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The Bulletin of Animal Health and Production in Africa publishes articles on original research relevant to animal health and production activities which may lead to the improvement of the livestock industry in Africa and better utilisation of her animal resources. The journal is published quarterly.

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BULLETIN

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GASTROINTESTINAL NEMATODE INFECTIONS IN SHEEP GRAZING ON COMMUNAL LAND IN NYANDARUA DISTRICT OF CENTRAL KENYA IN RELATION TO DEWORMING PRACTICES

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1Department of Veterinary Pathology & Microbiology, Faculty of Veterinary Medicine, University of Nairobi P.O. Box 29053, Nairobi, Kenya.
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INFECTIONS PAR LES NEMATODES GASTRO-INTESTINAUX CHEZ LES MOUTONS EN PATURAGE SUR LES TERRES COMMUNALES DANS LE DISTRICT DE NYANDARUA AU CENTRE DU KENYA PAR RAPPORT AU DEPARASITAGE

Résumé

Une étude a été conduite en vue de déterminer la prévalence et l'intensité de l'infection par les nématodes gastro-intestinaux chez les moutons, par rapport aux méthodes de déparasitage, sur les terres communales du canton d'Oi-Kalau dans le district de Nyandarua au Centre du Kenya. En août 1996, au total 100 agneaux âgés de 4 à 6 mois étaient choisis parmi les troupeaux de moutons appartenant à 10 propriétaires de bétail qui faisaient paître leurs moutons sur les terres communales dans la région. Les agneaux étaient marqués à l'oreille puis, on les laissait continuer à paître avec les autres moutons. Les propriétaires pouvaient déparasiter tout leur troupeau, y compris les agneaux faisant l'objet d'étude, quand ils le souhaitaient, mais ils enregistraient chaque fois qu'ils déparasitaient les animaux. Les œufs de nématode par gramme de fèces (EPG) pour chaque agneau étaient déterminés toutes les trois semaines pendant 12 mois. Des cultures fécales des agneaux étaient également préparées et des larves identifiées durant les saisons sèche et pluvieuse. Six éleveurs sur dix déparasitaient leurs moutons tous les 3 à 4 mois ; deux éleveurs parmi le reste déparasitaient leurs moutons 2 fois/an à 5 – 6 mois d'intervalle et les deux autres ne déparasitaient leurs animaux qu'une seule fois par an. Les traitements anthelmintiques étaient efficaces et ont permis aux animaux de se débarrasser des charges parasitaires comme le montre la baisse des EPG chez les agneaux faisant l'objet d'étude. Cependant, puisque ce n'était pas tous les éleveurs qui déparasitaient leurs animaux en même temps, les agneaux étaient réinfectés peu après le traitement à chaque fois. Lorsque la majorité des éleveurs déparasitaient leurs troupeaux présque en même temps, les EPG chez les moutons étaient fortement réduits. Haemonchus contortus était le nématode le plus répandu dans les cultures fécales pendant la saison des pluies (56%) et la saison sèche (62%), suivi par Trichostrongylus spp (28% et 21% respectivement), Oesophagostomum spp (12% et 9% respectivement) et Cooperia spp (4% et 8% respectivement). Les résultats de cette étude révèlent que dans le pâturage communal de certaines parties du canton d'Oi-Kalau où les moutons sont constamment exposés à l'infection, les nématodes gastro-intestinaux sont probablement la cause principale de la faible productivité et de la mauvaise santé des troupeaux. Il est possible de mieux réussir la lutte contre ces parasites grâce aux traitements anthelmintiques stratégiques ordonnés à tous les moutons à peu près à la même période, de préférence pendant la saison pluvieuse. En effet, ces traitements pourraient réduire la contamination des pâturages par les troupeaux non-traités ; cette contamination est un phénomène courant sur les pâturages communaux et elle rend presque tout le temps ces pâturages fortement infectants.

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Summary

A study was carried out to determine the prevalence and intensity of infection with gastrointestinal nematodes in sheep, in relation to deworming practices, on communal land in Ol-Kalau division of Nyandarua District in central Kenya. In August 1996, a total of 100 lambs aged between 4 and 6 months, were selected from sheep flocks belonging to 10 livestock owners who grazed their sheep on communal land in the area. The lambs were ear-tagged and allowed to continue grazing with the other sheep. The owners were allowed to deworm their entire flock including the study lambs whenever they wished to do so, but to record each time they dewormed the animals. Nematode eggs per gram (EPG) of faeces for each lamb were determined every three weeks for a period of 12 months. Faecal cultures from the study lambs were also prepared and larvae identified during the dry and rainy seasons. Six out of the 10 farmers dewormed their sheep every 3 to 4 months and the other two dewormed their animals only once during the entire 12 month. The anthelmintic treatments were effective in clearing worm burdens in the treated animals as evidenced by a reduction in the EPG for the study lambs. However, because not all farmers dewormed animals at the same time, the study lambs got re-infected soon after treatment in all cases. When majority of the farmers dewormed their flocks almost at the same time, the nematode EPG in the study lambs were significantly reduced. *Haemonchus contortus* was the most prevalent nematode in faecal cultures during the rainy season (56%) and dry season (62%), followed by *Trichostrongylus spp.* (28% and 21%, respectively), *Oesophagostomum spp.* (12% and 9%, respectively) and *Cooperia spp.* (4% and 8%, respectively). Results from this study indicated that under the communal grazing system practised in parts of Ol-Kalau division where sheep are constantly exposed to infection, gastrointestinal nematodes are likely to be a major cause of lowered productivity and ill health. Control of these parasites can best be achieved through strategic anthelmintic treatments given to all sheep approximately the same time preferably during the rainy season. This would be expected to reduce pasture contamination from untreated flocks, a common phenomenon on communally grazed pastures, which renders such pastures highly ineffective almost all the time.

Introduction

Small ruminants constitute an important source of dietary protein and income to smallholder farmers in tropical and subtropical regions of the world\(^1\). However, production levels are often low because of a number of factors, which include poor nutrition, poor management, diseases and internal parasites. While poor nutrition is considered the most critical factor, parasitism constitutes a major source of economic loss\(^1\). Gastrointestinal nematode parasites have been shown to reduce feed intake and nitrogen retention and correspondingly reduce growth rate by up to 30% or more\(^2\), in addition to other deleterious effects\(^3\). These losses may occur as a result of high mortality and reduced growth rate especially in kids and lambs. In adults, the effects of gastrointestinal nematode parasitism may be manifested as an increase in kidding and lambing intervals and reduced wool and meat production. To reduce production losses in small ruminants, control of these parasites is therefore important.

Control of gastrointestinal nematode infections in ruminants in Kenya is based primarily on the use of anthelmintics\(^4,5\). Anthelmintics can offer excellent control of these parasites in grazing ruminants, if applied at the appropriate time of the year, by eliminating the adult parasites in the host and reducing pasture contamination and subsequent infectivity. In many parts of tropical and subtropical Africa, livestock owners traditionally graze their livestock on communal land. These animals are not dewormed at the same time which implies that there is potential for constant pasture contamination and host re-infection soon after deworming. The epidemiology of gastrointestinal nematode infections in
Table 1: Mean strongyle eggs per gram of faeces for lambs belonging to 10 farmers but grazing together on communal land in Ol-Kalau division in Nyandarua District of Kenya. The samples were collected on 19 sampling occasion over a period of 12 months (Aug months (Aug. 96 to Aug. 97). The symbol (*) indicates the approximate time when anthelmintic treatments were given each flock.

<table>
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<tr>
<th>MONTH Sampling Occasion</th>
<th>Aug 96</th>
<th>Sep 96</th>
<th>Oct 96</th>
<th>Nov 96</th>
<th>Dec 96</th>
<th>Jan 97</th>
<th>Feb 97</th>
<th>Mar 97</th>
<th>Apr 97</th>
<th>May 97</th>
<th>Jun 97</th>
<th>Jul 97</th>
<th>Aug 97</th>
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<td>2000</td>
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<td>1700</td>
<td>2100</td>
<td>0 10</td>
<td>900</td>
<td>500</td>
<td>300</td>
<td>1100</td>
<td>3500</td>
<td>2500  4000</td>
<td>0 500  700</td>
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<td>2100</td>
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<td>1900</td>
<td>2800</td>
<td>0</td>
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small ruminants on private farms in various parts of Kenya has been examined by several workers\textsuperscript{3,6,7}. Information from these studies has formed the basis for recommendations on which worm control strategies under such management systems can be based. Comparable information for ruminants grazing on communal land in various parts of the country is however, lacking. The objective of this study was to examine the prevalence and intensity of infection with gastrointestinal nematodes in sheep grazed on communal land in Ol-Kalou division of Nyandarua District, in relation to the deworming regimes practised by the livestock owners over a period of 12 months.

Materials and Methods

Study Area

This study was carried out over a period of 12 months (August 1996 to August 1997) on sheep belonging to 10 farmers who grazed their livestock near Lake Ilporosat in Ol-Kalou division of Nyandarua District. The study area is located at an altitude of approximately 2200 metres above sea level with a cool, wet climate and mean annual rainfall of between 1780 and 2030 mm. The rainfall is bimodal, March to June (long rains) and October to December (short rains). The mean minimum monthly air temperature varies from 6\(^\circ\)C to 10\(^\circ\)C, while the mean maximum temperature varies from 22\(^\circ\)C to 26\(^\circ\)C. This climate is conducive for transmission of gastrointestinal nematodes almost throughout the year.

Study design

At the beginning of the study, a total of 10 young lambs, belonging to each of the 10 farmers, and aged between 4 and 6 months were ear tagged and allowed to continue grazing together with the other sheep belonging

Results

The mean monthly rainfall and the mean maximum and minimum monthly air temperatures recorded in the area during the study period (August 1996 to August 1997) are shown in Figure 1. October and November 1996 and April to July 1997 were the periods of the short and long rains seasons, respectively.

Table 1 shows the mean strongyle nematode EPG for the study lambs belonging to each farm during the 12 months study. The approximate period when the individual flocks were dewormed is shown by the symbol (*) in Table 1. Six out of the 10 farmers (Farmers No. 1-6 in Table 1) dewormed their sheep every 3 to 4 months during the study. These treatments were based on the farmers perception of the need to deworm the flock. Two of the other farmers (Farmer No. 7 and 8) dewormed sheep 2 times in a year, during the rainy season, which was an interval of 5 to 6 months. The other two farmers (Farmer No. 9 and 10) dewormed their animals only once during the entire 12 months. Except on a few occasions, the anthelmintic treatments given to the sheep flocks cleared worm burdens in the treated animals. This was evidenced by a reduction in the mean EPG for the study lambs soon after the treatments were given. In all cases however, the study lambs got re-infected soon after and all faecal samples taken during the second sampling occasion following the anthelmintic treatments were positive for strongyle nematode eggs. From then onwards, the mean nematode EPG for the study lambs steadily rose, and remained high until after the next treatment had been given.

Figure 2. shows the combined overall mean strongyle nematode EPG for all 100 lambs at each sampling occasion during the 12 months of the study. Mean strongyle nematode EPG were high during the
Figure 2: Arithmetic mean strongyle nematode eggs per gram (EPG) of faeces for 100 lambs grazing on communal land in Ol-Kalau division of Nyandarua District in central Kenya. The samples were collected on 19 occasions over a period of 12 months (August 1996 to August 1997).
Table 2: Mean percentage distribution of genera of gastrointestinal nematodes in faecal cultures from lambs grazed on communal land in central Kenya during the rainy season in November 1996 and the dry season February 1997.

