Prevalence of coccidiosis in Andaman local goat and its metaphylaxis in tropical island ecosystem

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ABSTRACT

This study reports the prevalence of coccidiosis in Andaman local goat, a native goat breed of Andaman and Nicobar Islands, India. The duration of study was one year. Maximum oocyst output was seen in kids of <6 months of age in month of March followed by in November, July, August, October, September, December, May and April. More oocyst count in kids of < 6 months of age compared to those of older goats may be attributed towards higher susceptibility towards this infection. Increase of oocyst output from the month of July was due to increase in relative humidity due to high rainfall. Onset of clinical cases of caprine coccidiosis with high oocyst count was due to fodder crisis in March which imposed stress in animals. Four species of Eimeria were detected and most prevalent species in pooled sample was E. arloingi (48%), followed by E. faurei (20%) and E. pallida and E. parva (16% each) and among them E. arloingi has been seen to be associated with clinical coccidiosis of goats. Amprolium, a potent thiamine antagonist, was used to treat the infected animals with high oocyst count and the compound was found effective @ 50 mg/kg body weight which was evaluated on the basis of oocyst count, improved body weight and clinical recovery. The report is the seminal information on prevalence of coccidiosis, species richness, metaphylaxis and its effect in Andaman local goat from Andaman and Nicobar islands, an isolated insular region of India.

Keywords: Amprolium, Andaman local goat, Coccidiosis, Eimeria, Prevalence

Success of goat rearing is mainly dependent on modest feeding requirements. Adaptability of the species in diversified climatic conditions and effective conversion of limited feed resources into meat, milk and hides has proved caprine as one of the important animal resources for sustainable livelihood development in rural economy (Balicka-Ramisz 1999). Andaman and Nicobar islands is home of 57,480 goats (Livestock Census 2012), of which 85% belong to native breed, locally known as Teressa and Andaman Local goat. Parasitic infection causes severe harmful effects through loss of production and mortality (Jalila et al. 1998). Coccidiosis, caused by Eimeria spp. is an important disease in goats (Pellérdy1974, Arslan et al. 1999). Parasitic infection is responsible for reduction of body weight gains up to 40–58% (Faizal et al. 1999). This pathogen causes anaemia, imbalance of electrolyte and poor absorption of nutrients. In general coccidiosis in small ruminants is associated with intensive breeding conditions, high animal density and high productivity (Foreyt 1990). Prevalence of gastrointestinal parasitic infection is dependent on changes in season (Malczewski et al. 1996).

Material and Methods

These groups of islands experience two seasons, monsoon and dry season. Further, gastrointestinal epidemics are common during hot and wet seasons compared to dry and cold seasons (Bankunzi et al. 2010). From mainland of India, coccidiosis in goats has been reported. To mention a few are 100% infection in kids and 84.61% infection in adult animals from North India (Singh et al. 2020), overall prevalence of 86.71% from semi-arid zone of India (Sharma et al. 2017) and as well as from hilly tracts of India (Sharma et al. 1997). But this information is lacking in Andaman and Nicobar islands. Therefore, prevalence data on coccidiosis in different seasons in these islands will be of great help in formulating control strategy against this disease along with its metaphylactic approach. Because metaphylaxis improves body weight (Foreyt 1990). Compounds like toltrazuril and diclazuril were effective to control coccidiosis in lambs (Gjerde and Helle 1991), calves (Mundt et al. 2005) and kids (Ruiz et al. 2012). Therefore, a study has been undertaken on prevalence of coccidiosis in Andaman and Nicobar islands in Andaman local goat and its metaphylaxis.

MATERIALS AND METHODS

The study was undertaken in South Andaman district of Andaman and Nicobar Islands, situated at 11.623°N and
92.7265°E. Average annual rainfall of South Andaman district is 318 cm and temperature ranges from 24°C to 31°C throughout the year. The goats are reared in semi-intensive system. As a regular practice, animals are not provided with concentrate mixture, anthelmintics and anticoccidial medicines. Very few farmers (10–15%) supplement rice, wheat and wheat bran.

Samples were collected from Andaman local goats from April, 2017 to March, 2018, a total of 1,155 rectal faecal samples were collected from three different age groups, viz. less than 6 months, 6 months to one year and more than one year (Table 1). Samples after collection were transported to the laboratory maintaining cold chain.

