GUIDANCE FOR AUTHORS

Aims and Scope
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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Two copies of articles should be sent to the Editor, Organisation of African Unity/Interafrican Bureau for Animal Resources, P.O. Box 30786, Nairobi, Kenya.

Manuscripts should be in clear concise English or French, typewritten with double spacing and adequate margins. The spelling should be that of The Oxford English Dictionary or Le Petit Robert.

An article submitted for publication implies that its content has not been published elsewhere and that it is subject to editorial revision.

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- Full papers providing accounts of original work.
- Short Communications.
- Review articles invited by the Editor.
- Editorials.
- Letters to the Editor.
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The manuscripts should contain the following features:
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Abstract not exceeding 200 words giving a synopsis of the findings presented and the conclusion(s) reached.

Introduction stating the purpose of the work.
Materials and Methods regular.
Results regular.
Discussion regular.
Acknowledgements.

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Name of country, year of reference, followed by the name of the department or organisation, first page number.

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Illustrations
Tables should be limited and number of headings restricted. A massive table is difficult to read even if it can be reproduced. Tables and figures should be numbered consecutively. Table 1 etc., or Fig. 1 etc., respectively, and attached at the end of the text. References to tables and figures in the text should be by number and not to “table below” or “figure below”. Coloured illustrations are reproduced only at the author(s) expense.

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REPRODUCTIVE AND PRODUCTIVE PERFORMANCE IN URBAN AND PERI-URBAN DAIRY CATTLE PRODUCTION SYSTEMS IN THE ADDIS ABABA REGION, ETHIOPIA

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³International Livestock Research Institute (ILRI), P.O. Box 5689, Addis Ababa, Ethiopia

PERFORMANCE DE REPRODUCTION ET DE PRODUCTION DANS LES SYSTEMES URBAIN ET PERI-URBAIN D'EXPLOITATION DE BETAIL LAITIER DANS LA REGION D'ADDIS-ABBEBA EN ETHIOPIE

Résumé

Les caractéristiques de performance de reproduction et de production des vaches croisées Frison x Zébu ont été étudiées entre mai et septembre 1997 dans trois systèmes d'exploitation, à savoir : le système urbain dans les petites villes, le système intra-urbain d'Addis-Abeba et le système périurbain. L'intervalle moyen des vêlages pour les trois systèmes de production était comme suit: 481 ± 11 jours avec le système urbain dans les petites villes; 421 ± 89 jours avec le système intra-urbain d'Addis-Abeba et 501 ± 111 jours avec le système périurbain. L'âge moyen au premier vêlage était de 37 ± 0,6 mois avec le système urbain dans les petites villes; 27 ± 0,4 mois avec le système intra-urbain d'Addis-Abeba et 39 ± 0,7 mois avec le système périurbain. Le nombre de services/conception était de 1,9 ± 1,3 pour le système urbain dans les petites villes: 2,4 ± 1,7 pour le système intra-urbain d'Addis-Abeba et 1,6 ± 0,9 pour le système périurbain. Dans l'ensemble, l'intervalle des vêlages, l'âge au premier vêlage et le nombre de services/conception étaient en moyenne de 497 ± 112 jours; 36 ± 0,7 mois et 1,7 ± 1,1 respectivement. Le rendement laitier moyen pour 305 jours était de 2,460 ± 970 kg avec le système urbain dans les petites villes; 1,497 ± 592 kg avec le système intra-urbain d'Addis-Abeba et 2,533 ± 866 kg pour les fermes périurbaines. Le rendement global en lait était en moyenne de 2,372 ± 921 kg. On a constaté une variation importante de toutes les caractéristiques de reproduction et du rendement laitier avec les trois systèmes d'exploitation (P < 0,05). L'association entre l'infection par Brucella et la faible performance de reproduction n'était pas significative (P > 0,05). L'alimentation insuffisante et le mode d'élevage sub-optimum seraient à l'origine de la faible performance de reproduction et de production observée.