<table>
<thead>
<tr>
<th>Nematode Genera</th>
<th>Mean percentage occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rainy season (Nov. 1996)</td>
</tr>
<tr>
<td><strong>Haemonchus</strong></td>
<td>56 (30-72)</td>
</tr>
<tr>
<td><strong>Trichostrongylus</strong></td>
<td>28 (15-35)</td>
</tr>
<tr>
<td><strong>Oesophagostomum</strong></td>
<td>12 (0-40)</td>
</tr>
<tr>
<td><strong>Cooperia</strong></td>
<td>4 (0-12)</td>
</tr>
</tbody>
</table>

entire study period. At all times during the 12 months, there were animals that were shedding nematode eggs and contaminating pastures. There was however, a drop in overall mean EPG between October and November 1996 (sampling occasion 4 to 6), the lowest overall mean EPG (560±641) being recorded in November 1996. This coincided with deworming of animals by majority of the farmers (7 out of 10) in October and November 1996. The overall mean EPG then steadily rose during the dry season, from 928±1107 in December 1996 to 1423±1311 at the end of March 1997. A second drop in overall mean EPG occurred during the long rains season in April and May 1997 when 6 out of the 10 farmers again dewormed their animals almost at the same time.

Table 2. shows the percentage distribution of various genera of gastrointestinal nematode larvae in the faecal cultures during the rainy season in November 1996 and the dry season in February 1997. *Haemonchus contortus* was the most commonly found nematode during both seasons, with mean percentage prevalences of 56% and 62% during the rainy seasons respectively. Other nematode genera found in order of prevalence were *Trichostrongylus* spp., *Oesophagostomum* spp. and *Cooperia* spp. There were no difference in the occurrences of the various genera of nematode from one farmer’s lambs to the other.

**Discussion**

Results from this study clearly indicated that sheep grazed on communal land in Ol-Kalou division of Nyandarua District have high levels of infection with gastrointestinal nematodes almost throughout the year despite the fact that the number of the livestock owners often deworm their animals. In contribution to economic losses in sheep and goats in the tropics, *Haemonchus contortus* mainly⁴,⁵ and to some extent *Trichostrongylus colubriformis*⁴,⁵ and occasionally *Oesophagostomum columbiae*⁴,⁵ are the most important. Production losses due to these parasites are generally high⁶. Faecal cultures from sheep in the present
study indicated that *Haemonchus* was the most prevalent nematode species, followed by *Trichostrongylus*. These findings are similar to those earlier recorded on private sheep farms in the district⁷ and indicated that under the communal grazing system practised in parts of Ol-Kalou division where sheep are constantly exposed to infection, gastrointestinal nematodes are likely to be a major cause of lowered productivity and ill health.

Results of this study also revealed that anthelmintic treatments given to sheep eliminated worm burdens, which was reflected in a drop in nematode EPG in the following one or two subsequent sampling occasions. However, because not all livestock owners dewormed their sheep at the same time, pasture contamination and infectivity remained high and all animals that were dewormed got re-infected soon after. During occasions when majority of the livestock owners dewormed their animals almost at the same time (October and November 1996 and April and May 1997), the levels of nematode EPG in the study lambs went down. These results suggest that to achieve effective control of gastrointestinal nematodes in sheep on communal grazing land in this area, the livestock owners need to deworm their animals at approximately the same time or deworm animals frequently at every short intervals as has previously been suggested¹⁷.

Previous studies on the epidemiology of nematode infection in sheep on private farms in the district⁷ have shown that pasture infectivity and levels of host infection are highest during the rainy season. Deworming sheep on private farms 3 to 4 weeks after the onset of both the long and short rains seasons and in the middle of the long rains season in this area has also been shown to effectively control nematode infections¹⁸. Results obtained from the present study do seem to support this deworming strategy. This is because although October and November 1996 and April and May 1997 were the rainy seasons when pasture infectivity is expected to be high, the levels of nematode infections were well controlled in the study animals, through deworming by majority of the farmers. If all the livestock owners dewormed their livestock at approximately the same time, following the above strategy, it is possible that worm control would be achieved. Bakunzi and Serumage-Zake¹⁷ working with sheep on communal land in South Africa suggested that, because most gastrointestinal nematodes pre-patent period is between 3 and 6 weeks, to gain maximum economic advantage from deworming under such conditions, anthelmintic treatments should be given every 4 weeks. While this strategy may be very effective in controlling the parasites, it has the danger of heavily selecting for worms that are resistant to anthelmintics¹⁹,²⁰. Such a strategy would also be very expensive in terms of anthelmintics to resource-poor farmers and it is therefore not recommended.

Acknowledgement

This study was funded through the DANIDA, ENRECA Livestock Helminth Research Project at the University of Nairobi. This financial assistance is acknowledged. We also thank the livestock owners who allowed the use of their animals in this study.

References


Received for publication on 27th July, 2001.
GASTROINTESTINAL HELMINTHS OF SCAVENGING FOWL IN AND AROUND
BAHIR DAR IN NORTHWEST ETHIOPIA

A. KIDANEMARIAM

National Animal Health Research Center, P.O. Box 04, Sebeta, Ethiopia.

LES HELMINTHES GASTRO-INTESTINAUX DES VOLAILLES
EN ELEVAGE EXTENSIF A BAHIR DAR ET DANS SES ENVIRONS
AU NORD-OUEST DE L’ETHIOPIE

Résumé

Une étude a été menée afin de déterminer les espèces d’helminthes gastro-intestinaux et leur prévalence chez les volailles en élevage extensif à Bahir Dar au nord-ouest de l’Ethiopie. Sur les 106 poulets examinés, 98 (92,4%) étaient infectés par une ou plusieurs espèces d’helminthes.

Au total, dix espèces d’helminthes étaient identifiées. Les espèces d’helminthes identifiées et leur prévalence étaient comme suit : *Amoebotaenia sphenoides* (12,2%), *Ascaridia galli* (62,2%), *Choanotaenia infundibulum* (8,4%), *Dyspharynx nasuta* (3,7%), *Heterakis gallinarum* (25,4%), *Hymenolepis cantiana* (27,3%), *Raillietina cesticillus* (6,6%), *Raillietina echinobothrida* (33%), *Raillietina tetrata* (32%) et *Subulura brumpti* (8,4%). 83,7% des poulets examinés avaient chacun des infections multiples, qui variaient entre deux espèces (45,92%) et six espèces (7,14%).

La présente étude a révélé une plus forte prévalence des helminthes gastro-intestinaux chez les volailles à Bahir Dar et il est proposé d’élaborer un programme de prévention, qui comprend la sensibilisation des éleveurs de volailles, la motivation du personnel vétérinaire et la fourniture d’anthelminthiques efficaces. En outre, il faudrait mener d’autres enquêtes pour déterminer l’importance pathologique des infections multiples par les helminthes.

Summary

A study was conducted to determine the species of gastrointestinal helminths and their prevalence in fowls kept extensively in Bahir Dar in northwest Ethiopia. Of the 106 chickens examined, (98/106) were infected with one or more species of helminth parasites.

A total of ten species of helminths were identified. The species of helminths identified and their prevalence were: *Amoebotaenia sphenoides* (12.2%), *Ascaridia galli* (62.2%), *Choanotaenia infundibulum* (8.4%), *Dyspharynx nasuta* (3.7%), *Heterakis gallinarum* (25.4%), *Hymenolepis cantiana* (27.3%), *Raillietina cesticillus* (6.6%), *Raillietina echinobothrida* (33%), *Raillietina tetrata* (32%) and *Subulura brumpti* (8.4%). 83.7% of the fowls examined had multiple infections ranging from two species (45.92%) to six species each (7.14%).

The present study showed a higher prevalence of gastrointestinal helminths of fowls in Bahir Dar and it is suggested that a preventive program, which includes sensitization of poultry breeders, motivation of veterinary personnel and supply of efficient anthelmintics be established. Moreover, further investigations are needed in order to determine the pathological importance of multiple helminth infections.
Introduction

A condition very often ignored, yet playing a significant role in adversely affecting the health of poultry is that caused by parasitic helminths\textsuperscript{1,2}. Helminthosis is still an important disease of poultry in the tropics where the standard of husbandry is often poor yet conditions are favorable for the developments of parasites\textsuperscript{3}.

According to the Food and Agriculture Organization\textsuperscript{4}, approximately 800 million fowls are found in Africa. Ethiopia has an estimated 54 million fowls. In Bahir Dar, the fowl consists largely of local fowls, which are kept under the traditional extensive or rural scavenging system and are subjected to the vagaries of nature. Subsistence farmers own 99\% of the population maintained under this extensive management system.

In Ethiopia, like other developing countries, there is a tendency to overlook the helminth parasites of poultry, more attention being given to viral, bacterial and protozoal diseases as these are often associated with high mortality with great economic consequences. However, the losses due to inefficient feed utilization and the deleterious effects of helminths are not quantifiable. Very few studies have been carried out on the effects of parasites in Ethiopia\textsuperscript{5,6,7} and relevant data related to helminthosis of indigenous fowl are still scanty. The present study was, therefore, carried out to provide additional information on the subject.

Materials and Methods

Study area

The study was conducted in and around the town of Bahir Dar, north west Ethiopia, which is situated on the southern shore of Lake Tana between 37°E and 11°N at an altitude of 1,802 m above sea level. Indegenous fowl make 99\% of the domestic poultry population in the study area and are estimated to be 518,400, accounting for 0.96\% of the total fowl population of the country\textsuperscript{8}. The poultry management system in the area is generally poor and includes the backyard free-range system where fowls are left free during the daytime to scavenge around to obtain food and kept indoor during the night together with the family. Occasionally household food wastes may be used as supplements.

Collection of specimens

Most of the chicken viscera from which helminths were recovered were collected from different hotels and private residences in Bahir Dar town where chickens are slaughtered for consumption. The other sources of specimen were fowls, which came to the local veterinary clinic for clinical inspection and necropsy. All the fowls examined from each source were considered as one population, as they had originated from similar environment and management practices.

Necropsy and collection technique of parasites

The dead birds or those selected for necropsy brought to Bahir Dar veterinary clinic were examined following the procedure described elsewhere\textsuperscript{9}. Their alimentary tracts were removed and the lumens exposed by longitudinal incision extending from the oesophagus to the rectum. The viscera collected from hotels and private residences were treated in similar manner.

Visible helminths were picked up using thumb forceps and preserved as described below. Once the largest worms were removed, the intestinal contents were gently evacuated into a container. The intestines were then spread on a dark surface and submerged under water to make the small
tapeworms on the intestinal mucosa visible against the dark background. The worms were then gently removed from the intestine using thumb forceps ensuring that all parts of the worms including the scolices were removed.

The intestinal contents were sedimented several times until most of the ingesta were removed and the worms could easily be seen. The sediment was then washed through sieves of 0.90 mm mesh size. The residue was poured on a dark surface and the visible worms recovered. The residue was poured on a dark surface and visible worms recovered. The rest of the material on the dark plate was examined under a stereomicroscope or magnifying lenses for small worms.

To recover worms embedded in the intestinal mucosa, scrapings of the mucosa were made and examined under the microscope for the presence of small helminths. In a few instances part of the intestine was cut and placed in warm physiological saline in a petridish so that worms would crawl out and float in the water. The water was then examined for worms under the microscope.

