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CAPRINE HAEMONCHOSIS: PATHOGENECITY OF *HAEMONCHUS CONTORTUS* INFECTION IN DESERT GOATS, SOUTH DARFUR, SUDAN

(With 2 Tables and 2 Figures)

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أمراضية الإصابة بدودة المعدة في الماعز الصحراوي بولاية جنوب دارفور – السودان

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أجريت في الدراسة عدوى تجريبية في ٢٤ رأس من الماعز الصحراوي لدراسة امراضية ديدان الهيمونكس كونتورتس. أوضحت نتائج هذه التجربة قابلية الماعز الصحراوي للإصابة بمستويات مختلفة من جرعات العدوى من ١٥٠ يرقة معدية/كجم وزن حي فأكثر.أبانت الإصابة أن الخمول، الضعف، فقدان الشهية، الهزال، الإمساك و شحوب الأغشية المخاطية المرئية هي الأعراض السريرية المميزة للمرض. ظهرت بيوض ديدان الهيمونكس كونتورتس في براز الحيوانات المخموجة في الفترة بين اليوم السابع عشر والثامن عشر بعد العدوى وبلغ أعلى معدل لطرح البيوض في اليومين الثالث و العشرون و الرابع و العشرون بعد الإصابة. حدث النفوق بسبب الإصابة خلال الفترة بين اليوم الخامس و الخامس و الثلاثين بعد العدوى في ٥%، ٨٣% و١٠٠% من الماعز الذي تم عدوته بـــ ١٥٠، ٣٠٠ و ٥٠٠ يرقة معدية/كجم وزن حي على التوالي.

SUMMARY

An experimental infection was conducted in 24 Desert kids to study the pathogencity of Haemonchus contortus. The results of the experiment demonstrated the susceptibility of desert goats to different levels of infective doses of 150-larvae/Kg body weight and above. Dullness, weakness, inappentence, emaciation, constipation, and pallor of visible mucous membranes manifested the clinical signs. Haemonchus contortus eggs were detected in faeces of infected animals 17 to 18 days post

infection with a maximum shedding on days 23 or 24. Death occurred within 5 to 35days in 5%, 83% and 100% of goats infected with 150, 300 and 500 L/kg body weight respectively.

Key words: *Haemonchus contortus, Goats*

INTRODUCTION

H. contortus was found to have a serious impact in the production of sheep and goats in the tropics (Eysker and Ogunsusi, 1980 and Fabiyi, 1987). The parasite is a blood sucking, dwells the abomasum of ruminants especially sheep and goats and to a lesser extend cattle. The third infective larvae of H. contortus enter the host and exsheath in the rumen and then migrate to the abomasum to complete their life cycle (Urquhart, *et al.*, 1996). Although H. contortus infect heterologous hosts, the establishment of these parasites on the other hosts is to some extent variable (Soulsby, 1982). In addition, some workers reported that infection of goats with H. contortus showed pathological findings similar to that in sheep (Idris, 1980; Al-Quaisy *et al.*, 1987; Al-Zubaidy *et al.*, 1987 and Rahman and Collinis, 1990). Very few informations were available concerning the experimental effects of Haemonchus contortus on small ruminants in the Sudan. Therefore, this study was designed to assess the pathogenecity of H. contortus infection in the desert goats in South Darfur.

MATERIAL and METHODS

Experimental animals:

Twenty four (6-18 months old) desert goats of both sexes were purchased from the local livestock market at Nyala town and brought to premises of the Faculty of Veterinary Science, Uninersity of Nyala. Unpon their arrival they were ear-tagged and housed in clean disinfected pens. All animals were thoroughly checked for clinical fitness and absence of internal parasites by faecal floatation and centrifugation examinations They were initially given prophylactic anthelmintic treatment (Albendazole 2.5% at dose rate of 1 ml/Kg Bwt. orally) and vaccinated against PPR, HS and goat pox. They were allowed a three-weeks period of adaptation before beginning of the experiment. The animals were fed on sufficient amount of green Lucerne and cereal concentrates with free access to drinking water.