Faecal samples were examined to determine oocysts per gram of faeces (OPG) by modified M’c Master technique as per the recommendation of Ministry of Agriculture, Fisheries and Food (MAFF1986).

The isolated oocysts were harvested into a shallow layer of 2.5% (w/v) aqueous potassium dichromate solution and were allowed to sporulate at 25°C. Species of Eimeria were identified on the basis of their characteristic morphological features described earlier (Pellérdy1974, Soulsby 1986, Wang et al. 2010). Differential oocyst count was performed out of 100 Eimeria oocysts identified from pooled faecal sample.

For this study, a total of 30 goats of less than 6 months of age, with history of diarrhoea, dehydration and decreased feed consumption and with more than 3 lakh OPG count were selected.

Amprolium soluble powder (20% w/w; Vetoquinol India Animal Health Pvt. Ltd., Maharashtra, India) was used for anti-coccidial therapy. The animals were divided into three equal groups. The animals were treated with two different doses of the medicine, i.e. 10 mg/kg body weight, 50 mg/kg body weight for 5 consecutive days and rest of the doses of the medicine, i.e. 10 mg/kg body weight, 50 mg/kg body weight for 5 consecutive days and rest of the medicine, i.e. 10 mg/kg body weight, 50 mg/kg body weight for 5 consecutive days and rest of the medicine, i.e. 10 mg/kg body weight, 50 mg/kg body weight for 5 consecutive days and rest of the medicine, i.e. 10 mg/kg body weight, 50 mg/kg body weight for 5 consecutive days.

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Data are presented as mean±standard error of mean (SEM). Statistical significance was determined by analysis of variance (ANOVA) using GraphPad Prism 7 software (http://www.graphpad.com).

RESULTS AND DISCUSSION

During the period under report, no oocyst output was observed in February and June in kids of <6 months and 6 months to 1 year of age. Maximum oocyst output (n) was observed in goats of <6 months of age in March (300850±720.33) followed by in November (3005±50.00), December (2100±20.59), May (1500±24.55) and April (1470±30.86). This was further observed that, oocyst output was more in kids of <6 months of age as compared to those of other two age groups, viz. 6 months –1 year and >1 year (Table 1). Analysis of weather data at South Andaman district revealed that, the maximum and minimum temperature did not vary much throughout the year. Moreover, occurrence of rainfall was observed throughout the year but the maximum rainfall was recorded in June. The oocyst output in kids (<6 months) suddenly increased to 5406.66±96.47 in July and faecal score remained >2000 up to December. But interestingly, again there was sharp increase of oocyst count in March in kids of <6 months of age (Table 1). A total of four species of Eimeria were detected based on their morphological features. E. arloingi was ellipsoidal in shape with distinct micropyre. Sporulation time of the species was 48–72 h. Length and breadth of E. arloingi oocysts were 27.9±0.002 µm (range: 27–29 µm) and 20.5±0.001 µm (range: 19–21 µm). The other species was indistinguishable from E. parva since the oocysts were sub-spherical in shape, sporulation time varied from 24–48 h and length and breadth of the oocysts were 16±0.001 µm (range: 15–17.3 µm) and 14.2±0.001 µm (range: 13.9–14.5 µm) (Fig. 1). The third species was E. pallida which could be identified on the basis of its typical ellipsoidal shape, sporulation time (which varied from 20–24 h) and as well as on its length and breadth. The length of E. pallida was 14.1±0.001 µm (range: 13.5–14.2 µm) and breadth was 13.9±0.002 µm (range: 13.5–14.4 µm). The fourth

