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SOME EPIDEMIOLOGICAL ASPECTS OF CAPRINE HAEMONCHOSIS IN SOUTH DARFUR STATE, SUDAN

(With One Table and One Figure)

By

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بعض الأوجه الوبائية للإصابة بدودة المعدة في الفصيلة الغنمية بجنوب دارفور – السودان

في هذه الدراسة تم تقصي ديناميكية العدوى بديدان الهيمونكس كونتورتس في الماعز الصحراوي عبر مسح لمدة ١٢ شهر. تأثير عوامل الطقس على حدوث العدوى والديدان المستقرة أظهرت ارتباط ايجابي معنوي مع هطول الأمطار و الرطوبة النسبية. العدد الكلي للديدان المستقرة من كل حيوان لم يظهر أي ارتباط مع أي من عوامل الطقس سالفة الذكر. متوسط قيمة نسبة الذكور للإناث لكل فترة المسح كانت ١,٣٣ قيمة سجلت في يناير في حين أعلي قيمة سجلت في مارس (٢,٧٣). القياسات الشكلية أوضحت أن لكل من الذكور و الإناث نفس الخصائص الشكلية لدودة معدة الماعز. لوحظ كذلك تباين معتبر في حجم الدودة وهو ذو علاقة بالتوزيع الموسمي للطفيل.

SUMMARY

In this study the dynamic of *Haemonchus contortus* infection in Desert kids over 12-month survey has been investigated. The effect of climatic factors on the prevalence and worm burden revealed a significant positive correlation with rainfall and relative humidity. The total worm burden per animal was neither correlated with any of the previously mentioned climatic factors. The mean male/female ratio value for the whole survey period was 1.33. The lowest male/female ratio was recorded during January while the highest value of male/female ratio (2.73) was observed during March. The morphometric studies showed that both male and female *Haemonchus contortus* have the typical morphological features of caprine stomach worm. Considerable variations in the size of the worm were observed in relation to seasonal distribution of the parasite.

Key words: Epidemiology, *Haemonchus contortus*, goats.

INTRODUCTION

The stomach worm *Haemonchus contortus* has a worldwide distribution in both temperate and tropical zones (Blood and Radostitis, 1989; Ikeme *et al*, 1987; Urquhart *et, al.* 1996; Abdel Nabi, 2000). The occurrence and significance of the disease caused by this parasite depend mainly upon the availability and density of infective larvae invading the host. This is controlled by many factors including environmental conditions, which play a major role in the control of the development and survival of extrahost stages of the parasite (Fakae and Chiejina, 1988;*Gatongi et, al.* (1998)). Changes in the climatic factors throughout the year cause a significant variation on the dynamic of *Haemonchus contortus* population. Moreover, seasonally in the occurrence of haemonchosis recognized as a main feature in many parts of the world. *Haemonchus contortus* reported as the most predominant parasite in South Darfur State (Bashar, *et, al.* 2002; Ismail, *et, al.* 2002). This particular state is well suitable for the disease occurrence due to climatic considerations, livestock density and traditional systems of animal husbandry. Nevertheless, documented information on the disease caused by this parasite is apparently lacking. The present investigation was therefore, designed to provide basic data on the seasonal distribution of *Haemonchus contortus* in local desert goats in South Darfur State.

MATERIALS and METHODS

The present study was conducted at Nyala area, South Darfur State. Nyala, the capital of the State, is located in the South west of Sudan between the latitude 8 30-13 30^{O} north and longitude 23 15^{O} east. The climate in this State is Savannah type with clay sandy soil in the South, while the north is semi desert with sandy soil. The meteorological annual data of the last 40 years obtained from Nyala Airport Meteorological Station showed that the mean minimum and maximum temperature were 20.98^{O}C and 35.14^{O}C, respectively and the annual relative humidity and total rainfall were 35.58%and 402.49 ml, respectively. The lowest temperature was reported in May while the highest relative humidity was encountered in February and July. The annual rainfall peaked in August and declined to zero or near zero in November, December, January and February.