Preparation of the infective material:

About 2000 mature gravid H. contortus females were collected directly from the abomasa of naturally infected goats. All the worms were put in a mortar and then crushed with a pestle to expel the eggs out of the uteri of the worms.

The faecal culture and the harvesting of the infective larval stages were performed according to Urquhart, *et al.* (1996). One ml of the larval suspension was pipetted into a glass slide with cover slip for microscopic examination and counting under low magnification. The number of infective larvae per ml was given as a mean of five repeated readings. The amount of larval suspension (ml) required for infection of experimental animals was determined as follows:

$$\text{Larval suspension (ml)} = \frac{\text{Animal body weight (Kg)} \times \text{infective dose (larvae/Kg Bwt)}}{\text{The number of larvae/ ml}}$$

Experimental design:

The experimental animals were allotted into four equal groups (n=6). Group I goats were orally inoculated with the larval suspension at a dose rate of 150 larvae/Kg Bwt (mild infection). Group II goats were further infected with 300 larvae/Kg Bwt (moderate infection), wehereas group III goats was infected with 500 larvae/Kg Bwt (severe infection). Group IV goats was used as uninfected controls. Details of the experimental design were given in table (1)

Clinical observations:

The experimental animals were thoroughly observed for clinical changes with special attention to appetite, general body condition, visible mucous membranes and consistency of faeces. The body weight of each experimental animal was determined at weekly intervals throughout the experimental period.

Faecal egg count:

Faecal samples were collected daily from the rectum of experimental animals. Faecal egg count was performed by the use of a modified McMaster technique (Urquhart, *et al.*, 1996).

RESULTS

Clinical observations:

Group I animals which were infected with 150 larvae/Kg Bwt did not show adverse clinical changes during the first two weeks of infection. However, they gradually started to lose their appetite

thereafter and became rather dull and inactive. One animal was more severely affected as from day15. It was remarkably weak and depressed, unable to stand and died on day 19 post infection. The other animals continued to be dull, depressed and with reduced appetite. They further became weak and emaciated, with pale visible mucous membranes and rough coat. They were very reluctant to move and tended to keep their tail down. Two animals were unable to stand and they became recumbent and subsequently died on days 25 and 35 post infection. The remaining three animals (survivors), however, started to show a gradual improvement in their appetite and general health until the end of the observation period (7 weeks).

Similar clinical sings were also observed in group II animals, which were infected with 300 larvae/Kg Bwt. One animal died on day 12 post infection after showing remarkable dullness and inappetence. The other animals continued to be dull with extremely reduced appetite and pallor of the visible mucous membranes. They further suffered constipation and severe emaciation. Their condition was much deteriorated by the end of the third week post infection. Four animals were unable to stand and were almost off food. They further became recumbent and subsequently died on days 20, 25, 26 and 29 post infection. The only one animal, which survived infection, started to show a gradual improvement in appetite and general health until the end of the observation period (7 weeks).

Group III animals which were infected with 500 larvae/Kg Bwt showed more pronounced clinical signs of depression, dullness and reduced appetite immediately after the end of the first week of infection. One animal died suddenly on day 5 post infection without showing apparent clinical changes and the rest of the group continued to be weak, depressed and had extremely reduced appetite. They further became emaciated and inactive on the second week of infection. They had rough coat and pale visible mucous membranes. Most animals were reluctant to move and tended to drop their tail down. None of these animals showed any signs of an improvement and died on day 9 (two animals), 12, 15 and 28 post infection.

Control animals (group VI) did not show abnormal clinical changes throughout the observation period.

Body weight:

The results of the body weight of H. contortus infected and control group is illustrated in Fig. (1). Infected animals showed significant reduction ($P < 0.05$) in their mean body weight as from the

second week of infection. However, no significant difference in body weight was observed within animals in the three infected groups. Non-significant increase in body weight was observed in survivor animals in group I and group II by the end of the fourth week and onward. Control animals (group VI) on the other hand showed slightly fluctuation in their body weight throughout the observation period.

Parasitological findings:

The parasitological findings of H. contortus infected goats (group I, II and III) are summarized in table (2). Faecal egg shedding is further illustrated in Fig. (2).

