Prevalence of gastrointestinal helminthes in camels of hyper-arid partially irrigated zone of Rajasthan

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ABSTRACT

A total 509 faecal samples were collected from camel population of different age and sex from hyper-arid partially irrigated zone of Rajasthan from March, 2016 to January, 2017. An overall prevalence rate of helminthic infection was recorded in 60.70% camels by conventional faecal examination techniques. Among helminthes, highest prevalence was of strongyles (49.31%) followed by Trichuris sp. (24.75%), Strongyloides sp. (14.14%) and Nematodirus sp. (13.16%). Egg per gram counts of Strongyloides sp, Trichuris sp and strongyle group was recorded from 100-900 (261.11±40.08); 100-1600 (564.81±23.17) and 100-1900 (624.07±47.73), respectively. Statistical analysis using multivariate binary logistic regression model revealed a highly significant difference (p<0.01) in seasonal dynamics and district wise prevalence of gastrointestinal helminthic infections in camel population whereas age and sex wise prevalence analysis revealed statistically non-significant difference. Coproculture study revealed the presence of Haemonchus sp., Trichostrongylus sp., Strongyloides sp. and Nematodirus sp. in the decreasing order of prevalence.

Key words: Camel, Gastrointestinal helminthes, Hyper arid partially irrigated zone prevalence, Risk factors.

INTRODUCTION

The camel population in Rajasthan is approximately 0.32 million, which comprises 81.37% of total camel population in India (Livestock census, 2012). The climate of a particular region determines the prevalence and severity of parasitic diseases. Rajasthan has been divided into 10 Agro-climatic zones on the basis of climatic conditions and agricultural produce (Hussain, 2015). Hyper arid partially irrigated zone covers all tehsils of Bikaner and Jaisalmer districts and Sujangarh, Ratangarh, Sardarsahar and Bidasar tehsils of Churu district. The camel population in Jaisalmer, Bikaner and Churu districts is approximately 49,000, 46,000 and 33,000, respectively (Livestock Census, 2012). Camel forms an integral part of the culture and agriculture in Rajasthan.

Parasitism is one of the major problems affecting productivity and performance of camels (Anwar and Khan, 1998) through a wide variety of mechanisms including reduction in voluntary feed intake, loss in productivity, diarrhoea and decrease in the performance of animals without notable clinical manifestations (Borji et al., 2010). Camels can acquire helminthic infections during grazing in infected pasture or drinking water (Fowler, 1996). The study of parasitic species occurring in a host is of paramount importance for planning an efficient control programme and to prevent economic losses due to helminth infection (Tajik et al., 2011). Prevalence of gastrointestinal helminth infections in camels has been studied to a limited extent in the world (Wafaand Megrin, 2015; Borji et al., 2010; Mahfooz et al., 2006) and in India (Joshi, 1997; Rewatkar et al., 2009; Prasani et al., 2008; Chaturvedi et al., 2012). Therefore, present investigation was undertaken with an objective to assess the occurrence of gastrointestinal helminthes with their infection rates, identification of genera of various strongyles and the impact of various risk factors on the prevalence of gastrointestinal helminthic infection in camel population in hyper arid partially irrigated zone of Rajasthan.

MATERIALS AND METHODS

The camels from hyper arid and partially irrigated zone of Rajasthan covering an area of 71 million hectares spread over Bikaner, Jaisalmer and Churu districts was selected for the present studies. It is situated at 28°10’ N latitude, 73°35’ E longitude and 235 meter above mean sea level. The mean daily maximum temperature goes beyond 46°C during summer and drops up to 14°C during winters. The area is characterized by stormy southwest winds with frequent dust storms (http://raubikaner.org/arsbikaner.asp).

The status of prevalence rate of infection, the expected prevalence of 50% with confidence limits of 95% and a desired absolute precision of 5% was studied by collecting maximum number of representative samples (Thrusfield, 2005). The number of samples thus calculated

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was adjusted for finite population and was correlated with 509 samples collected randomly from camel population of hyper arid partially irrigated zone of Rajasthan during summer, rainy and winter seasons from March 2016 to January 2017. The samples were placed in sterile polythene bags and labeled carefully indicating the host’s detail, location and month of collection, kept in a cool transport box and brought to laboratory for further examination. Faecal samples were qualitatively examined by faecal flotation and sedimentation techniques (Solusby, 1965) for helminthic eggs and quantitatively by modified McMaster egg counting technique (Coles et al., 2006). Coproculture study was also performed to harvest and identify infective strongyle larvae (Solusby, 1965). Statistical analysis was performed by using SPSS 20.0 software by applying Chi Square ($\chi^2$) test and subjected to the multivariate binary logistic regression model with significant association at $P<0.05$ (two-sided).