Parasitological methods:

The present work constituted a 12-month parasitological survey on the abomasal parasite, *Haemonchus contortus*, in goats. A total of 401 abomasae were collected from the local abattoirs in Nyala town. At least, Two to three samples were collected every other day though out the period of survey (from the first of June 2000 to the end of May 2001). Each abomasum was ligated from both ends and immediately separated from the rest of the digestive tract. The age, sex and the general body condition of each animal sampled were recorded.

Total worm count:

Total worm count includes adult and immature worms. This was done according to the method described by Urquhart *et. al.* (1996).The abomasae were placed on a large plastic bowl and each one was opened a long its greater curvature. The abomasal content was poured on a large plastic bowl and then the abomasal mucosa was gently washed with running tap water. The attached worms on the mucosal surface were further removed by fingers. Then the content of the bowl were sieved through a wire mesh screen (0.15mm aperture). The material caught by the sieve was continuously washed with a low flow of tap water until no coloured material of food particles were passed through. The sieve with its content was then inverted on another bowl, and its content was further washed by running water in to the bowl. A small amount of the bowl content was then transferred into a petri dish and examined. Adult *H. contortus* were identified according to the morphological criteria stated by Urquhart, *et al.* (1996). The collected worms were further removed into another dish containing 10% formalin and individually counted. The numbers of male and female worms were also determined. The immature worms were further recovered by digestion of the abomasal mucosa in pepsin/HCl (8g pepsin, 20 ml concentrated HCl and 23 ml saturated NaCl in 940 ml H_2O). The whole abomasal mucosa was scraped off and placed into a glass flask containing the digestive fluid (100-150 ml). The flask with its content was placed on a magnetic stirrer adjusted to 5 rpm for three hours until the mucosa tissue was completely digested. The digested material was poured through two sieves (0.075 and 0.038mm aperture). The material remaining on the sieves was then washed with a jet of tap water. The sieves content was further washed on a jar and the volume was completed to 500 ml with tap water. 10 ml of the fluid, after well mixing, was taken in a test tube. A few drops were pipetted into a glass slide with a cover slip for microscopic examination and counting with low magnification. The immature worm

burden per animal was determined by multiplying the number of larvae present in the 10 ml fluid by 50.

Statistical Analysis:

Statistical analysis was carried out using the statistical programme SPSS (Microsoft ver. 10, USA). Data was analyzed using correlation coefficient for the comparison between means and various climatic factors. Levels of significance was taken at ($P \leq 0.05, 0.01$)

RESULTS

The effects of climatic factors:

The effects of climatic factors on the monthly prevalence and worm burden of *Haemonchus contortus* are summarized in table (1). The prevalence of adult worms showed a significant positive correlation with rainfall and also with relative humidity, but no correlation was found with monthly temperature. The prevalence of immature worms, on the other hand, showed a significant positive correlation with relative humidity only, but not with temperature or rainfall. However, the total worm burden was neither correlated with rainfall, relative humidity nor with temperature.

The monthly mean burden of adult and immature worms per animal similarly showed a significant positive correlation with rainfall and also relative humidity but no significant correlation was found with monthly temperature. However, the total worm burden per animal was neither significantly correlated with any of the previously mentioned climatic factors.

Male/female (M/F) ratio:

The monthly record of M/F ratio of adult *Haemonchus contortus* populations is illustrated in Fig. (1). The mean value for the whole period of survey (12 month) was 1.33. However, the lowest M/F ratio (0.9) was recorded in January and the highest M/F ratio (2.72) was observed in March. No significant positive or negative correlation was observed between M/F ratio and any of the climatic factors.