H. contortus eggs started to appear in faeces 17 to 18 days post infection in all infected groups. The prepatent period was calculated as 17.2, 17.8 and 18 days for group I, II and III respectively (table, 2). The maximum egg shedding occurred at days 23, 23 and 24-post infection for group I, II, III respectively (fig., 2).

The mean egg count during maximum shedding was 37.3 X 103 for group I, 82.7 X103 for group II and 254.0 X 103 for group III. A sharp drop in faecal egg count was observed in surviving animals in group I and II as from day 29 post infection. The faecal egg shedding continued to decline in gradual manner and finally disappeared on days 37 and 43 post infection in group II and I respectively.

The establishment rate of H. contortus was variable according to the infective dose (49.9 for group I, 13.1 for group II and 10.9 for group III). A significant difference ($P<0.01$) was found between the establishment rates of different infective doses. Furthermore, the establishment rate showed a negative correlation ($r = 0.927$, $P < 0.01$) with the size of the infective dose.

DISCUSSION

This study was designed to investigate the pathogenecity of the stomach worm infection in the desert goats raised under experimental condition in south Darfur state. The results of study demonstrated that local breeds of goats in South Darfur are fairly susceptible to the experimental infection with infective H. contortus larvae at dose levels of 150, 300 and 500 larvae/Kg Bwt. The main clinical signs were depression, weakness, emaciation, loss of appetite and constipation. Sudden death was observed in cases of high level of infection. These findings were similar to those previously reported for the natural and experimental course of the disease (Fabiyi *et al.*, 1979; Idris, 1980;

Eysker and Ogususi, 1980; Jubb *et al.*, 1985; Blood and Radositis, 1989; and Omar, 1999). However, the submandibular oedema (bottle jaw) reported by some of the previously mentioned authors was not observed in this study. The absence of submandibular oedema is mainly due to the fact that this clinical feature requires much-protracted course of the disease with high worm burden resulting in chronic severe hypoproteinaemia.

Considerable variation in the severity of the clinical signs was observed in goats receiving different levels of infection. The lowest infective dose (150 larvae/Kg) produced mild clinical signs similar to those previously reported by Idris (1980) and Al-Quaisy *et al.*, (1987). However, the latter authors reported death and more severe clinical signs on day 19 and 21 post infection respectively. On the other hand, the higher infective doses (300 and 500 larvae/kg) produced more severe clinical signs and death of the experimentally infected animals. It is therefore, concluded that the level of infection with H. contortus is a major factor with respect to the morbidity and mortality of the disease.

A decrease in body weight was observed in H. contortus infected goats in the present study. This is in agreement with many previous findings (Idris, 1980; Al-Quaisy, *et al*, 1987; and Omar, 1999). The decrease of body weight in H. contortus infected animals may be due to anorexia which results in decrease of food intake and/or decrease of the digestibility of nutrients due to alteration in abomasal pH (Nicholls *et al.*, 1988).

The perpatnent period in H. contortus infected goats in the present work ranged from 17 to18 days in different infected groups. This is in agreement with the previous results of Hunter and Mackenzie (1982) and Omar (1999). The time of the maximum egg shedding was shorter than that reported by Rahman and Collinis (1990). This is probably due to that sheep-derived strain of H. contortus used by those authors had less adaptability to infected goats.

The establishment rate of H. contortus in goats in this study ranged from 10.9 to 49.9 in different infected groups. A significant negative correlation was observed between the establishment rate and infective dose. This may induced the role of the density regularity mechanism on the establishment of the parasite (Michel, 1968). Similar observations in the establishment of H. contortus were previously reported by Salman and Duncan (1984); Al-Quasiy *et al.* (1987) and Rahman and Collinis (1990).

Three different types of host-parasite interactions in H. contortus

infected goats were observed in the present investigation. The first type was characterized by sudden death before the parasite had completed its establishment and maturation. This was observed in animals which received 500 larvae/Kg Bwt. (group III). This type of peracute reaction would not allow the development of clinical signs. The second type of interaction was manifested by detectable illness due to the establishment and maturation of the parasite. This was observed in group II animals, which were infected with 300 larvae/Kg Bwt. Infected goats were not able to withstand the pathogenic effect of the parasite and the host-parasite interaction resulted in severe clinical signs and death. The third type of interaction was reflected by the ability of the host to tolerate infection after the establishment of the parasite and the appearance of the clinical syndrome. This effect was clearly observed in-group I animals which received 150 L/Kg Butt. This type of interaction resembles the self cure phenomenon early stated by Stoll (1929) in which expulsion of burden parasite population coincided with gradual recovery.