**Preservation and identification of helminths**

The worms collected above were first washed in distilled water and then preserved in 70% ethanol. Worms were identified as described by previous workers\textsuperscript{10,11}. The worms were picked up from the preservative using thumb forceps, cleared in 5% lactic acid and examined under the light

<table>
<thead>
<tr>
<th>Helminth species</th>
<th>Prevalence (%)</th>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ascaridia galli</em></td>
<td>62.2 (83.5)</td>
<td>1-100</td>
<td>7.8</td>
</tr>
<tr>
<td><em>Dyspharynx nasuta</em></td>
<td>3.7 (5.0)</td>
<td>7-31</td>
<td>20.2</td>
</tr>
<tr>
<td><em>Heterakis gallinarum</em></td>
<td>25.4 (34.1)</td>
<td>2-72</td>
<td>12.3</td>
</tr>
<tr>
<td><em>Subulura brumpti</em></td>
<td>8.4 (11.3)</td>
<td>8-57</td>
<td>16.5</td>
</tr>
<tr>
<td><strong>Cestode worms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Amoebotaenia sphenoides</em></td>
<td>12.2 (15.5)</td>
<td>2-56</td>
<td>16.3</td>
</tr>
<tr>
<td><em>Choanotaenia infundibulum</em></td>
<td>8.4 (10.7)</td>
<td>2-32</td>
<td>7.6</td>
</tr>
<tr>
<td><em>Hymenolepis cantiana</em></td>
<td>27.3 (34.5)</td>
<td>5-250</td>
<td>45.8</td>
</tr>
<tr>
<td><em>Rallietina cesticillus</em></td>
<td>6.6 (8.3)</td>
<td>4-8</td>
<td>6.0</td>
</tr>
<tr>
<td><em>Rallietina echinobothrida</em></td>
<td>33.0 (41.6)</td>
<td>3-140</td>
<td>17.8</td>
</tr>
<tr>
<td><em>Rallietina tetragona</em></td>
<td>32.0 (40.6)</td>
<td>3-45</td>
<td>14.5</td>
</tr>
</tbody>
</table>
microscope with 40-100 X magnifications or kept in a petridish and examined under a stereomicroscope. All identified worms were counted.

### Results

Parasitic gastro-intestinal helminths that were encountered in poultry in and around Bahir Dar fell under the classes Nematoda (nematodes) and Cestoda (cestodes). Nematodes identified belong to the families of Ascariddidae (*Ascaridia galli*), Acuaridae (*Dyspharynx nasuta*), and Heterakidae (*Heterakis gallinarum & Subulura brumpti*) while the cestodes fell within the families of Davainedae (*Raillietina echinobothrida, Raillietina cesticillus* and *Raillietina tetragona*), Dilepididae (*Amoebotaenia sphenoides & Choanotae- nia infundibulum*) and Hymenolepidae (*Hy- menolepis cantiana*) (Table 1). The identified helminthis are classified according to Soulsby (1982)\textsuperscript{11}.

Of the infested fowls, 16.3\% (16/98) harbored one species of helminths each, 45 (45.9\%) had 3 species, 30 (30.6\%) had 4 species and 7 (7.14\%) had 6 species (Figure 1). It was observed that *A. galli* formed the major combination with almost all helminth parasites that colonized the

![Figure 1. Number of helminth species per fowl and the percentage of fowls infested](attachment:image.png)
same host. A. galli was found to be the most common (83.5%) roundworm in Bahir Dar followed by H. gallinarum (34.1%). Among the cestodes, R. echinobothrida and R. tetragona with the prevalence rates of 41.6% and 40.6% respectively, were the more widespread tapeworms.

Discussion

The results of the present study showed that the prevalence of gastrointestinal helminths in the study area was high and many birds had multiple infections. Earlier studies on parasitic problems of domestic fowl in Ethiopia have recorded some similar helminths\(^6\).\(^7\). An investigation in Ghana demonstrated 18 species of helminth parasites from the gastrointestinal tract of local scavenging chickens\(^12\). Otaru and Nsengwa\(^13\) recovered nine species of helminths in the Mtwar Region of Tanzania. A study of helminth parasites of poultry in the Sudan also recorded Raillietina spp., Hymenolepis spp., Amoebotaenia sphenoides and Subulura brumpti\(^14\).

The prevalence of parasites in local fowls can be associated with the exposure to range conditions where chickens are always seeking food in the superficial layers of soil, which often contaminated with invertebrate organisms that serve as intermediate hosts for helminth parasites\(^2\).\(^3\).\(^15\).

The most prevalent roundworm in the study area was A. galli and is the most disastrous worm\(^16\). Although chickens that are three months or older manifest considerable resistance to infestation with A. galli\(^17\), the recovery of bundles of the worm (maximum count = 100) in the intestinal lumen of the birds examined caused distention and occlusion of the intestine. A survey conducted in Uganda showed large numbers of A. galli worms clumped together in masses the size of golf balls in the intestines of local birds\(^17\).

The relatively high infection rates with the cestodes Raillietina spp. could be attributed to the exposure of local fowl to the widespread and easily available intermediate hosts, such as ants, earthworms and beetles. The high prevalence of cestodes that use beetles as intermediate hosts is well documented\(^18\). These cestodes were found to be common in Uganda in chickens kept under similar management situations\(^3\). The tapeworm, R. echinobothrida induces the formation of nodules in the intestinal wall that can lead to confusion with tuberculosis\(^11\). In the present study a similar nodular swelling of the intestinal serosa appeared in one case, which was infested with R. echinobothrida and R. tetragona. The greater prevalence rate of this tapeworm (R. echinobothrida) coupled with the highly pathogenic nature of the parasite poses danger on poultry farming\(^16\).

The majority of helminths species midentified are reported to be potentially pathogenic for the fowl, in which they may cause enteritis, ulcerations or granulomas followed by anorexia, depression, emaciation and death\(^11\).

In view of the occurrence of different species of gastrointestinal helminths at higher prevalence in scavenging fowls in Bahir Dar, it is suggested that a preventive program, which includes sensitization of poultry breeders, motivation of veterinary personnel and supply of efficient anthelmintics be established.

However, the impact of the parasitic infections was not investigated and further studies are needed to determine the pathological importance of multiple helminth infections in local fowls.

Acknowledgements

The author is grateful to staff of Bahir Dar Regional Veterinary Laboratory, Parasitology Department, for their technical assistance. The comments of Dr. Kassa
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References


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CASH-FLOW MODEL OF THE COST OF BRUCELLOSIS IN TRADITIONALLY MANAGED CATTLE HERDS IN NIGERIA

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MODELE D’ANALYSE DES PERTES ET PROFITS A LA SUITE DE LA BRUCELLOSE CHEZ DES TROUPEAUX BOVINS EN ELEVAGE TRADITIONNEL AU NIGERIA

Résumé

L'analyse des pertes et profits dans le système traditionnel de production bovine dans les réserves de pâturage de Wase et Wawa-Zangee a été faite afin de déterminer la rentabilité ou non du système.

L'analyse précitée porte sur un troupeau moyen et inclut le coût de la brucellose bovine et la valeur de la main-d'œuvre de la famille nomade, qui se chiffrent chaque année à 44.892 N (528,14 $ EU) à Wase et à 93.289 N (1.097,52 $ EU) à Wawa-Zangee.

Sous le système traditionnel actuel de production bovine, le nomade à Wase semble gagner/an/troupeau 21.279 N (250,34 $ EU). Toutefois, chez le troupeau infecté par Brucella, le nomade dépense en moyenne par troupeau 3.571 N (42,01 $ EU), ce qui réduit le profit à 17.708 N (208,33 $ EU). Dans la réserve de pâturage de Wawa-Zangee, la gestion d’un troupeau bovin revient à 12.799 N (150,58 $ EU) par an. Le coût annuel de la production bovine chez un troupeau affecté par la brucellose s’élevait à 15.289 N (179,87 $ EU), soit un frais supplémentaire de 2.490 N (29,29 $ EU). La différence entre le coût de la brucellose dans les deux réserves n’était pas significative (P > 0,05). Il semble que les nomades élèvent leur bétail à perte, mais les pertes subies sont beaucoup plus importantes (P < 0,05) à Wawa-Zangee qu’à Wase. Les nomades qui s’établissent devraient être éduqués et réorientés vers une production bovine plus rentable. La main-d’œuvre familiale pourrait être affectée à la culture des céréales, au développement des pâturages et à l’éducation des jeunes pasteurs.

Summary

Herd-based cash-flow, profit and loss analysis of the traditional system of cattle production in Wase and Wawa-Zangee grazing reserves were carried out in order to determine the profitability or otherwise of the system.

Cash-flows indicate an average herd, with inputted cost of bovine brucellosis and the worth of the nomad family labour input, forgo a sum of N44,892.00 ($528.14) in Wase and N93,289.00 ($1,097.52) in Wawa-Zangee annually.

Under the current traditional system of cattle production, the nomad in Wase appear to gain a sum of N21,279.00 ($250.34) per herd annually. In brucella-infected herd however, it cost the nomad an average sum of N3,571.00 ($42.01), per herd, reducing the gain to N17,708.00 ($208.33). In Wawa-Zangee grazing reserve, it costs a sum of N12,799.00 ($150.58) per annum to manage a herd of cattle. The annual cost of cattle production in a herd with brucellosis amounted to N15,289.00 ($179.87) an additional cost of N2,490.00 ($29.29). The differences between the cost of brucellosis per herd in the two reserves were not significant (P>0.05). The nomads appear to be managing the cattle at a loss. The imputed losses are however significantly higher (P<0.05) in Wawa-Zangee compared to those incurred in Wase. The need to educate and re-oriented cattle production is indicated. The opportunity cost of labour input by the family could be diverted to crop farming, pasture development and the education of the young herders.

*Corresponding Author.
Introduction

The nomadic Fulani are the focus of most studies relating to cattle production in Nigeria. It is important that their way of life and general sociology be understood in order to ensure that the study of their animal, the main source of their livelihood, is relevant and considered in proper perspective. The nomads exhibit seasonal migration in search of grazings and water for their valued cattle. During such movements the animals are exposed to numerous diseases and have clashes with crop farmers. The nomads are being settled in Wase and Wawa-Zange grazing reserves in Plateau and Gombe States respectively. An objective of the settlement is to improve the productivity of the nomad's cattle and involve them in socio-economic development of the nation. Development programmes that ignore or belittle basic cultural realities of the nomad may as well be self defeating.

Availability of pasture and water for livestock appear to determine the willingness of the nomad to settle in the grazing reserves. The prevalence rate of brucellosis, an important reproductive and economic disease, found to be 12.0% and 7.0% in Wase and Wawa-Zange grazing reserves respectively. The financial losses and social consequences of brucellosis based on the current prevalence rate have also been enumerated. The sociology of the nomads including demographic characteristics, animal husbandry practices, social organisations at various levels such as family units migratory trends and economic activities have been studied.

The traditional system of animal husbandry is considered cheap in terms of labour and feed requirements. The opportunity cost of a whole family unit involvement in herding cattle is often not taken into consideration. This investigation aims at determining the profitability of the traditional system of animal production using a reproductive disease such as brucellosis and inputted labour requirement of the nomad's family as indices. The findings are expected to serve as basis for advising the nomads to engage in purposeful and profit-oriented livestock production.

Materials and Methods

Scheduled visits were made to Wase and Wawa-Zange grazing reserves in order to be acquainted with the mode of life of the settling nomads. Group meetings were held with the nomads during which occasion their views on the development of the grazing reserves were obtained. Structured questionnaires were applied during such meetings to complement personal observations. The questionnaires among other things addressed issues such as the number and price at which cattle were sold, sale of milk and other livestock including poultry, number of dead cattle with possible reasons, expenses on hired labour (hired herder), cost of supplementary feeding and veterinary services. The questionnaires were applied during the rainy season (May to November) when most of the nomads usually returned to the grazing reserves. An interpreter who was fluent both in Hausa and Fulfulde assisted in interpreting the contents of the questionnaire.