Table 1. Seasonal prevalence of coccidial infection of Andaman local goat

<table>
<thead>
<tr>
<th>Month/Age</th>
<th>&lt;6 months (n)</th>
<th>6 months (n)</th>
<th>&gt;1 year (n)</th>
<th>Overall (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>885± 21.10(30)</td>
<td>248.57 ± 6.93(40)</td>
<td>28.12 ± 5.64(40)</td>
<td>240.32±16.84</td>
</tr>
<tr>
<td>February</td>
<td>0.00(35)</td>
<td>0.00(30)</td>
<td>0.00(35)</td>
<td>0.00</td>
</tr>
<tr>
<td>March</td>
<td>300850 ± 120.33(30)</td>
<td>270 ± 11.02(35)</td>
<td>15± 5.07(16)</td>
<td>75290±509.62</td>
</tr>
<tr>
<td>April</td>
<td>1470 ± 30.86(32)</td>
<td>275 ± 7.41(30)</td>
<td>42.63 ± 7.18(35)</td>
<td>247.74±22.00</td>
</tr>
<tr>
<td>May</td>
<td>1500±24.55(35)</td>
<td>350 ± 14.73(36)</td>
<td>30 ± 7.25(36)</td>
<td>220.58±18.86</td>
</tr>
<tr>
<td>June</td>
<td>0.00(30)</td>
<td>0.00(30)</td>
<td>21±6.45(30)</td>
<td>48.68±6.97</td>
</tr>
<tr>
<td>July</td>
<td>5406.66 ± 96.47(35)</td>
<td>760± 8.68(30)</td>
<td>70 ± 11.01(30)</td>
<td>3934±89.10</td>
</tr>
<tr>
<td>August</td>
<td>4000 ± 72.73(32)</td>
<td>760 ± 8.68(35)</td>
<td>70 ± 11.01(36)</td>
<td>2960.79±67.94</td>
</tr>
<tr>
<td>September</td>
<td>3000 ±30.00(30)</td>
<td>840 ± 14.00(31)</td>
<td>31.87 ± 7.64(31)</td>
<td>4478.57±106.10</td>
</tr>
<tr>
<td>October</td>
<td>3232.85 ± 54.83(32)</td>
<td>617.14 ± 14.68(35)</td>
<td>95.29 ± 10.16(31)</td>
<td>1577.50±49.46</td>
</tr>
<tr>
<td>November</td>
<td>10354.21 ± 123.35(27)</td>
<td>546± 13.59(29)</td>
<td>84.70 ± 10.03(35)</td>
<td>5358.68±108.44</td>
</tr>
<tr>
<td>December</td>
<td>2100 ± 20.59(30)</td>
<td>450.00 ± 0.00(30)</td>
<td>80.00 ± 10.15(31)</td>
<td>450.00±27.45</td>
</tr>
</tbody>
</table>

Data are presented as Mean±SEM; Means between columns not sharing a common superscript letter differ significantly (P<0.05); Figures in the parentheses depicts the number of animals in each age group.
The characteristic feature of the species included its oval shape. Sporulation time of the species varied from 24–48 h. Length and breadth of the oocysts was 28.0±0.001 µm (range: 27.1–28.0 µm) and 20.6±0.003 µm (range: 19.9–21.0 µm).

Differential oocyst count revealed that, occurrence of *E. arloingi* was the maximum (48%) followed by *E. faurei* (20%) and *E. pallida* and *E. parva* (16% each).

The oocyst count in goats treated with amprolium @ 50 mg/kg body weight decreased significantly as compared to control from day 5 post-treatment onwards. On the other hand, the goats treated with 10 mg/kg body weight took little more time to respond (Table 2). Although, oocyst output decreased significantly in both the groups as compared to control group, amprolium dose @ 50 mg/kg body weight was found more effective in terms of oocyst output 25 days post treatment (Table 2).

Coccidiosis is a common infection of small ruminants. Literature suggests that, this infection is common throughout the world and has been reported time to time by different workers (Koudela and Bokova 1998, Balicka-Ramiz 1999, Gadahi et al. 2009, Sharma et al. 2017). Although there are reports of coccidiosis from mainland of India (Reshi et al. 2013, Sharma et al. 2017), there is no report on coccidiosis in Andaman local goat as well as from the island ecosystem. Therefore, systematic study on prevalence of caprine eimeriosis from this island has provided surely an insight on caprine coccidiosis in Andaman local goat, adopted in this island ecosystem.

It was observed that, intensity of infection was more in kids (<6 months) as compared to other two groups of animals. Previous studies also suggested that, young animals suffered more compared to older animals (Balicka-Ramiz et al. 1999, Arslan et al. 1999) which might happen due to lower resistance or less immunity to this infection in kids compared to older animals (Maigni and Munyuua 1994). The present finding speaks about age-related decrease in *Eimeria* infection in goats and in accordance with the previous findings from France (Chartier et al. 1991), Spain (de la Fuente and Alunda 1992) and Netherland (Borgsteede and Dercken 1996). Older goats in between 6–12 months and >1 year of age may serve as potential source of infection for kids <6 months of age (Woji et al. 1994).