Summary

Reproductive and productive performance traits of Friesian-Zebu crossbreed cows were studied in three production systems namely; urban in secondary towns, Addis intra-urban, and peri-urban between May and September 1997. The mean calving interval in days for the three production systems were; urban in secondary towns 481±11, Addis intra-urban 421±89, and peri-urban 501±111. The mean age at first calving in months were; urban in secondary towns 37±0.6, Addis intra-urban 27±0.4, and peri-urban 39±0.7. The number of services per conception were; urban in secondary towns 1.9±1.3, Addis intra-urban 2.4±1.7, and peri-urban 1.6±0.9. The overall mean calving interval, age at first calving and number of services per conception were 497±112 days, 36±0.7 months, and 1.7±1.1, respectively. The mean 305-day lactation milk yield was 2460±970 kg for urban in secondary towns, 1497±592 kg for Addis intra-urban, and 2533±866 kg for peri-urban farms. The overall mean yield was 2372±921 kg. Significant variation in all the reproductive traits and milk yield was observed among the three systems (P<0.05). The association between Brucella infection and the low performance in the reproductive traits was significant (P<0.05). Inadequate feeding and sub-optimum management practice was thought to be responsible for the observed poor reproductive and productive performance.

* Corresponding Author.
Introduction

Subsistence animal production cannot adequately meet the growing demand for dairy products in developing countries. Over the past two decades, sub-Saharan Africa experienced relatively low growth rates in the production of dairy products compared to the average production level for all developing countries. The low growth rate in dairy products is associated with inadequate feeding, poor reproductive management, diseases and breed. Infertility, subfertility, abortions, requirement of more than two services to conceive, and long calving intervals are some of the major problems reported in many of the farms in Africa.

In Ethiopia, a growing tendency for intensification of dairy cattle around major cities is observed and this is particularly evident around Addis Ababa, the capital city. These farms in and around big cities form urban and peri-urban production systems. Data on the reproductive and productive performance of cows in these fast emerging production systems under the prevalent tropical management are not available in all countries. The purpose of this paper is to give estimates on the reproductive performance and milk yield for crossbreed cows in urban and peri-urban dairy production systems of the Addis Ababa region in Ethiopia.

Materials and Methods

The study was carried out in central Ethiopia in a 50 km radius around Addis Ababa, Ethiopia, between May 1 and September 31, 1997. The altitude ranges from 1800 to 2400 meters above sea level. The average temperature ranges from 16°C to 23°C, and the annual rainfall from 845 mm to 1153.3 mm. The rainy season is bi-modal; the long rainy season occurs from June to August, and the short rainy season from March to April.

A two step multi-stage sampling procedure was applied to select farmers from the Addis Ababa milk shed-area supplying milk to the Addis Ababa market. The milk shed comprises Addis Ababa and the surrounding areas. The sampling frame in the first level were Highers (in Addis Ababa) and Woredas (in the surrounding areas). In the first step, Highers and Woredas were randomly selected. In the second step, from these selected Highers and Woredas, 147 farmers (or farms) were randomly selected from various farmer lists available (Dairy Development Enterprise, Artificial Insemination Center, Dairy Producers’ Association). No classification criteria being available a priori, factorial correspondence analysis and cluster analysis were used to identify seven types of market-oriented dairy farms, on the basis of 45 farm resources data and parameters reflecting farm functioning. These were: traditional crop/livestock farms in rural areas (10 farms), intensified dairy/crop livestock farms in remote rural areas (30 farms), crop/livestock farms with intensive cropping (23 farms), specialized dairy farms (9 farms), peri-urban producers in secondary towns (20 farms), Addis intra-urban farms (24 farms), and urban dairy in secondary towns (31 farms).

The latter three types (production systems) have minimum grazing, the level of exotic blood is highest, are specialized farms and relatively get better inputs. This study was conducted on the 45 farms randomly selected from the 75 farms in these three production systems. Holstein-Zebu crossbreeds totaling 394 cows were used. The genetic make up of the crossbreeds was mixed, but most have 75% and above Holstein-Friesian blood.

Cow reproductive parameters that is
calving interval, age at first calving, and number of services per conception and milk yield were taken from individual records from May to September 1997. The milk yield of 305 days was used in this study. Farmers and employees used a graduated bucket to record milk for each cow on daily basis. Veterinarians employed as part of the production systems research program supervised a large part of the recording. In addition, a questionnaire was administered to each farm to collect information on the farms’ management practices. Descriptive statistics was calculated using Excel 5.0. To determine presence of variation among the production systems analysis of variance (ANOVA) were computed using Statgraphics plus 2.1.