REFERENCE

Al-Quaisy, h. H. K.; Al-Zubaidy, A. J.; Altaif, K. I. and Makkawi, T. A. (1987): The pathogencity of haemonchosis in sheep and goats in Iraq: 1. Clinical, parasitological and haematological findings. Veterinary Parasitology, 24: 221-228.

Al-Zubaidy, A.J.; Altaif, K.I.; Alquaisy, H.H.K. and Makkawi, T.A. (1987): Gross pathology and histopathology of haemonchosis in sheep and goats in Iraq. Veterinary Parasitology, 23: 249-256.

Blood, D. C. and Radostitis, O. M, (1989): Veterinary Medicine, A textbook of the diseases of Cattle, Sheep, Pigs, Goats and Horses. 7th Edition, Bailliere Tindall. Oxford University Press. 1502pp.

Eysker, M. and Ogunsusi, R. A. (1980): Observation on epidemiological and clinical aspects of gastrointestinal helminthiasis of sheep in northern Nigeria during the rainy season. Research in Veterinary Science, 28: 58-62.

Fabiyi, J. P.; Oluyede, D. A. and Negedu, J. O, (1979): Late dry season outbreaks of clinical haemonchosis and cooperiasis in cattle of nouthern Nigeria. Veterinary Records. 105: 399-400.

Fabiyi, J. P.(1987): Production losses and control of helminthes in ruminants of tropical regions. International Journal for Parasitology. 17:435-441

Hunter, A. R. and Mackenzie, G. (1982): The pathogenesis of a single challenge dose of H. contortus in lambs under six months of age. Journal of Helminthology, 56: 135-144.

Idris, U. A. (1980): Studies on the chemotherapy of experimental haemonchosis in goats. M. V. Sc. Thesis, University of Khartoum, Sudan.

Jubb, K. V. F.; Kennedy, P. C. and Palmer, N. (1985): Pathology of domestic animals. Academic Press, California.

Michel, J.S. (1968): Immunity to helminth associated with the tissue: Immunity to parasites. 6th Symposium of British Scoaity for Parasitology, 67-89.

Nicholls, C. D.; Lee, D. L.; Adrian, T. E.; Bloom, S. R. and Care, A. D. (1988): Hypergasterinaemia of sheep infected with H. contortus. Research in Veterinary Science, 45: 124-126.

Omar, F. A. (1999): Pathogenesis of H. contortus in naturally and experimentally infected Sudanese Desert sheep. Ph. D. thesis, University of Khartoum, Sudan.

Rahman, W. A. and Collinis, G.H. (1990): Changes in live weight gain, blood constituent and worm egg output in goats artificially infected with a sheep derived strain of H. contortus. British Veterinary Journal, 146: 543-550.

Salman, S. K. and Duncan,J.L. (1984): The abomasal histology of worm free sheep given primary and challenge infection of H. contortus. Veterinary Parasitology, 16: 43-54.

Soulsby, E.J.L.(1982): Helminthes, Arthropods and Protozoa of Domesticated Animals. Bailliere Tindall, London. 809 pp.

Stoll, N. R. (1929): Studies on the strongylid nematode H. contortus. 1. Acquired resistance of hosts under natural reinfection condition out of doors. American Journal of Hygiene, 10: 384-418.

Urquhart, G. M.; Armour, J. Duncan, J. L.; Dunn, A. M. and Jenning, F. W.(1996): Veterinary Parasitology. 2nd edition. Blackwell Science. 279pp.