Coccidia infection aggravates with increasing humidity. During the present study, increase in rainfall from the month of June to October was observed.

Table 2. Efficacy of amprolium soluble powder against caprine coccidiosis

<table>
<thead>
<tr>
<th>Drug dosage</th>
<th>Parameter</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
</tr>
<tr>
<td>10 mg/kg</td>
<td>Oocyst (n)</td>
<td>358906± 358906± 358906±</td>
<td>365406± 365406± 365406±</td>
</tr>
<tr>
<td>B.Wt.</td>
<td></td>
<td>167.002 A</td>
<td>178.69 A</td>
</tr>
<tr>
<td>50 mg/kg</td>
<td>Oocyst (n)</td>
<td>361103± 10320± 741 B</td>
<td>8177±623.3 B</td>
</tr>
<tr>
<td>B.Wt.</td>
<td></td>
<td>115.14 A</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Oocyst (n)</td>
<td>358906± 358906± 358906±</td>
<td>365406± 365406± 365406±</td>
</tr>
<tr>
<td></td>
<td></td>
<td>167.002 A</td>
<td>178.69 A</td>
</tr>
<tr>
<td>10 mg/kg</td>
<td>Body weight (kg)</td>
<td>5.339± 5.373±</td>
<td>5.578± 5.857±</td>
</tr>
<tr>
<td>B.Wt.</td>
<td></td>
<td>0.06642 A</td>
<td>0.1174 A</td>
</tr>
<tr>
<td>50 mg/kg</td>
<td>Body weight (kg)</td>
<td>5.35± 5.34±</td>
<td>5.76± 6.15±</td>
</tr>
<tr>
<td>B.Wt.</td>
<td></td>
<td>0.05761 A</td>
<td>0.1713 A</td>
</tr>
<tr>
<td>Control</td>
<td>Body weight (kg)</td>
<td>5.297± 5.245±</td>
<td>5.499± 5.783±</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.08775 A</td>
<td>0.1064 a</td>
</tr>
</tbody>
</table>

Data are presented as Mean ± SEM; Means between columns not sharing a common superscript letter differ significantly (P<0.05).
Coccidiosis in goats happens due to complex interaction with parasites and hosts, involving several other factors, which influences the severity of the disease. The severity of the disease is dependent on involvement of species (Koudela and Bokova 1998). Clinical coccidiosis is most frequently caused by E. ninakohlyakimovae (Yvore et al. 1985), E. arloingi (Sayin et al. 1980), E. caprina (Norton 1986) and E. christenseni (Jagatheswaran 1957). During the present investigation, it was found that, frequency of E. arloingi oocysts were more (48%) as compared to the other three identified species. E. arloingi had been reported as a highly pathogenic species especially for kids (Prasad et al. 2017).

This has been well documented in the literature that, subclinal form of coccidiosis is responsible for production losses in domestic ruminants (Platzer et al. 2005). In kids, diarrhoea, dehydration, anorexia and damage of the colon result into poor development or slow growth in kids. Therefore, to evaluate the effect of coccidiosis in goats, the study was undertaken to see the efficacy of widely used amprolium in infected animals through faecal score and body weight gain. Proper medication against coccidiosis reduced oocyst shedding ameliorated intestinal lesions and increased the average growth rates of small and large ruminants (Platzer et al. 2005).

Young and others (2011) found that administration of amprolium @ 50 mg/kg body weight for five consecutive days was effective to reduce the infection. But, their data was not supported by regular monitoring of faecal oocyst count and body weight gain. Regular monitoring of post treatment faecal score evaluation and body weight gain was felt obligatory by the group of workers (Young et al. 2011) since they recorded significant number of eimerian oocysts even on 7th day post-treatment. In the present study, the points raised by Young et al. (2011) have been addressed.

Available literature suggests that, there is wide dose variation of amprolium, which starts from 10 mg/kg body weight to 100 mg/kg body weight (Yadav et al. 2007). To limit the chances of overdosing of amprolium, in the present experiment under field condition, the compound has been used in two different doses.

The present study is the first report on prevalence and speciation of Eimeria in goats in Andaman and Nicobar islands. The prevalence of Eimeria was found more in months of high rainfall and fodder crisis. The metaphylaxis study concludes that use of amprolium @ 50 mg/kg body weight is effective in controlling clinical cases of coccidiosis and may be recommended for treatment of coccidiosis in goats.

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