Farm-gate prices of various age group of cattle and milk were used to value the cattle per herd and the milk sold. At off-take rates of 25%, 15%, 10% and 10% for sheep, goats, chicken and ducks respectively, the average prices at which these groups of livestock were sold formed the basis for estimating the income of the nomads. Cash outflows were estimated based on the cost of dead cattle not sold, cost of veterinary services and cost of supplementary feeding with salt licks. Cost of used capital was estimated at an interest rate of 29%. 
Estimated financial losses due to bovine brucellosis in the form of calf and milk losses resulting from Brucella-associated abortions was used as a disease index. A hired labour was housed at approximately N365.00 (US$ 4.29) per annum (the rate of N85 = 1 US$) in thatched hut and fed at the rate of N30.00 (0.35 US$) per day. Such a hired herder is compensated with a female calf if the herd size is large that is over 50 animals and with a male calf herd size is less than 50. A young herder was considered half as efficient as the adult and thus the compensation was half that of the adult. Based on this information the inputted cost of labour if it were hired for the family of 3 adult and 2 young herders in Wasa-Zange and 2 each adult and young in Wase were computed. All the analysis were herd-based.

Results

The summary of cash flow profit or loss analysis of cattle production in the grazing reserves is shown in Table 1. The average herd size of cattle investigated in 41 herds (Wase) and 27 herds (Wasa-Zange) were 47 and 54 respectively.

Cash inflow comprised income from sale of cattle, milk and other livestock. The total cash inflow per annum per herd amount to N49,946.00 and N42,368.00 in Wase and Wasa-Zange respectively. Milk constituted the major source of income to the nomads, accounting for 60.8% in Wase and 45.5% in Wasa-Zange of the total cash inflow. Sale of cattle accounted for 26.8% and 38.7% in Wase and Wasa-Zange respectively (Table 1).

Cash outflow resulted from dead cattle that could not be sold. These accounted for 56.8% of the N27,281.00 in Wase and 75.5% of the N57,657.00 in Wasa-Zange grazing reserves respectively.

Annual inputted cost of labour if it were hired accounted for N62,600.00 per herd in Wase and N78,000 per herd in Wasa-Zange. On an average herd, a sum of N21,270.00 accrued annually in the absence of brucellosis while it dropped to N17,700.00 if there was brucellosis in Wase. There was difference of N3,601 in the-with and without brucellosis. In Wasa-Zange grazing reserve even in the absence of brucellosis the cost of cattle production was N12,799.00 when there was brucellosis the cost further rose to N15,269.00 per herd, annually.

The estimated annual income forgone per herd with brucellosis and the imputed cost of labour amounted to N44,892.00 and N93,289.00 in Wase and Wasa-Zange grazing reserves respectively. These represent substantial waste if all the herds settled in the grazing reserves are taken into consideration.

Discussion and Conclusion

Cattle production as currently practised in the grazing reserves is not profit-oriented. The cost of managing the herds is high especially when the opportunity cost of labour input by the nomad’s family is considered. Under the traditional system of cattle production cash is not usually paid for labour. As the herds settle in these grazing reserves, fewer hands will be required to herd the cattle. The excess labour of the nomad’s family could be diverted to alternative economic activities such as increasing the value of the fallow land through crop farming and development of the pasture for improved grazing by the animals. The young herders of school age could then go to school.

Milk is the major source of income to the nomad’s family. It is usually sold at a give-away price especially when produced in excess of family requirements. This tends to discourage the nomad from milking the cows. The current initiative of building milk collection sheds is encouraging.
Table 1. Cash Flows, Profit and Loss Analysis of Cattle Production in Wase And Wawa-Zange Grazing Reserves

<table>
<thead>
<tr>
<th>Description</th>
<th>WASE</th>
<th>WAWA-ZANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Herd</td>
<td>41</td>
<td>27</td>
</tr>
<tr>
<td>Size of Herd</td>
<td>47</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Amount per</td>
<td>Amount Per</td>
</tr>
<tr>
<td></td>
<td>Herd(s)</td>
<td>Herd(s)</td>
</tr>
<tr>
<td>Capital value of cattle</td>
<td>273,629.00</td>
<td>315,228.00</td>
</tr>
<tr>
<td>Sources of Cash Inflow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income from milk</td>
<td>30,355.00</td>
<td>19,264.00</td>
</tr>
<tr>
<td>Income from sale of cattle</td>
<td>13,400.00</td>
<td>16,400.00</td>
</tr>
<tr>
<td>Income from sale of other</td>
<td>6,191.00</td>
<td>6,704.00</td>
</tr>
<tr>
<td>Livestock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cash inflow (income)</td>
<td>49,946.00</td>
<td>42,368.00</td>
</tr>
<tr>
<td>Sources of Cash Outflow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenses of Veterinary Services</td>
<td>2,335.00</td>
<td>2,716.00</td>
</tr>
<tr>
<td>Expenses on mineral salt licks</td>
<td>600.00</td>
<td>400.00</td>
</tr>
<tr>
<td>Cost of dead cattle (not sold)</td>
<td>13,331.00</td>
<td>43,520.00</td>
</tr>
<tr>
<td>Cost of used capital</td>
<td>7,414.00</td>
<td>8,531.00</td>
</tr>
<tr>
<td>Sub-total cash outflow (a)</td>
<td>23,680.00</td>
<td>55,167.00</td>
</tr>
<tr>
<td>Imputed cost of calf forfeited due to brucellosis</td>
<td>1,996.00</td>
<td>-</td>
</tr>
<tr>
<td>Imputed cost of milk forfeited due to brucellosis</td>
<td>-</td>
<td>1,996.00</td>
</tr>
<tr>
<td>Sub-total cash outflow (b)</td>
<td>3,601.00</td>
<td>2,490.00</td>
</tr>
<tr>
<td>Total Cash outflow (a + b)</td>
<td>27,281.00</td>
<td>57,657.00</td>
</tr>
<tr>
<td>Imputed cost of labour</td>
<td>62,600.00</td>
<td>78,000.00</td>
</tr>
<tr>
<td>Profit and Loss without</td>
<td></td>
<td></td>
</tr>
<tr>
<td>brucellosis</td>
<td>21,279.00*</td>
<td>(-)12,799.00**</td>
</tr>
<tr>
<td>Profit and Loss with brucellosis and cost of labour</td>
<td>17,708.00***</td>
<td>(-)15,289.00</td>
</tr>
<tr>
<td>Profit and loss without brucellosis and cost of labour</td>
<td>(-)44,892.00****</td>
<td>(-)93,289******</td>
</tr>
</tbody>
</table>

Exchange rate = US$ 1 = N85

* Equivalent to US$ 250.34
** Equivalent to US$ 250.34
*** Equivalent to US$ 250.34
**** Equivalent to US$ 250.34
***** Equivalent to US$ 250.34
As incentive to milking the cows regularly, government, through Federal Department of Livestock and Pest Control Services (FLDPCS) and Non-governmental organisations (NGO) should buy the milk off the nomads. Many more sheds as possible should be constructed. The demand for milk in Nigeria is high. Imported powdered milk is sold at very exorbitant prices. Milk from these sources will satisfy the demands.

The cost of dead cattle to the nomads as found in this study is comparatively high. Starvation due to inadequate feeding appears to be the major cause of the deaths. There is need for other possible causes of deaths to be investigated and prevented as deaths are threats to production.

Cash inflow from sale of cattle is low. Sale of bulls in excess of dam-sire ratio of one bull to 30 cows could be a source of revenue that could be ploughed back into maintaining the surviving animals in the herd. The available cash could also be used for improvement of the social welfare of the nomad's household. In Wase, the cost of veterinary services and supplementary feeding accounting for 7.2% and 1.9% respectively are low but veterinary services are rising with the high cost of drugs, salt licks and labour input by the veterinarian.

The cost of bovine brucellosis will rise as more herds settle in the grazing reserves. Brucellosis incidence is known to flare up especially when animals congregate either for drinking water or treatment. Brucellosis as an important reproductive problem of public health importance should be controlled and where possible prevented before losses escalate to manageable proportions. Alternative control strategies for the disease in the grazing reserves have been suggested and could be useful.

Our findings from this investigation indicate that the traditional system of cattle production, although less capital intensive, is not cheap. The opportunity cost of labour input by the nomad's family is high. The settling nomads deserve re-orientation and education towards a more purposeful profit targeted cattle production.

Acknowledgement

The authors appreciate the support of the Ministries of Agriculture and Natural Resources in the two states. The veterinary Units in Dukku Local Government Area of Gombe and Wase Local Government Area of Plateau State contributed in no small way to the successful execution of this investigation. The project was financed by the National Veterinary Research Institute, Vom.

References


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SHORT COMMUNICATION

OVERWINTERING RESIDUAL HERBAGE INFECTIVITY IN PASTURES GRAZED BY DUDDINGTONIA FLAGRANS FED CALVES FED CALVES

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There is much evidence that nematophagous fungi may be a realistic adjunct or alternative to the widespread use of anthelmintics in the control of gastrointestinal (GI) nematodes of livestock. One fungus, Duddingtonia flagrans, selected by in-vitro and in-vivo methods has been shown to survive gut passage in calves and to grow and entrap trichostrongylid larvae on dung pats. Field studies conducted in Denmark on the control of GI nematodes of cattle have demonstrated that feeding of calves during the first two months of the grazing season with the D. flagrans grown on barley grain reduced herbage infectivity and subsequently ingestion of trichostrongylid larvae, mainly of Ostertagia ostertagi, later in the season. A subsequent investigation showed that the strategic feeding of first season calves with D. flagrans over the first three months of the grazing season was able to prevent severe clinical trichostrongylosis in the late summer.

The present investigation was designed to determine the overwinter residual grass infectivity in pastures previously grazed by D. flagrans treated and untreated calves.

The experiment was conducted at the field station of the Royal Veterinary and Agricultural University. This pasture was grazed by two experimental groups of calves the previous year and twenty group 1 calves had been fed fungal material (D. Flagrans grown on barley grain). The fungal-barley amount given corresponded to 200 g dry weight per animal per day, and the approximate number of chlamydospores was 10⁶ per g fungal-barley (d.w). The control, group 2 calves received barley grains only as above.

Ten parasite-naïve male Jersey calves, 6 months old were used. The animals were divided into two comparable groups, A and B, on the basis of body weight. The average weight in group A was 188.0±22.9 kg, and in group B, 188.4±10.7 kg. The total area available was 2.24 hectares and was divided into two by a fence to comprise experimental plot A and control plot B, which had been grazed by group 1 and the 2 calves of the previous experiment, respectively. The calves were set-stocked for 4 weeks, before being housed for 3 weeks prior to slaughter on week (wk) 7 post-turnout. Herbage samples were collected weekly, for the first 4 weeks, while faecal samples were obtained at weekly intervals until termination of the study. The calves were weighed on three occasions, at turnout (wk 1), at wk 4 and during termination of the experiment (wk 7).
### Table 1: Mean worm counts from tracer calves grazed on a plot previously grazed by calves not offered any fungus (group B).

<table>
<thead>
<tr>
<th>Calves group</th>
<th>Abomasum</th>
<th>Small intestines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Ostertagia spp.</strong></td>
<td><strong>Cooperia spp.</strong></td>
</tr>
<tr>
<td></td>
<td>Animal No.</td>
<td>Larvae</td>
</tr>
<tr>
<td>Controls</td>
<td>17</td>
<td>176</td>
</tr>
<tr>
<td>(B)</td>
<td>516</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>524</td>
<td>242</td>
</tr>
<tr>
<td></td>
<td>518</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>559</td>
<td>177</td>
</tr>
<tr>
<td>Mean</td>
<td>194</td>
<td>724</td>
</tr>
<tr>
<td>S.E.</td>
<td>30</td>
<td>392</td>
</tr>
<tr>
<td>Experimental</td>
<td>530</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>533</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>514</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>515</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>307</td>
<td>151</td>
</tr>
<tr>
<td>Mean</td>
<td>72</td>
<td>882</td>
</tr>
<tr>
<td>S.E.</td>
<td>26</td>
<td>434</td>
</tr>
</tbody>
</table>

\(^a\)Larvae = Larvae not differentiated to species level

Three grass samples were collected randomly from each of the two plots during each sampling. Each grass sample consisted of 300-500 g of grass collected by hand following a W-shaped route across each plot. Grass in close proximity to dung pats was avoided. Third-stage trichostrongylid infective larvae (L3) were isolated by a technique established earlier. The number of trichostrongylid eggs per gram (epg) of faeces were determined using a modified McMaster technique. Three faecal cultures from each group were carried out to determine the nematodes at genus level.