Morphological observations:

Adult *Haemonchus contortus* worms showed typical morphological features of the large stomach worm. The males were of an average length of 20mm. with uniform deep red colour. The females were a bit longer, red in colour with white striping showing characteristic barber's pole appearance. However, considerable variation in the size of the adult worms was observed in relation to the seasonal distribution of the parasite. For

example, young adults worms with relatively small size [0.5-1.5cm (males), 0.7-1.9cm (females)] were consistently observed from March upto the end of the rainy season. However, the size of the worms was found to increase in winter, particularly in January and February. At this time, all adult worms recovered were rather old and considerably large in size [0.8-1.9cm (males), 2.5-3.1cm (females)]. The immature worms recovered from autumn until the end of winter showed rod-like crystals in their gut.

DISCUSSION

Climatic conditions were considered to be responsible for the seasonal pattern of *Haemonchus contortus* infection. This was clearly observed in this study and in many previous reports (Gibbs, 1982, Asanja, 1988; Omar, 1999; Abdel Nabi, 2000). In this study the rainfall and relative humidity appear to be the main factors correlated with the seasonality of the parasite distribution. Since the relative humidity mainly depends upon the rainfall, it can be concluded that rainfall is the main factor affecting *Haemonchus contortus* prevalence and density in the study area. This was in agreement with Ikeme *et al*, (1987) who stated that in most tropical areas where little temperature variation occurs, variation in rainfall is the main factor affecting the free living stages of the parasite. The positive correlation of the prevalence and mean worm burden (mature and immature) with rainfall may be due to favourable environment of the rainy season for development and survival of free living stages of the parasite. Hence, infective stages will be available for the host with considerable numbers. On the other hand, the environment of the dry season was unfavourable for the development and survival of the extrahost stages of the parasite as previously observed (Chiejina, 1989). The absence of the free living stages of the parasite was attributed to the rapid drying out of the faecal pellets during the hot dry weather. It was clearly evident from the present survey that haemonchosis in goats in South Darfur State is a rainy season syndrome. However, the disease incidence was also observed in winter and early summer due to accumulation of the parasite infection from the previous rainy season.

Observations on male/female ratio did not show significant correlation with climatic factors in the different seasons of the year. The same findings were reported by Fakae, (1990) who found no significant difference in sex ratio of *Haemonchus contortus* population in the dry and rainy seasons in Nigeria.

It was also observed in the present survey that young adult worms were most dominant in early summer (ie before the onset of rain) when the

climatic conditions are not suitable for recent infections. This would only be explained by the fact that these young adults worms were actually inhibited larvae from the previous autumn and they were able to resume their development in early summer. The morphological characteristics of inhibited larvae (ie rod-like crystals in the gut cells) were clearly observed in immature stages recovered from late autumn up to the end of winter. Similar observations were also reported by Blitz and Gibbs, (1972). It is therefore, evident from this study that hypobiosis of *H. contortus* larvae in South Darfur occurs in late autumn. The same phenomenon was observed in Nigeria (Ogunsusi, *et al*, 1979). The inhibited larvae remain inactive throughout the winter after which they resume their development at early summer, just before the onset of rains. It is finally concluded from this basic data that *Haemonchus contortus* is fairly prevalent in South Darfur State. The presence of the parasite (as adults and larvae) throughout the year may well emphasize the role of hypobiosis in the epidemiology of the disease.

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Table 1: Climatic effects on the prevalence and worm burden of *Haemonchus contortus* in goats.

Climatic factors (monthly means) ψ	Prevalence			Worm burden		
	Adult	Immature	Total	Adult	Immature	Total
Temperature (Max.& Min.)	(-)	(-)	(-)	(-)	(-)	(-)
Rainfall	(+) r = 0.61*	(-)	(-)	(+) r = 0.771**	(+) r = 0.773**	(-)
Relative humidity	(+) r = 0.713**	(+) r = 0.644*	(-)	(+) r = 0.818**	(+) r = 0.821**	(-)

ψData obtained from Nyala Airport Meteorological Station.
(-) Absence of significant correlation.
(+) Positive correlation.
* $P \leq 0.05$, ** $P \leq 0.01$

Fig. (1) Monthly means of male/female ratio of *H. contortus* mature worm burden