Thereafter, the Student-Newman-Keuls-Test (SNK) was used to establish if significant differences existed across the production systems. Data were analyzed by chi-square statistics to estimate the association between reproductive performance and Brucella infection using Epi Info Version 6.02.

**Results**

In peri-urban farms, the average calving interval was 501±111 days. In Addis Ababa intra-urban farms the interval was 421±89 days. The overall calving interval was 497±112 days. For some of the cows, a calving interval of three years was observed. There was significant variation in the calving interval across the three production systems (F=8.4, p<0.05) (Table 1).

In peri-urban farms, average age at first calving was 39=0.7 months while in urban secondary towns it was 37±0.6 months. The overall value was 36±0.7 months and there was significant variation across the production systems (F=22.3, p<0.05).

The mean number of services required per conception were 1.9±1.3, 2.4±1.7, and 1.6±0.9 for urban secondary towns, Addis intra-urban and peri-urban farms, respectively. The overall value was 1.7±1.1 and the variation in the number of conceptions was significantly different across the production systems (F=13.9, p<0.05).

The mean 305 - day lactation milk was 2460±970 kg for urban secondary towns, 1497±592 kg for Addis intra-urban, and 2533±866 kg for peri-urban farms (Table 1). The overall mean yield was 2372±921 kg. The average daily milk yield per cow in Addis intra-urban farms was 5 kg while in peri-urban farms it was 8 kg. The variation in milk yield across the production systems was significantly different (F=35.1, p<0.05).

There was casual association between Brucella infection and low reproductive performance (p<0.05) (Table 2).

From the questionnaire study, feed shortage was found in 95 percent of the farms (Table 3). Only 2.5 percent of the farms got veterinary services. Eighty seven percent of the farmers did not know what brucellosis is. Dry cow therapy and teat dips were practiced only in 2.5 and 5 percent of the farms respectively. However, association between sub-optimum management practice and the poor performance was not statistically tested across production systems.

**Discussion**

The productive performance of cows in urban and per-urban production systems in this study were generally low. The calving interval for some cows in this study was as long as three years. At Debre Zeit Research Station, Ethiopia, a calving interval of 411 days has been observed, though, the cows are kept under optimum feeding and management in experimental conditions.
Table 1: Reproductive performance and productive traits in urban and peri-urban dairy production systems (mean±standard deviation, standard error (SE), coefficient of variation (CV))

<table>
<thead>
<tr>
<th>Reproductive/Urban Productive trait</th>
<th>Urban towns</th>
<th>Addis in secondary</th>
<th>Addis intra-urban</th>
<th>overall Peri-urban</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calving interval (days)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>481±111*</td>
<td>421±89b</td>
<td>501±111c</td>
<td>497±112</td>
</tr>
<tr>
<td>SE</td>
<td>14.4</td>
<td>14.7</td>
<td>7.5</td>
<td>6.5</td>
</tr>
<tr>
<td>CV</td>
<td>0.23</td>
<td>0.21</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>range</td>
<td>370-752</td>
<td>360-762</td>
<td>375-1087</td>
<td>360-1087</td>
</tr>
<tr>
<td>n</td>
<td>60</td>
<td>36</td>
<td>223</td>
<td>319</td>
</tr>
<tr>
<td><strong>Age at first calving (months)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>36.8±0.6a</td>
<td>27.2±0.4b</td>
<td>39.1±0.1c</td>
<td>36.2±0.7</td>
</tr>
<tr>
<td>SE</td>
<td>0.09</td>
<td>0.09</td>
<td>0.08</td>
<td>0.06</td>
</tr>
<tr>
<td>CV</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.24</td>
</tr>
<tr>
<td>range</td>
<td>24-51.6</td>
<td>18-36</td>
<td>24-60</td>
<td>18-60</td>
</tr>
<tr>
<td>n</td>
<td>54</td>
<td>24</td>
<td>66</td>
<td>144</td>
</tr>
<tr>
<td><strong>Number of AI services per conception</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>1.9±1.3a</td>
<td>2.4±1.7b</td>
<td>1.6±0.9c</td>
<td>1.7±1.1</td>
</tr>
<tr>
<td>SE</td>
<td>0.2</td>
<td>0.4</td>
<td>0.1</td>
<td>0.09</td>
</tr>
<tr>
<td>CV</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>range</td>
<td>1-6</td>
<td>1-8</td>
<td>1-4</td>
<td>1-8</td>
</tr>
<tr>
<td><strong>Milk yield (kg)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>305-day lactation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>2460±970a</td>
<td>1497±592b</td>
<td>2533±866c</td>
<td>2372±921</td>
</tr>
<tr>
<td>SE</td>
<td>122</td>
<td>76.8</td>
<td>51.6</td>
<td>46.4</td>
</tr>
<tr>
<td>CV</td>
<td>0.41</td>
<td>0.23</td>
<td>0.37</td>
<td>0.39</td>
</tr>
<tr>
<td>range</td>
<td>511-4734</td>
<td>150-3202</td>
<td>200-4925</td>
<td>150-4925</td>
</tr>
<tr>
<td>n</td>
<td>60</td>
<td>57</td>
<td>277</td>
<td>394</td>
</tr>
</tbody>
</table>