At post mortem, the abomasum and the proximal four metres of the small intestines of each animal were eviscerated and examined according to standard procedures. Larvae and adult parasites were enumerated and identified to genus level. The differences between the experimental and control groups were tested using a one-tailed Mann-Whitney U test.
throughout the study period.

The two groups of calves started shedding eggs after week 2 post turnout and mean epg counts between the groups were comparable. There was a predominance of strongyloid-type eggs (Ostertagia spp., Cooperia spp.). Larvae recovered from faecal cultures were comparable and there was a predominance of Cooperia spp. over Ostertagia spp. Nematodirus spp. larvae did not appear in the faecal cultures, presumably because they require a longer period of time to permit hatching of eggs and larval development.

Table 1 shows that the intestinal worm Cooperia spp. was the predominant parasite in the gastrointestinal tract of the two groups of calves. The average abomasal larval adult worm counts of Ostertagia spp. were markedly similar in the two groups. In the small intestine, markedly large numbers of Cooperia spp. relative to Nematodirus spp. were recovered. The increase in body weight within the two groups was similar throughout the experimental period (P<0.05)

Overwintered population of infective larvae (L3) which survive on the pasture from the preceding grazing season provide the source of infection for calves turned out in spring16. The present observations confirm the results from other studies

\[\text{Infective larvae per kg dry matter}\]

\[0 \quad 20 \quad 40 \quad 60 \quad 80\]

\[0 \quad 1 \quad 2 \quad 3\]

\[\text{Treated (plot A)} \quad \text{Control (plot B)}\]

\textbf{Figure 1: Herbage trichostrongilid larval counts}
that the large numbers of eggs passed by infected calves later in the grazing season (September and October) do not contribute significantly to the herbage infestation. However, outbreaks of early-season trichostrongylosis in calves have been reported.

In the present study, the parasitological parameters for the two groups of calves and their respective grazing plots were comparable, indicating that there were no differences in pasture infectivity between the treated and control plots. This showed that the treatment effect of *D. flagrans* was eventually lost later in the grazing season as tracer calves had strikingly comparable worm burdens as control calves. Body weight gains within the two groups remained similar throughout the experimental period. It was possible that the number of overwintering larvae were influenced by the level of pasture contamination the previous season and weather conditions during winter rather than the microfungus *D. flagrans*. The results demonstrated that the effectiveness of *D. flagrans* in destroying parasitic nematodes of cattle in dung pats was limited only to the early grazing season. Further studies are indicated to elucidate the effect of the fungus when fed for the entire normal grazing season or while administered in controlled release devices.

**Acknowledgement**

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**References**


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A STUDY ON THE DISEASES OF ONE-HUMPED CAMELS (CAMELUS DROMEDARIUS) IN BORANA, SOUTHERN ETHIOPIA

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The camel (Camelus dromedarius) is an important animal uniquely adapted to hot and arid environments. Ethiopia has an estimated 1.06 million camels1 which play an important role in the life of pastoral society with a potential of bringing food security to the region2. Currently, due to increased desertification and repeated drought, the camel is gaining more importance in Ethiopia than in the past. Despite its importance, little attention is given to camels.

Diseases are among the most important limiting factors hampering its full utilisation. There are only very few published works on different aspects of camel disease problems from southern Ethiopia3,4. The knowledge gap has long been a limitation to design a proper disease on the major diseases and lesions of camel from southern Ethiopia. This may contribute to the understanding of dromedary pathology in the region.

The study was carried out from November 1998 to April 1999 in lowlands of Borana, southern Ethiopia located between 3036'-6038'N latitude and between 36043'-410-40'E longitude. Topographically, 62.5% of the area is below 1500 meters above sea level (a.s.l.) with semi-arid climate. The rainfall pattern is bi-modal with short (September-October) and long (May-July) rainy seasons. The study was made in camels slaughtered in two areas, namely:

Neghelle-Borana: located 965 km South East of Addis Ababa at Ethiopia - Somali border. The area is characterised by arid and semi-arid climate, and the altitude ranges from 200 to 1250m a.s.l. The annual rainfall and temperature range between 300-800 mm and 28-38°C, respectively5,6.

The study was carried on 121 one-humped adult camels slaughtered at Neghelle-Borana (n=91) and Dollo-Addo (n=30). The animals were brought from different parts of arid and semi-arid areas of southern Ethiopia. Ante-mortem and post-mortem examinations were made on live animals and carcasses of slaughtered camels, respectively. The lesions and parasites observed were recorded. The parasites were identified according to the description given by Soulsby7. Tissue samples were collected in 10% formalin, dehydrated in alcohol, embedded in paraffin, sectioned at 4-5um thick sections, stained with Haematoxylin-Eosin and examined under a light microscope.

A chi-square (x²) test was applied to compare the prevalence of different diseases between the two study locations.

Cephalopina titilator, pulmonary lesions, hot-iron branding, hydatidosis on liver and lungs, lymphadenopathy, bruising on carcass, Cysticercus camelli (dromedarii) and filarial parasites were recorded in 100, 52.9, 28.1, 22.3, 19, 11.6 and 5.8% of the camels, respectively (Table 1).

The lymphadenopathy was characterised by enlargement and abscessation of the lymph nodes that contained creamy yellow pus. Some abscesses were ruptured

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Table 1: Neutralization of toxins in goats intestinal contents and enumeration of C. perfringens in diarrhoeic faeces

<table>
<thead>
<tr>
<th>Lesions/diseases</th>
<th>Dollo-Addo (and) (n=30)</th>
<th>Neghelle-Borena (semi-arid) (n=91)</th>
<th>Total (%) (n=121)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cephalopina titillator</td>
<td>30 (100%)</td>
<td>91 (100%)</td>
<td>121 (100%)</td>
</tr>
<tr>
<td>Pulmonary lesions</td>
<td>17 (56.7%)</td>
<td>47 (51.6%)</td>
<td>64 (52.9%)</td>
</tr>
<tr>
<td>Hot-iron branding</td>
<td>11 (36.7%)</td>
<td>23 (23.3%)</td>
<td>34 (28.1%)</td>
</tr>
<tr>
<td>Hydatidosis*</td>
<td>2 (6.67%)</td>
<td>25 (27.5%)</td>
<td>27 (22.3%)</td>
</tr>
<tr>
<td>Lymphadenopathy*</td>
<td>2 (6.67%)</td>
<td>21 (23.1%)</td>
<td>23 (19%)</td>
</tr>
<tr>
<td>Bruising on carcass*</td>
<td>8 (26.7%)</td>
<td>10 (11%)</td>
<td>18 (14.9%)</td>
</tr>
<tr>
<td>Cysticercus camali</td>
<td>4 (13.33%)</td>
<td>10 (11%)</td>
<td>14 (11.6%)</td>
</tr>
<tr>
<td>Filarial worms*</td>
<td>7 (23.3%)</td>
<td>0 (0%)</td>
<td>7 (5.8%)</td>
</tr>
</tbody>
</table>

*Vary significantly between the two locations (P<0.05)

and were discharging pus through open wounds.

The pulmonary lesions were mostly localised, unilateral with varying extensions and included red and grey hepatization, fibrosis, adhesion to thoracic walls and diaphragm, calcification and emphysema. The pneumatic lesions were characteristic of bronchopneumonia and interstitial pneumonia. Numerous caseated lesions were observed all over the lung in one case in Dollo-Addo.

Filarial parasites were recovered in seven of the 30 camels (23.3%) in Dollo-Addo and from none of the 91 camels from Neghelle-Borana. Onchocerca fascinta was recovered from nodules in the subcutaneous connective tissue in six of the seven cases. The nodules were few to many in number, firm in consistency and 1.0-3.5 cm in diameter. They were observed along ligamentum nuchae, masseter, caudal thigh and pre-scapular regions in four cases and scattered over many parts of the carcass (pre-scapular region, caudal thigh, rump, along the thorax and the neck) in two cases. The worms were coiled in fibrous connective tissue nodules and were difficult to recover intact. In the remaining one case, Dipetalonema evansi were recovered from aneurysm filled with unclotted dark-red blood in the spermatic arteries at about the head of epididymis. They were slender, white, actively moving intact worms, 3.7-7.0 cm in length with two lateral flaps at the posterior end.

The present study showed that a number of diseases affecting camel production in arid areas of eastern Ethiopia. Lower prevalence of hydatidosis were reported from previous studies on camels from eastern Ethiopia (18.6%)2 and So-
malia (14.8%)8. Hydatidosis was significantly higher (P<0.05) at Neghelle-Borana (27.5%), where the pastoralists keep dogs than at Dollo-Addo (6.67%) where the pastoralists are Moslems and don’t keep dogs. Similarly, high infection rate was reported from Kano, northern Nigeria where the dog population was high9.

Wild carnivores and dogs may play an important role in maintaining the life cycle of hydatid. Disposal of the carcass in the wild exposed the carnivores to infected tissues. Cases of human hydatidosis in Borana have not been documented. However, a high prevalence (23.3%) recorded in this study indicates a potential danger echinococcus (hydatidosis) in the area. A detailed study in this area is recommended.

Pulmonary lesions (52.9%) were the most common lesions recorded. The latter may impair camel health and have a negative impact on camel productivity. A lower (26.6%) prevalence was recorded in camels from eastern Ethiopia2. The higher prevalence in this study may have been due to chronic lesions in recovered animals after an outbreak of respiratory disease few years before current study10. The dusty environment, heat stress, heavy work load and feed insufficiency may render camels susceptible to various pulmonary infections. The cause and associated factors of respiratory diseases in dromedaries merit an investigation.

Cepalopina titillator was recovered from all camels examined. Similar results were recorded in camels from eastern Ethiopia2 and Nigeria11 (100% & 97.4%, respectively). The parasite irritates the nasal mucosa and may cause respiratory problems. It could partly contribute to the high prevalence of lung lesions in this study as described by Dorschies and Yilma12 for Oestrus ovis, a nasal bot fly in sheep. Purulent nasal discharge that interfered with breathing was reported to accompany7 infestation with C. titilator and ovis13. However, this should be justified through a detailed investigation.

Cysticercus camelii (dromedarii) was recorded in 11.6% of the camels examined. Similar results were recorded from eastern Ethiopia (15.7%)2 and Somalia (20%, Graber et al., 1967; as cited by Richard, 1979)9. Little in formation is available on the incidence of C. camelii (dromedarii), which may be as a consequence of its insignificant zoonotic potential8.

Lymphadenopathy was recorded in 19% of the camels. It was significantly (P<0.05) higher in those from Neghelle-Borana (23.1%) than Dollo-Addo, (more a rid) (6.67%) probably due to variation in climate. Previously Corynebacterium (Actinomyces) pyogenes was incriminated as a cause in Borana camels3. Lymphadenopathy and abscessation may be a consequence of bacteraemia or local cutaneous infection. However, in this study the micro-organisms involved were not isolated.

Filarial worms were not observed in camels from Neghelle-Borana. A similar observation was made by Richard3. Probably the micro-and macro-climate does not favour the survival of the vector. However, this should be verified through further studies. Onchocerca fasciata has been reported from the Sudan, Ethiopia, Kenya, Mauritania, USSR, India and Saudi Arabia14,15. Vector responsible for disease transmission are not known3. However, Dipetalonema evansi was recorded for the first time in camels from Ethiopia. It is specific for camels and develops in the spermatic arteries, heart, pulmonary arteries as well as lymph nodes and lymph vessels. The vector of the disease (mosquito) belongs to the genus of Aedes15, 16. The parasite is recognised in India. Egypt, Sudan, Algeria, Pakistan, USSR and other countries14,16.