RESULTS AND DISCUSSION

The present studies revealed the presence of gastrointestinal helminthic infections in 60.7% camels. Similar reports have also been made from many Indian states including Rajasthan (Joshi, 1997), Gujarat (Solanki, 2011) and Maharastra (Rewalkar et al., 2009) and several other countries including Pakistan (Mahfooz et al., 2006) and Tanzania (Swai et al., 2011).

In contrast to present observations, Mahmoud et al. (2008) from Halaieb, Shalateen and Abu-Ramad region of Egypt, Ibrahim et al. (2016) from Mogadishu of Somalian were reported lower whereas Sharif et al. (1997) from northern and eastern parts of Jordan, Baimai and Kalu, (2011) from Maiduguri abattoir of Nigeria, Tekle and Abebe, (2001) from southern rangelands of Borena and Abegaz, (2016) from Eastern Amhara Regional State of Ethiopia reported higher prevalence rates than the present one. These variations can be attributed to the differences in agro-ecology, management, sample size, time of sampling and husbandry practices used in different countries (Abegaz, 2016).

Further studies revealed higher prevalence of strongyle (49.31%) eggs followed by Trichuris sp. (24.75%), Strongyloides sp. (14.14%) and Nematodirus sp. (13.16%) eggs. Strongyle infection was also reported to be the most prevalent in the camel population by Birhanu et al. (2014) from Akaki, Addis Ababa abattoir and Abegaz, (2016) from Eastern Amhara Regional State of Ethiopia. A comparatively higher prevalence rate of strongyle infection has been previously reported earlier from the Rajasthan state (Partani et al., 1996; Chaturvedi et al., 2012) than the present study. The difference in prevalence may be due to nutritional status, level of immunity, stage of parasite infection and lack of improvement in animal health management programs or non-adoption of the modern animal health care programs by camel owners (Kasahun et al., 2014).

Quantitative analysis revealed mild to severe infection of Strongyloides sp., Trichurus sp. and strongyles with an average of 261.11±40.08 (100-900), 564.81±23.17 (100-1600) and 624.07±47.73 (100-1900) eggs per gram (Epg) counts, respectively. Highest Epg count of Strongyles was than other nematode species in camel population is in congruent to the findings of Sharma, (1991) and Mahfooz et al. (2006), Partani et al. (1998) and Solanki, (2011). The reason of higher prevalence of strongyles is due to the similarity in microclimates of the localities (Muhomed et al., 2017).

Seasonal dynamics revealed a highly significant ($P<0.01$) difference with maximum prevalence in rainy season (70.00%) followed by summer (60.66%) and winter (54.06%) (Table 1) and it is in agreement with the findings of Ukashatu et al., 2012; Parsani et al., 2008; Bekele, 2002 in India and around the world. Rainy season provides more suitable environmental conditions in terms of humidity, temperature and rainfall for the development of preparasitic stages of most of parasitic nematode. Where as cold and dry climate have destructive effects on the development of the helminthic stages and allow fewer pre-infective larvae to reach the infective stage (Solusby, 1982). Among various gastrointestinal helminths, strongyle (66.00%) and Strongyloides sp. (17.33%) were reported maximum in rainy season, whereas Trichuris sp. (27.33%) was most prevalent during summer season and Nematodirus sp. (14.83%) was more in the cold months. These observations are similar to earlier report of Lodha, (1977), Raisinghani, (1992), Partani et al. (1996). Statistical analysis using multivariate binary logistic regression model revealed a positive association of summer and rainy seasons when compared to winter season that is odds ratio of infection increased by 1.402 and 2.701 for summer and rainy seasons, respectively with complete details in Table 2.