*abc estimates with different superscripts significantly different (P<0.05).
In small holder farms in southern Malawi, Agyemang and Nkhonjera\textsuperscript{10} reported a calving interval of 482 days in 75% Friesian crossbreeds. A calving interval of 631±35 days was reported by Mekonnen and Goshu\textsuperscript{11} in half-breeds (Fogera X Friesian) in northwestern Ethiopia (Fogera is a Zebu type local breed).

Age at first calving in Holstein-Boran crossbreeds at Debre Zeit Research Station was 29.7 months\textsuperscript{9}. Galal et al\textsuperscript{12} reported a 35.5 months age at first calving in Friesian-Zebu crossbreeds at different locations in Ethiopia, while Agyemang and Nkhonjera\textsuperscript{10} reported 40.1 months in 75% Friesian crossbreeds.

According to the report of Mukasa-Mugenwa\textsuperscript{14} the number of services per conception in this study is acceptable. He asserted that the performance can be rated as unacceptable if the value is greater than 2. Similarly, Azage et al\textsuperscript{13} reported a value of 1.6±0.6 in Friesian-Zebu crossbreeds in Ethiopia.

From the results of this study, the milk yield of cows in all the production systems was low. Holstein-Boran crosses reportedly yield 2280 kg in 305-day lactation\textsuperscript{8}. Agyemang and Nkhonjera\textsuperscript{10} have reported a yield of 1950 kg in half-breeds and 1850 kg in 75% Friesian crossbreeds in Malawi. Similarly, in Nigeria, Buvanendran et al\textsuperscript{15} reported 1684 kg and 2051 kg in 305-day lactation in half-breeds and 75% Friesian crossbreeds (Friesian-Fulani), respectively.

Although, brucellosis is the most important disease affecting reproductive parameters

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|}
\hline
Reproductive trait & Chi-square value & p-value \\
\hline
Calving interval: & & \\
\leq 540 days & 1.44 & 0.31 \\
< 540 days & & \\
\hline
Age at first calving: & & \\
< 42 days & 0.041 & 0.91 \\
\leq 42 days & & \\
\hline
Number of AI services per conception: & & \\
1 service & 0.0026 & 0.77 \\
<service & & \\
\hline
\end{tabular}
\caption{Causal association between \textit{Brucella} infection and reproductive performance}
\end{table}
Table 3: Some of the farms' management activities (n=40*)