Other lesions encountered such as bruising (14.9%) and hot-iron branding on
the skin pastoralists brand their camels production and productivity. The productivity of camels will increase if diseases are controlled or their impact reduced. Therefore, a detailed epidemiological study on camel pathology and determination of the true impact of the major diseases on camel productivity is recommended. We believe that this study will contribute to the understanding of camel pathology, helpful in envisaging effective control measures.

References


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SHORT COMMUNICATION

OUTBREAK OF DIARRHOEA ASSOCIATED WITH CLOSTRIDIUM PERFRINGENS IN WEST AFRICAN DWARF GOAT KIDS

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Clostridium perfringens is major cause of diarrhoea in human beings and animal species\(^1\). The organism is classified into several types (A,B,C,D and E) according to the pattern of predication four major lethal toxins. Clostridium perfringens types B, C and D are important animal pathogens, having been reported to cause lamb dysentery (type B), necrotic hemorrhagic enteritis of lambs, calves and pigs and struck in adult sheep (type C) and enterotoxaemia in adult sheep cattle (type D)\(^2\). Most reports of enterotoxaemia caused by C. perfringens in adult goats are associated with C. perfringens type D\(^1,2,3,4,5,6,7\).

This case report describes the isolation of C. perfringens in the faeces of 12 West Africans Dwarf (WAD) breed of goats kids in herd that experienced an outbreak of diarrhoea in Oyo State, Nigeria. There were no other known infectious organisms isolated. The organism’s possible role in the diarrhoea is discussed. To the author’s knowledge, this is the first report of C. perfringens associated with diarrhoea in WAD goats in Nigeria.

In May 1999, 12 WAD breed of goats aged 3-5 months, managed under the intensive system presented with mild diarrhoea. The clinical signs observed included loss of appetite, profuse watery diarrhoea (pale yellow in colour with blood and shreds of intestinal mucosa in 9 of the 12 cases). By the second day the disease had worsened.

General weakness and prostration were observed in seven of the affected kids. The clinical course lasted four days in all cases but abated following treatment and recovery. The goats were fed on cassava and millet diet and occasionally released to pasture. There had been no previous cases of diarrhoea in the flock comprising of 12 WAD goats. The diarrhoea lasted for five days and one goat died on the 4th day. Metronidazole was administered on the third day of onset of diarrhoea after faecal samples collection.

Faecal samples were obtained from each diarrhoeic animal. The first samples were collected on the second day and were processed within one hour of collection. To investigate the presence of enteric pathogens including Escherichia coli, Aerommas hydrophila, Salmonella and Shigella species, the stools were inoculated in to selective media\(^8\). Plates were incubated aerobically at 37°C for 24 hours.

Faecal samples were collected on the third day and were investigated for C. perfringens. The samples were cultured in Cooked Meat Medium (Oxoid), sheep blood agar plate supplemented with 100ug/ml neomycin sulphate and egg yolk medium\(^9\). For the determination of colony forming unit (cfu) of organism per gram of faeces, 1.0g of each faecal material was weighed and added to 9ml of sterile saline buffer, mixed thoroughly and the debris was allowed to sediment. Ten-fold dilutions were prepared in further 9ml volumes of the same buffer saline upto 1 in 10\(^4\). Colony count was carried out in sheep blood agar supplemented with 10ug/ml neomycin and

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egg yolk medium by plating 0.2ml of each dilution. Samples were also subjected to alcohol shock treatment for selective isolation of spores. Faecal sample of nine apparent health kids were also collected and treated as for diseased animals. These were taken as the controls. All plates were inoculated anaerobically at 37°C for 24 hours.

Typical colonies resembling *C. perfringens* were collected and identified biochemically. The toxin types were identified in the faecal samples and the clostridial isolates by the method previously described. Two mice were inoculated intraperitoneally with samples of the supernatants.

**Table 1:** Neutralization of toxins in goats intestinal contents and enumeration of *C. perfringens* in diarrheic faeces

<table>
<thead>
<tr>
<th>Animal No.</th>
<th>Approx. age (months)</th>
<th>cfu/g of feaces</th>
<th><em>C. perfringens</em> type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>(1.5 \times 10^7)</td>
<td>D</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>(1.7 \times 10^{10})</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>(5.2 \times 10^8)</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>(4.1 \times 10^8)</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>(6.5 \times 10^7)</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>(4.3 \times 10^9)</td>
<td>D</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>(2.7 \times 10^{10})</td>
<td>D</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>(2.2 \times 10^8)</td>
<td>D</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>(2.5 \times 10^8)</td>
<td>D</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>(2.3 \times 10^9)</td>
<td>D</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>(1.4 \times 10^9)</td>
<td>D</td>
</tr>
<tr>
<td>12</td>
<td>5</td>
<td>(2.0 \times 10^8)</td>
<td>D</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>(1.1 \times 10^3)</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>(1.4 \times 10^2)</td>
<td>A</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>(1.2 \times 10^3)</td>
<td>A</td>
</tr>
</tbody>
</table>

*C. Perfringens* was type-determined by toxin neutralization in vivo; all animals not treated with antibodies died within 2 days.
Culture of samples collected on the second day after onset of diarrhoea under aerobic conditions revealed that only in two cases were scanty growth observed on the MacConkey plates and the organism recovered was *E. coli*. No other enteric pathogens were isolated in any of the samples. The bacteriological findings from direct smears and culture of faecal materials collected on the third day demonstrated the presence of *C. perfringens* in the intestines of the affected animals. The cfu/gram of faecal material of diarrhoeic animals ranged from 1.5 x 107 to 2.7 x 1010 (Table 1). The results of toxin neutralization tests in mice are also presented in Table 1. In 11 of the 12 faecal samples tested with antisera, the inoculated mice were protected by type *D* antiserum. Types *B* and *C* antisera failed to protect the mice in all cases. Similar results were obtained from culture filtrates of the isolates.

The results of the toxin neutralization tests strongly suggested that the diarrhoea among the kids was an enterotoxaemia caused predominantly by *C. perfringens* typed *D*. *Clostridium perfringens* type D produces epsilon toxin, which is the major lethal toxin. The results of this findings indicated that the organisms could cause enterotoxaemia in WAD goat kids. It was difficult to classify the enterotoxaemia into per acute, acute or chronic forms because the clinical signs observed in the kids varied widely from one kid to another. Since the association between the isolation of *C. perfringens* type D and diarrhoea was significant, it was probable that *C. perfringens* was the cause of the diarrhoea.

Although *C. perfringens* type D is a commensal in the intestinal tract of most healthy ruminants, the significantly high levels in the diarrhoeic goats with no other enteric pathogen isolated strongly suggested that the organism was the aetiologic agent in these cases. A much lower level of *C. perfringens* (<1.5 x 103 cfu/gram of faeces) detected in 6 of 9 healthy kids was in agreement with earlier observation although in all these cases *C. perfringens* identified were type A.

The poor diet fed to the goats and the cold weather prevalent in the environment where the goats were kept could also have played a role in predisposing the goats to the diarrhoea.

The results of this investigation suggested that *C. perfringens* type D may be as widely distributed as it is in the sheep with enterotoxaemia. It was not clear whether the presence of *C. perfringens* type *A* in the healthy goats in which it was recovered was through contact with the only goat died of mixed infections.

Acknowledgements

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10. Koransky, J.R., Allen, S.D. and Dowell, V.R.

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SHORT COMMUNICATION

STUDIES ON MAREK'S DISEASE IN THE SUDAN

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In the Sudan, Mareks disease was first reported in 1956 among imported flocks\textsuperscript{4}. Kheir, El-Amin and El Hassan\textsuperscript{6}, investigated the incidence of the disease during the years 1960 - 78 showing that it continued to be reported annually with moderate incidence. High disease outbreaks were reported in 1986 - 88, which led to the introduction of turkey herpesvirus vaccine (HTV) resulting in substantially diminished incidences of the disease.

However, there was sharp increase in the incidence of acute disease with high morbidity and mortality in vaccinated flocks during the years 1992 - 1996.

This paper reports the prevalence of MD in the Sudan during the years 1985 - 1997.

All materials originated from sick birds with acute symptoms brought to the Central Veterinary Laboratory at Soba during the period 1985 - 1996. Clinical signs and husbandry were carefully examined.

Birds with typical signs were necropsied, microscopic lesions were noted, small pieces taken from different organs were fixed in 10% formaldehyde, cut and embedded in paraffin wax, sectioned and stained with Haematoxylin and Eosin (H.E.).

Sterile pieces from kidneys were chopped or passed through a 5.0 c.c. syringe. They were washed in phosphate buffered saline (PBS) until they were clear and subsequently centrifuged at 2000 r.p.m. for 5 mins. They were then trysinized and cultured directly as direct kidney cell (DKC) culture\textsuperscript{2}. and were daily observed for signs of cytopathic effect (CPE). The supernatant fluid was used to inoculate preformed primary chick kidney cell cultures.

Cultures grown on coverslips were fixed in acetone and used for the indirect immunofluorescent test\textsuperscript{2}. against a known Marek’s disease positive antiserum (originally supplied by Ohio State University U.S.A.).

Cultures with 75\% or more CPE were drained, washed in PBS, frozen and thawed three times and used as test antigen for the AGP test\textsuperscript{4}. A known positive serum was included in the test. The positive antigen used was a cell-free MDV HPRS (Houghton Poultry Research Station) obtained from Leaust, subdepartment of Preventive Medicine, avian diseases, University of Liverpool U.K. one gm purified agar unipath (Ltd UK) and 8 gm sodium chloride, completed to 100ml DDW were used.

A histogram showing the prevalence of field outbreaks during the year 1985-1986 is shown in Figure 1.

The disease occurred through all seasons in broilers and layers at 3-6 months of age. It involved both small and large farms as well as Bovan and Hisex breeds. The majority of chickens vaccinated againsts MD with HVT succumbed to severe acute disease.

The disease was manifested by high

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Fig. 1: Outbreaks of MD during 1985/86-1996/97
Fig 1 and 2: Marek's disease infected chickens showing characteristic MD paralysis and torticollis
Fig 4: Opened chicken showing enlarged liver with diffuse granular infiltration

Fig 5: Nodular tumour on the liver of a chicken.
Fig 6: Kidney cell culture monolayer showing cytopathic effect as grapelike clusters of refractile cells and syncytia. (Wet preparation).

Fig 7: Severe lymphocytic infiltration of the nerve. (H & E).
morbidity rate reaching 30%. The mortality rose sharply over one week and then ceased or continued sporadically for several months. The most common signs were depression, ruffled feathers, diarrhoea, torticollis, prostration and death (Figs. 2 & 3). In one farm swollen head, conjunctivitis and blindness were seen.

Macroscopic lesions were variable from one bird to the other. The most striking feature was lymphomas. The liver was seen covering the whole abdominal surface area with coarse granular appearance and diffuse infiltration (Fig. 4). Focal nodular tumour-like growth was also seen (Fig. 5). The spleen was enlarged to several times its normal size. The ovaries were swollen with loss of foliated appearance. Occasionally the lungs and heart showed whitish areas and the kidneys were swollen with granular appearance or conspicuous, nodular tumorous out growth. The proventriculus was thickened and firm with swollen proventricular glands. Nerve enlargement reached up to several times its normal thickness, with bilateral and unilateral enlargement occurring most frequently in birds dying later in the disease process.

Within 3-4 days, cultures showed CPE seen as rounded grape-like clusters of refractile cells and syncytia (Fig 6).