A highly significant ($P<0.01$) difference among three districts(Churu-70.11%, Bikaner-64.24% and Jaisalmer-46.15%) of the study area (Table 2) may be attributed to the fact that different districts receive different rainfall resulting into different relative humidity and suitable microhabitat for the growth of helminthic stages in the respective district. The multivariate binary logistic regression analysis for gastrointestinal helminthic infection indicated a positive association of Bikaner and Churu when compared to Jaisalmer (Table 2). The difference may be attributed to the fact that these districts receive different levels of maximum rainfall in the study area resulting in high relative humidity and suitable microhabitat for the growth of helminth stages. Moreover, availability of limited pasture for grazing for the whole year, animal husbandry practices and different deworming programme management of different districts play essential role in the variation of
prevalence of gastrointestinal helminth infections among the districts of hyper arid partially irrigated zone of Rajasthan.

High prevalence (66.16%) of gastrointestinal helminths in Group III among four age groups viz. Group I (Below 2yr), Group II (2-5yr), Group III (5-10yr), and Group IV (>10 yr) (Table 2) in agreement to the findings of Swai et al. (2011) and Birhanu et al. (2014). The reason for high prevalence in camels of 5-10 year-old may be due to the fact that this age group is used more for field work, longer travel and excessive grazing on pasture land than other groups compared (Lodha et al., 1977). The multivariate binary logistic regression analysis for gastrointestinal helminth infection revealed a positive association of group I, group II and group III as compared to group IV i.e. odds ratio of infection increased by 1.113, 1.204 and 1.630 in group I, group III & group II, respectively (Table 2). The present study revealed a non-significant statistical difference among age groups unlike the previous observations made by Partani et al. (1996) and Joshi, (1997) from various parts of the Rajasthan indicating change in trend due to the declining interest of rearers due to lack of avenues and involvement of animals of all age groups for field works.

Higher prevalence of helminthic infections in males (64.35%) than females (Table1) is in agreement to the finding of Sena et al. (2000) and Parsani et al. (2008) from different parts of the India and Pandit et al (2013), Birhanu et al. (2014) and Mahmuda et al. (2014) from different countries. The higher prevalence rate in males may be due to difference in their overexposure to infection acquired by them during grazing in field condition after field work (Pandit et al., 2013) and difference in stocking density of male and female (Mahmuda et al., 2014). Statistical analysis using multivariate binary logistic regression model revealed a positive association in female than male (Table 2). Sex wise analysis revealed no significant difference in the prevalence

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Table 1: Prevalence of gastrointestinal helminthes of camel population in hyper arid partially irrigated zone of Rajasthan.

<table>
<thead>
<tr>
<th>Season</th>
<th>Examined</th>
<th>Infected(%)</th>
<th>Mixed(%)</th>
<th>Strongyle(%)</th>
<th>Strongylesloid(%)</th>
<th>Trichuris(%)</th>
<th>Nematodirus(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>150</td>
<td>91(60.66)</td>
<td>46(30.66)</td>
<td>78(52.00)</td>
<td>21(14.00)</td>
<td>41(27.33)</td>
<td>15(10.00)</td>
</tr>
<tr>
<td>Rainy</td>
<td>150</td>
<td>105(70.00)</td>
<td>41(27.33)</td>
<td>99(66.00)</td>
<td>26(17.33)</td>
<td>36(24.00)</td>
<td>21(14.00)</td>
</tr>
<tr>
<td>Winter</td>
<td>209</td>
<td>113(54.06)</td>
<td>55(26.31)</td>
<td>74(35.40)</td>
<td>25(11.96)</td>
<td>49(23.44)</td>
<td>31(14.83)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses indicates percentage,*= significant, **= highly significant

Table 2: Multivariate Binary logistic regression for gastrointestinal helminthes of camel population in hyper arid partially irrigated zone of Rajasthan.

