) body condition as compared to medium (75.1%) and good (74.1%) body condition scores ($\chi^2=30.21; p=0.00$). This finding is in agreement with the report by Regassa, *et al*. [21]. As it was documented this might be because of *C. titillator* larvae infestation has severe impact on body condition of camels and causes losses in terms of body weight gain [12]. It was also documented that *C. titillator* larvae infestation has several impacts on respiratory function, feeding, health and productivity of the animals where infected camels lose their appetite and show respiratory problem and abnormal behavior resembling cranial coenurosis [26].

**CONCLUSION**

In general, the prevalence of *C. titillator* larvae infestation in the study area was very high (81.1%) and *C. titillator* larvae infestation was found to be one of the major disease entities in the study area and it is among the major constraints of camel health and production. Even though there is an improvement in veterinary service in camel rearing areas *C. titillator* larvae infestation remains very high. Therefore to design treatment and control approach well integrated studies on the life cycle and ecology of the fly are recommended. Studies on the economic impact of infection of camel with *C. titillator* larvae infestation are also recommended. Appropriate control measure should also be implemented to improve the health, productivity and welfare of camels.

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**REFERENCES**