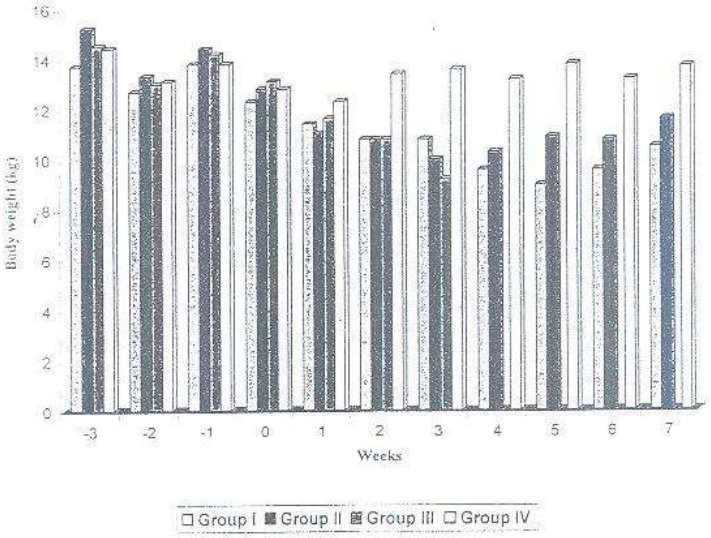
Table .(1): The experimental design.

Group (n = 6)	Mean body weight (Kg)	Infective dose (Larvae/Kg Bwt)	Size of infection (Larvae/animal)
I (Mild infection)	12.3 ± 1.14	150	1854
II (Moderate infection)	12.7 ± 2.2	300	3810
III (Severe infection)	13.1 ± 0.87	500	6550
IV) Control)	12.8 ± 1.00	-	-

Table. (2): Parasitological findings in H. contortus infected groups

Group	Infective dose (L/Kg)	Prepatent Period (days)	Onset of max egg shedding (days)	Maximum shedding (mean epg)	Mean worm Recovery (Adult+larvae)	Establishment rate (%)
I (n = 6)	150	17.2 (n = 6)	22 (n = 5)	37.3×10^2 (n = 5)	920.7	49.9 (n = 3)
II (n = 6)	300	17.8 (n = 5)	23 (n = 4)	82.7×10^2 (n = 4)	499.1	13.1 (n = 5)
III(n = 6)	500	18 (n = 1)	24 (n = 1)	254×10^2 (n = 1)	714	10.9 (n = 6)

Fig. 1: Mean values of body weight of *H. contortus*- infected and control goats.



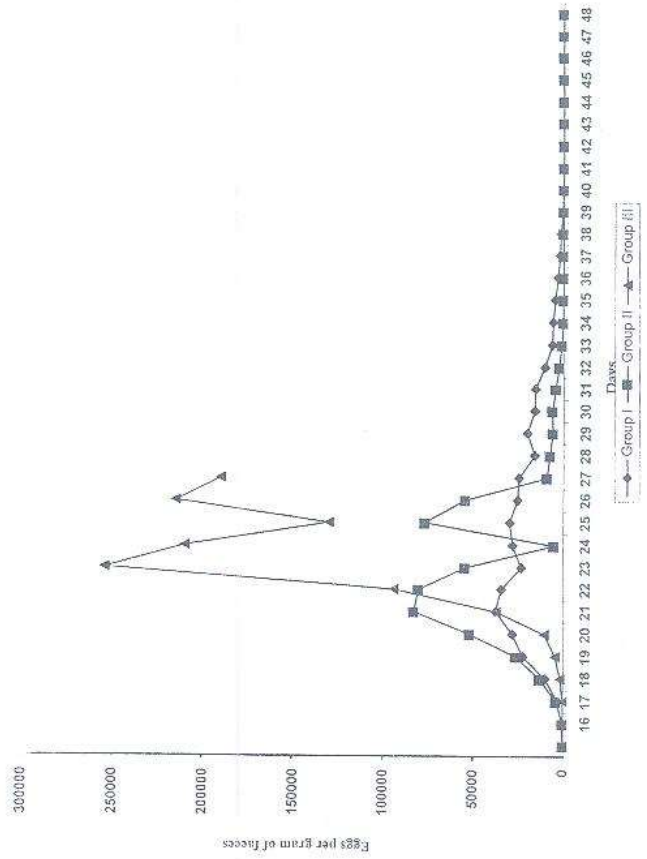


Fig. 2: Faecal egg shedding in different *H. contortus* - infected groups