<table>
<thead>
<tr>
<th>Season</th>
<th>Parameter</th>
<th>Logistic regression coefficient (B)</th>
<th>S.E.</th>
<th>Wald test</th>
<th>Df</th>
<th>PValue</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td></td>
<td>.338</td>
<td>.234</td>
<td>2.076</td>
<td>1</td>
<td>.150</td>
<td>1.402</td>
</tr>
<tr>
<td>Rainy</td>
<td></td>
<td>.994</td>
<td>.249</td>
<td>15.919</td>
<td>1</td>
<td>.000</td>
<td>2.701</td>
</tr>
<tr>
<td>Winter</td>
<td></td>
<td>.986</td>
<td>.250</td>
<td>9.076</td>
<td>1</td>
<td>.003</td>
<td>2.680</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Districts</th>
<th>Parameter</th>
<th>Logistic regression coefficient (B)</th>
<th>S.E.</th>
<th>Wald test</th>
<th>Df</th>
<th>PValue</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Churu</td>
<td></td>
<td>.759</td>
<td>.252</td>
<td>9.076</td>
<td>1</td>
<td>.003</td>
<td>2.137</td>
</tr>
<tr>
<td>Churu</td>
<td></td>
<td>.986</td>
<td>.250</td>
<td>15.554</td>
<td>1</td>
<td>.000</td>
<td>2.680</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Parameter</th>
<th>Logistic regression coefficient (B)</th>
<th>S.E.</th>
<th>Wald test</th>
<th>Df</th>
<th>PValue</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I(&lt; 2 yrs)</td>
<td></td>
<td>.107</td>
<td>.350</td>
<td>.094</td>
<td>1</td>
<td>.759</td>
<td>1.113</td>
</tr>
<tr>
<td>Group II(2-5yr)</td>
<td></td>
<td>.488</td>
<td>.280</td>
<td>3.040</td>
<td>1</td>
<td>.081</td>
<td>1.630</td>
</tr>
<tr>
<td>Group III(5-10yr)</td>
<td></td>
<td>.186</td>
<td>.250</td>
<td>.553</td>
<td>1</td>
<td>.457</td>
<td>1.204</td>
</tr>
<tr>
<td>Group IV (&gt;10 yr)</td>
<td></td>
<td>.225</td>
<td>.325</td>
<td>3.225</td>
<td>3</td>
<td>.358</td>
<td>1.278</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Parameter</th>
<th>Logistic regression coefficient (B)</th>
<th>S.E.</th>
<th>Wald test</th>
<th>Df</th>
<th>PValue</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td></td>
<td>.074</td>
<td>.216</td>
<td>.118</td>
<td>1</td>
<td>.731</td>
<td>1.077</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>-1.81</td>
<td>.324</td>
<td>6.269</td>
<td>1</td>
<td>.012</td>
<td>.445</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses indicates percentage,*= significant, **= highly significant
of gastrointestinal helminths between male and female camel population of hyper arid partially irrigated zone of Rajasthan.

Coproculture study revealed the presence of \textit{Haemonchus} sp. (46.00%), \textit{Trichostrongylus} sp. (27.66%), \textit{Strongyloides} sp. (15.34%) and \textit{Nematodirus} spp. (11.00%) in the decreasing order of prevalence similar to earlier reports of Partani et al. (1996) and Partani et al. (1998) from Rajasthan, Rewatkar et al. (2009) from Maharashtra and Solanki et al. (2014) from middle part of Gujarat. \textit{Haemonchus} sp. has been reported as the major contributor similar to earlier observations of Lodha et al. (1977) from Rajasthan, Yadav and Kumar, (1990) from Haryana and Sharma, (1991) from Maharastra.

Climatic factors influence the rate of larval movement (Croll, 1975) and higher rate of infection in rainy months may also be attributed to suitable molarity of salt present in soil which is an important factor for ecdysis (Soulsby, 1982). Seasonal variation was observed in the proportion of various strongyle larvae. \textit{Haemonchus} sp. larvae have been found most dominant in summer season whereas \textit{Trichostrongylus} sp. was most dominant in rainy season. Development and survival of pre-helminthic stages of \textit{Haemonchus} sp. are highly influenced by hot and humid weather (Kates, 1950) and total monthly rainfall (more than 50mm) and mean monthly maximum temperature (more than 18.3°C) (Gordon, 1953). Metrological data of the hyper arid partially irrigated zone of Rajasthan (www.bharatonline.com, 2016) indicated that the temperature required for survival of \textit{Haemonchus} sp. persisted throughout year.

**CONCLUSION**

Present study brings out a comprehensive report on the status of GI parasites in camels of hyper-arid partially irrigated zone of Rajasthan (India). This study can be helpful in formulating a comprehensive control and preventive strategy in this and similar zones of Rajasthan and other states.

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**CONFLICT OF INTEREST**

We declare that we have no conflict of interest.