The most common and striking lesions were the mononuclear cellular infiltratation of nerves, brain and visceral organs. The lesions on the nerves and brains consisted of mild to severe lymphocytic infiltration, sometimes accompanied with oedema. Perivascular cuffing of the brain was common (Figs 7 and 8).

A single precipitin line of identity was observed between the test antigen and the positive serum.

The indirect immunofluorescent test showed specific rounded fluorescing cells. Uninfected control cultures showed no specific fluorescence.

The symptoms, gross, pathological and microscopic lesions observed in the different outbreaks, were consistent with other reports and were indicative of an acute Marek's disease infection. This was confirmed by the virus isolation and identification.

The disease attacked equally all breeds involved in the Sudan at the age of 3-6 months. Biggs, observed the disease could occur as early as the third week of life. However, in this study three outbreaks occurred as late as 9-10 weeks. The birds involved in these outbreaks were locally
hatched and were all vaccinated at one day of age with the HVT vaccine. The overall mortality rate ranged between 10 and 30% occasionally reaching over 50% in some farms. This may suggest that a very virulent virus strain was involved in this outbreaks.

Acknowledgements

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SEROEPIDEMIOLOGICAL SURVEY OF MAREK'S DISEASE VIRUS IN POULTRY FLOCKS OF THE SUDAN

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2. Omdurman Islamic University, Faculty of Basic and Medical Science, Omdurman, Sudan.

ENQUETE SEROEPIDEMIOLOGIQUE SUR LE VIRUS DE LA MALADIE DE MAREK CHEZ LES BANDES DE VOLAILLE AU SOUDAN

Résumé

Dans une enquête séroépidémiologique sur les anticorps antivirus de la maladie de Marek, un antigène de follicule de plumes a été préparé et utilisé comme antigène dans les tests de précipitation sur gélose (AGP) et d'électrocytrophéresis (CIE). Au total, 1,156 sérums de volaille de différentes localités du Soudan ont été examinés. Le taux positif global était beaucoup plus faible avec le test AGP (70%) par rapport au test CIE (79.7%). De même, les sérums des volailles locales donnaient un taux positif de 38.7% avec le test AGP et 48.9% avec le test CIE. Selon les résultats, l'infection avec le virus de la maladie de Marek est répandue à la fois chez les espèces de volaille exotique et locale, et le test CIE est plus sensible et plus rapide que le test AGP pour la sérosurveillance de la maladie.

Summary

In a seroepidemiological survey of Marek's disease virus antibodies, a feather follicle antigen was prepared and used as antigen in the Agar Gel Precipitation (AGP) and Counter Immunoelectrophoresis (CIE) tests. A total of 1156 fowl sera from different localities of the Sudan were examined. The overall positive rate was significantly lower in the AGP test (70%) compared to the CIE test (79.7%). Likewise local birds' sera gave a positive rate of 38.7% in the AGP compared to 48.9% in the CIE test. The finding indicate that the infection with MD virus is widespread in both foreign and local types of birds and that the CIE test is more sensitive and rapid than the AGP test in serosurveillance of the disease.

Introduction

Marek's disease (MD) has been considered one of the most important diseases in the poultry industry because of its severe economic losses. The disease importance is due to its mortality that commences shortly before chickens reach maturity and continues throughout the laying period.

In Sudan, MD was first reported in 19561 and continued to be regularly reported2. The present survey was conducted to determine the extent and magnitude of the disease in the Sudan.

Materials and Methods

Sera

Positive MDV serum was originally obtained in lyophilized form from Ohio State University, USA.

Chicken test sera

A total of 1156 serum samples were collected from chickens on widely distributed farms in different parts of the country including Khartoum State, Kordofan, Gezira, Kassala and Northern State (Table 1).

Blood samples were taken from the jugular or wing veins in to sterile Bijououx
bottles and were left to clot at room temperature. The clot was separated from the edges of the bottle and left overnight at 4°C. Sera were taken then collected and stored at -20°C until used.

Antigens

a) Cell-free MDV HPRS (Houghton Poultry Station) was obtained from Leahurst, Subdepartment of Preventive Medicine, Avian Diseases, University of Liverpool, U.K.

b) Feather follicle antigen

Preparation

The procedure described by Sharma was used. Feathers were cut close to the skin on the surface of the major feather tracts. Skin strips were removed, cut with scissors and minced. Of 1:5 and 1:10 suspensions were made in phosphate buffered saline (PBS). They were then homogenized for 3-5 minutes with a homogenizer and subsequently kept in an ice batch. Suspensions were centrifuged at 200 revolutions/minute for 10 minutes. Antibiotics were added to the supernatant fluids. The antigen was tested by AGP test against the positive MDV/serum and the cell-free HPRS, as the standard antigen.

Agar Gel Precipitation (AGP) test

This was carried out as described before using the unknown cell-free anti-
gen and the known positive MDV serum. The immunodiffusion medium contained 1% purified agar (Unipath Ltd U.K.) and 8 gm sodium chloride dissolved in 100 ml DDW.

**Counter Immuno-electrophoresis (CIE) test**

This test was performed as described earlier\(^5\) using Tris Barbitone buffer and purified agar. The agar was poured on microscopic slides. Two rows of wells were cut on the solidified agar. The anode-oriented wells were filled with antigen. The samples were electrophorized at a constant voltage of 3 volts/cm for 45 minutes at a room temperature. Readings were made against an indirect illumination. Positive reactions were shown by the formation of precipitin lines between the antigen and serum wells.

**Results**

The results of testing 987 bird’s sera are shown in Table 2. The results of testing local type birds’ sera are presented in Table 3. Sera tested by the AGP test

<table>
<thead>
<tr>
<th>Locality</th>
<th>No. of sera tested</th>
<th>AGP test</th>
<th>CIE test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. positive</td>
<td>Positive %</td>
<td>No. positive</td>
</tr>
<tr>
<td>Gobara farm (Soba West)</td>
<td>59</td>
<td>57</td>
<td>97</td>
</tr>
<tr>
<td>Virology farm (Sobaa West)</td>
<td>189</td>
<td>186</td>
<td>100</td>
</tr>
<tr>
<td>African Company (El Bagair)</td>
<td>37</td>
<td>27</td>
<td>73</td>
</tr>
<tr>
<td>Coral (Soba West)</td>
<td>22</td>
<td>20</td>
<td>91</td>
</tr>
<tr>
<td>Omdurman</td>
<td>71</td>
<td>35</td>
<td>49.3</td>
</tr>
<tr>
<td>El Halfaya</td>
<td>40</td>
<td>27</td>
<td>67.5</td>
</tr>
<tr>
<td>Khartoum North Abattoir</td>
<td>216</td>
<td>106</td>
<td>49.1</td>
</tr>
<tr>
<td>Shambat</td>
<td>49</td>
<td>28</td>
<td>57.1</td>
</tr>
<tr>
<td>El Gireif</td>
<td>72</td>
<td>32</td>
<td>44.4</td>
</tr>
<tr>
<td>El Geili</td>
<td>21</td>
<td>21</td>
<td>100</td>
</tr>
<tr>
<td>Kassala</td>
<td>70</td>
<td>70</td>
<td>57.1</td>
</tr>
<tr>
<td>Atbara</td>
<td>90</td>
<td>77</td>
<td>85.6</td>
</tr>
<tr>
<td>El Obeid</td>
<td>54</td>
<td>21</td>
<td>38.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>987</strong></td>
<td><strong>677</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Average%</strong></td>
<td><strong>70.0%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Results of testing local fowls' sera for MDV antibodies Using AGP and CIE tests

<table>
<thead>
<tr>
<th>Locality</th>
<th>No. of sera tested</th>
<th>AGP test</th>
<th>CIE test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. positive</td>
<td>Positive %</td>
</tr>
<tr>
<td>Khartoum North Abattoir</td>
<td>36</td>
<td>21</td>
<td>58.3</td>
</tr>
<tr>
<td>Shambat</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>El Gireif</td>
<td>88</td>
<td>47</td>
<td>53.4</td>
</tr>
<tr>
<td>El Geili</td>
<td>28</td>
<td>12</td>
<td>42.9</td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>Average%</td>
<td></td>
<td></td>
<td>38.75%</td>
</tr>
</tbody>
</table>

showed an average of 70% positives compared to 7% positives estimated by the CIE test. Again the local birds' sera gave an overall positive rate of 38.7% in the AGP test compared to 46.9% in the CIE test (Table 3).

Discussion

In comparative studies using the AGP and CIE tests for screening sera for MDV antibodies, the CIE test proved to be more sensitive and rapid compared to the AGP test. Most of the farms showed a range of 39-100% positives in both tests, with the least positive rates (39% and 48%) being detected in EL Obeid and El Giref respectively. These findings indicate that MD is widespread in Khartoum and other parts of the country. Examination of local fowls' sera for evidence of MDV revealed that sera from Khartoum North abattoir were the highest positives (83.3%). On the other hand all sera tested from Tambool were negative indicating that MD probably does not exist in this area. The presence of MDV antibodies in sera of local fowls that are not normally vaccinated suggests that natural infection exists and is widespread in this country. Although limited numbers of serum samples were screened in this study, yet the widespread infection and significance of MD in the Sudan have been established.

Acknowledgements

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SHORT COMMUNICATION

A PATHOMORPHOLOGICAL STUDY ON THE OCCURRENCE OF HYDROPERICARDIUM SYNDROME (LEECHI HEART DISEASE) IN BROILER CHICKS IN WEST BENGAL, INDIA

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Since introduction of leechi heart disease in 1987 in Pakistan1, hydropericardium syndrome (HPS) was first observed in India in some parts of Punjab2 and is still prevailing in the poultry population of India. The incidence was first reported in West Bengal involving group-1 avian adenovirus in broiler chicks3. The present communication describes the detailed pathomorphological studies of HPS in broiler chicks in West Bengal, India.

Five commercial broiler farms distributed in three different districts (Howrah, South 24-Parganas and North 24-Parganas) of West Bengal having the records of the incidence of HPS were studied. The broiler farms were situated in Andul (A) and Mourigram (B) of Howrah district, in Bongaon (C) of North 24-Parganas district and in Mograhat (D) and Narendrapur (E) of South 24-Parganas.

Following post-mortem examination of chicks from frank HPS cases or from experimentally infected dead birds, the livers, spleen, hearts, lungs, kidneys, bursa of fabricius and gastrointestinal tracts were removed and fixed in 10% buffered formaline. The experimentally infected birds were given 0.2ml liver homogenate 15%w/v, from frank HPS cases injected subcutaneously to 1-week old seronegative birds. All tissue samples were embedded in paraffin, sectioned at 4μm, and stained with heamatoxyllin and eosin (H&E). Attempt to isolate bacteria from livers and hearts were made by culturing portions of liver and heart on MacConkey agar and sheep blood agar and incubated at 37°C for 24 hours.

For viral isolation, liver samples were inoculated into specific-pathogen-free (SPF) chicken eggs (10-day-old embryos) via the allantoic cavity and incubated at 37°C and onto the primary chick embryo liver culture of SRF chickens. The Agar Gel Precipitin (AGP) and Counter Immuno-Electrophoresis (CIE) tests were carried out using known group-1, serotype-4 avian adenovirus against serum samples of the affected flock. Liver sample, from both the natural and experimentally infected HPS birds were sent to the Department of Veterinary Microbiology, Punjab Agriculture University, Ludhiana, Punjab for serotyping.

Table 1 shows the outbreak pattern of HPS cases in the five different broiler farms. The most common characteristic gross lesion in the affected flocks (farm A, B, C, D and E) was hydropericardium. This accumulation of clear straw coloured fluid in the pericardial cavity occurred in 8/10, 7/8, 4/6 and 7/9 chickens in farms A, B, C, D and E respectively. Only two dead broiler chicks of each farm A and C and dead broiler chick of each farm B, D and E did

* Corresponding Author.
Table 1: Pathomorphological features of natural HPS cases in five different farms of West Bengal

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Place of Farms &amp; District</th>
<th>Flock Strength (In days)</th>
<th>Duration of Diseases (In days)</th>
<th>Mortality No. %</th>
<th>No. of tissue Samples Tested</th>
<th>Hydropericardium Present (Numbers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A Andul (Howrah)</td>
<td>5000</td>
<td>30-34</td>
<td>500</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>B Mourigram (Howrah) C Bongaon</td>
<td>8500</td>
<td>17</td>
<td>970</td>
<td>11.04</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>C Narenpur (North 24 Parganas)</td>
<td>1000</td>
<td>35</td>
<td>12</td>
<td>1.20</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>D Mograham (South 24 Parganas)</td>
<td>800</td>
<td>40</td>
<td>30</td>
<td>3.75</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>E Narenpur (South 24 Parganas)</td>
<td>400</td>
<td>43</td>
<td>5</td>
<td>1.25</td>
<td>9</td>
</tr>
</tbody>
</table>

not show hydropericardium.

Macroscopically, most of the liver tissues of birds examined showed enlargement and congestion with haemorrhagic patches on the surface and was tan-yellow in colour. The lungs were oedematous and congested. Red, cone shaped heart was found to be floated in fluid-filled, swollen pericardial sac and distention of the right atrium with hydroplasia of left ventricle was prominent. The kidneys were enlarged, pale yellow, friable and haemorrhagic with some showing cooked-meat appearance while the bursa of fabricius were regressed and congested. These findings agreed with earlier findings from past studies.

Microscopically, the liver tissues from naturally occurring HPS cases revealed moderate degree of vascular congestion with patchy areas of haemorrhage. Perivascular lymphocytic and neutrophilic infiltrations were prominent. Few hepatocytes showed the presence of both intracytoplasmic intranuclear basophilic inclusion bodies. Hepatic tissues from experimentally infected birds showed vascular congestion and dilatation of blood vessels along with moderate degree of fatty changes. Patchy areas of hepatonecrosis and intranuclear and intracytoplasmic basophilic inclusions were found.

The kidney showed glomerular obsolescence at a few areas while in other areas, glomeruli appeared hypercellular. Peritubular and periglomerular lymphocytic infiltrations were evident, but no inclusion body was found. The kidney tissues from natural cases revealed the same picture as above with presence of both intranuclear and intracytoplasmic basophilic inclusions. Myocardial cells showed mild degree of fatty changes and necrosis. Intermuscular spaces showed congestion with intranuclear and intracytoplasmic basophilic
inclusions in the affected cells. Lung parenchyma showed areas of interstitial haemorrhages, alveoli contained acute inflammatory exudate and bronchial lining epithelial cells showed presence of intracytoplasmic basophilic inclusions. Lymphoid follicles showed evidence of germinal hyperplasia and moderate amount of lymphocytes depletion. Surface lining epithelial cells and a few lymphoid cells showed the presence of both intranuclear and intracytoplasmic basophilic inclusions. The pathological features were similar to the lesions reported earlier\(^4,5,6\).

No bacteria were isolated from liver and heart samples of the chickens with HPS. The supernatant from liver homogenate suspension (15%w/v) was found positive by AGP test using known positive serum against group-1 adenovirus serotype-4, in 50-57% cases. No other viral agent was isolated from liver samples by chick embryo inoculation test. Out of four samples (prepared from AGP test positive liver suspension) inoculated in primary chick embryo liver cell culture system, only one sample showed cytopathic effect (CPE) during first passage level, another two showed CPE during second passage level while the rest, only one showed during third passage level and they all were characterized by granular changes, cytoplasmic vacuolation and rounding of cells, syncytia formation and ultimately total degeneration of cell sheet with detachment of cells from the glass surface.

The striking characteristic of the present investigation revealed that the presence of intracytoplasmic basophilic inclusion bodies along with intranuclear inclusion bodies in different morgans other than liver have never been noted in any reports of HPS field cases and experimental cases.

The present strain of isolated adenovirus from cases of HPS was found to be group-4 (confirmed by the department of microbiology, Punjab Agriculture University, Ludhiana, Punjab) which was also found in different HPS cases in the tropic and causes HPS condition. Molecular biological study of these virus strains will be necessary to explore the epidemiology of adenoviruses.

Acknowledgement

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References


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The report also examined the implications of large-scale deployment of 5G networks on the economy and society, including job creation and the potential for innovation. It highlighted the importance of ensuring that the benefits of 5G are shared equitably and that the technology is developed in a way that is socially responsible.

The report was commissioned by the Department of Communications and the Technology, Media, and the Arts and was authored by a team of experts from across the field. It included a comprehensive review of the current state of 5G technology and its potential applications, as well as an analysis of the economic and social impacts of its deployment.

The report also examined the role of 5G in the context of the Fourth Industrial Revolution, including the implications for the future of work and the potential for 5G to drive innovation and economic growth.

The report was released in June 2020 and has been widely praised for its thorough analysis and its practical recommendations for policymakers and industry leaders.
SHORT COMMUNICATION

CLOACAL PROLAPSE IN A SIX WEEK OLD OSTRICH CHICK

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The Ostrich Struthio camelus is the largest bird in the world and it originates from Africa. It is a multipurpose bird raised for leather and meat. The bird is now raised in all continents of the world.\(^1\,2\,3\).

Cloacal prolapses are common in young chicks. This condition is most common in birds less than 4 weeks and it has been associated with diarrhoea or impaction within the gastro-intestinal tract.\(^4\) Cloacal prolapse is also associated with distention of the abdomen as a result of excessive water intake, retention of the yolk sac and tenesmus. Mild cases of cloacal prolapse can be corrected by simply replacing the cloaca through the vent. More severe cases require retention suture for 1 - 3 days.\(^4\)

This is the first case of cloacal prolapse in an ostrich chick that has been reported to the Poultry Health Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria. In this communication, we report a case of cloacal prolapse in a six-week old ostrich chick.

A six week old ostrich chick, belonging to a flock of 40 chicks of the same age, was presented to the Poultry Health Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria with cloacal protrusion which was noticed a day prior to presentation.

The 40 chicks were obtained from the same source at 3 weeks of age. They had no history of the medication of vaccination and were fed on lettuce, cabbage, wheat, wheat-bran, corn bran and kitchen left over. The chicks were housed in a walled, open space within the premises of the owners compound and shade was provided for the chicks. The affected chick was the smallest in size in the flock.

Clinically the chick was alert, in fair body condition and restless. A large hyperaemic protruding mass of the cloaca (Figure 1) was noticed in the perineal area. It was oedematous and lacerated.

Figure 1: Protruding mass of cloaca showing severe hyperaemia and oedema
The chick was restrained in sternal recumbency with the perineal area tilted upward. The prolapsed cloaca was gently washed with mild soap using warm water mixed with disinfectant (chlorhexidine). Some sugar was then applied liberally on the prolapsed cloaca and it was gently massaged using sterile towel to reduce the oedema. When the oedema was reduced considerably the cloaca was then returned in the pelvic cavity and purse-string sutured using 3-0 silk around the cloacal opening in order to prevent recurrence (Figure 2). The index finger was inserted into the cloaca before the final knot was tied in order to ensure that the cloaca remained patent. The chick was injected with terramycin® (oxytetracycline, pfizer) intramuscularly at 5mg/kg for 3 days. The purse-string sutures were removed 4 days after the correction of the prolapse.

It is important to note that this condition occurred in the smallest chick in the flock of 40. It has been suggested that there are environmental and genetic factors that affect the growth of ostrich chicks. It has also been suggested that such stunted chicks might be chicks that were assisted to hatch and such chicks perform poorly for the rest of their lives.

Prolapse of the cloaca is reported to be common in ostrich chicks less than 4 weeks of age. But here we record its occurrence in a six week old chick. Previous studies have reported that the condition is normally associated with excessive water intake on hot days, proventricular impaction, retention of yolk and tenesmus. However, in our observation, the prolapse occurred in the month of January, during the cold harmattan season, when temperatures are low at Zaria. It is, therefore, unlikely that excessive water intake was one of the contributing factors. We believe it could have been as a result of tenesmus.
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Le Bulletin de la Santé et de la Production animales en Afrique contient des articles de recherches originales traitant d'activités en matière de santé et de production animales visant à assurer le développement de l'industrie animale et une meilleure utilisation des ressources du bétail en Afrique. Le Bulletin est un périodique trimestriel.

Présentation des articles
Deux exemplaires des articles doivent être adressés à Monsieur le Rédaacteur en Chef, Bulletin de la Santé et de la Production Animales en Afrique, Organisation de l'Unité Africaine/Bureau interafricain des Ressources animales, P.O. Box 30786, Nairobi, Kenya
Un article ne peut être soumis pour publication que s'il n'a pas encore été proposé ailleurs; il faudra l'objet de quelques modifications par le Comité de Rédaction.

Genres d'articles publiés dans le Bulletin
- des communications originales
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- informations et annonces

Format des articles
Les manuscrits doivent respecter les conditions suivantes: Le titre doit être concis et ne pas dépasser plus de 15 mots, il est suivi du (des) nom(s) de l'auteur (ou des auteurs) et des établissements où le travail a été effectué, ainsi que de l'adresse pour les correspondances si elle n'est pas la même.
Le résumé ne doit pas dépasser 200 mots. Son texte bref et concis comprendra les principaux résultats et la (les) conclusion(s) de l'étude.
L'introduction expose le but de la recherche.
Le matériel et les méthodes utilisés.
Les résultats présentés brèvement.
Un débat sur l'importance de l'article.
Remerciements éventuels.
Bibliographie: les références bibliographiques doivent être numérotées dans l'ordre, telles qu'elles apparaissent dans le texte. L'identification des références dans le texte se fera à l'aide de numéros (entre parenthèses) et non pas par les noms des auteurs.
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1. Journal
Le nom de l'auteur (ou des auteurs) suivi des initiales du ou des prénoms, l'année de parution (entre parenthèses), l'abréviation du titre du périodique suivant la "World List of Scientific Periodicals" (soulignée), le numéro de la première page. Le titre de l'article ne doit pas être inclus.

2. Revue
Le nom de l'auteur (ou des auteurs) suivi des initiales du ou des prénoms, l'année de parution (entre parenthèses), le titre exact (souligné), la ville où elle a été publiée, les éditeurs, le numéro de la première page.

3. Rapport annuel
Le nom du pays, l'année faisant l'objet du rapport, puis le nom du service ou de l'organisation, le numéro de la première page.
Si le même auteur est cité plus d'une fois, ses publications seront indiquées dans l'ordre chronologique dans la liste bibliographique et s'il y a plus d'une publication, les lettres "a,b,c," seront ajoutées aussi bien dans la liste bibliographique que dans le texte.

Illustrations
Les tableaux et les titres doivent être en nombre aussi réduit que possible. Un tableau d'une trop grande dimension est difficile à lire même s'il peut être reproduit. Les tableaux et les figures doivent être numérotés dans l'ordre, respectivement Tableau 1, etc., ou Fig. 1 etc. et joints à la fin du texte. Les références aux tableaux et aux figures dans le texte doivent être numérotées et non pas indiquées "tableau ci-dessous" ou figure ci-dessous. Les illustrations en couleurs ne sont reproduites qu'aux frais de l'auteur (ou des auteurs).

Brève communication
Une brève communication signifie que l'article ne peut pas être publié comme une communication normale. Elle ne doit pas dépasser deux pages imprimées ou 1000 mots en incluant deux illustrations au maximum. Elle doit donc respecter les mêmes normes qu'un article habituel, sauf que le résumé et les sous-titres ne sont pas nécessaires.

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Les épreuves typographiques sont envoyées à l'auteur qui en effectue la correction des coquilles et en assure le retour rapide (dans les 3 jours).

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