<table>
<thead>
<tr>
<th>Farm description</th>
<th>Number of farms</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm demographics Sex of owner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>26</td>
<td>65.0</td>
</tr>
<tr>
<td>female</td>
<td>14</td>
<td>35.0</td>
</tr>
<tr>
<td>Average age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;40</td>
<td>12</td>
<td>30.0</td>
</tr>
<tr>
<td>≥40</td>
<td>28</td>
<td>70.0</td>
</tr>
<tr>
<td>Farm management self-hired labor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>self</td>
<td>37</td>
<td>92.5</td>
</tr>
<tr>
<td>hired labor</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Time spent on the farm (in self managed farms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>full time job</td>
<td>12</td>
<td>32.4</td>
</tr>
<tr>
<td>part time</td>
<td>25</td>
<td>67.6</td>
</tr>
<tr>
<td>Years of experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>19</td>
<td>47.5</td>
</tr>
<tr>
<td>≥10</td>
<td>21</td>
<td>52.5</td>
</tr>
<tr>
<td>Farm management characteristics a) general</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed shortage yes</td>
<td>38</td>
<td>95.0</td>
</tr>
<tr>
<td>no</td>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>Veterinary services easily available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>no</td>
<td>39</td>
<td>97.5</td>
</tr>
<tr>
<td>Engagement in crop farming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>6</td>
<td>15.0</td>
</tr>
<tr>
<td>no</td>
<td>34</td>
<td>85.0</td>
</tr>
<tr>
<td>Contact allowed with other animals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>no</td>
<td>31</td>
<td>77.5</td>
</tr>
<tr>
<td>b) on brucellosis Knowledge of brucellosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>no</td>
<td>35</td>
<td>87.5</td>
</tr>
<tr>
<td>Presence of parturition pens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>no</td>
<td>38</td>
<td>95.0</td>
</tr>
<tr>
<td>Cleaning and disinfection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>12</td>
<td>30.0</td>
</tr>
<tr>
<td>no</td>
<td>28</td>
<td>73.0</td>
</tr>
<tr>
<td>Culling of Brucella infected animals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>6</td>
<td>15.0</td>
</tr>
<tr>
<td>no</td>
<td>34</td>
<td>85.0</td>
</tr>
<tr>
<td>c) on mastitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry cow therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>no</td>
<td>39</td>
<td>97.5</td>
</tr>
<tr>
<td>Use of teat dip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>no</td>
<td>38</td>
<td>95.0</td>
</tr>
<tr>
<td>Check milk for abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>21</td>
<td>52.5</td>
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<tr>
<td>no</td>
<td>19</td>
<td>47.5</td>
</tr>
<tr>
<td>Teats washed before milking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>39</td>
<td>97.5</td>
</tr>
<tr>
<td>no</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Abrupt drying off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>28</td>
<td>70.0</td>
</tr>
<tr>
<td>no</td>
<td>12</td>
<td>30.0</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>yes</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>no</td>
<td>31</td>
<td>77.5</td>
</tr>
<tr>
<td>Mastitic cows milked last</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>26</td>
<td>65.0</td>
</tr>
<tr>
<td>no</td>
<td>14</td>
<td>35.0</td>
</tr>
</tbody>
</table>

* five farms dropped out of the study during the questionnaire investigation
and the prevalence is 8 percent in these farms\textsuperscript{16} this infection was not responsible for the poor reproductive performance.

Reproductive traits discussed have low heritability\textsuperscript{14}. They are much influenced by the environment especially nutrition and management which are of low standards in the tropics. For example, one of the most important traits, the calving interval, can be improved by serving cows at 30-60 days post-partum. The significant variation observed in the reproductive traits and milk yield among the production systems was thought to be due to variation in feeding, housing, herd size and availability of professional services. This finding agrees with Bekele et al\textsuperscript{17} who reported significant difference in calving interval and number of services per conception among farms in central Ethiopia. These factors need to be investigated further. From the results of this study, it can be concluded that more attention need to be given to the dairy industry in this country.

**Acknowledgements**

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**References**


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INFLUENCE OF IVERMECTIN AND CLORSULON STRATEGIC TREATMENTS ON LIVEWEIGHT GAIN AND HELMINTH INFECTIONS OF GRAZING CALVES IN KENYA

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EFFETS DES TRAITEMENTS STRATEGIQUES A L’IVERMECTINE ET AU CLORSULON SUR LE GAIN PONDERAL ET LES INFECTIONS PAR LES HELMINTHES DES VEAUX EN PATURAGE AU KENYA

Résumé

Les taux de croissance des veaux en pâturage ont été évalués après des traitements stratégiquest sous-cutanés à l’ivermectine (IVM) en association avec le clorsulon (CLS). Trente veaux au sevrage infectés par Fasciola gigantica et souffrant de nématodose infractionnelle gastro-intestinale (GI) ont été affectés au hasard à l’un des trois groupes sous traitement ci-après : le groupe I composé de 10 veaux non-traités (groupe-témoin), le groupe II comprenant 10 veaux traités avec 0,2 mg IVM/kg1 de poids vif, le groupe III constitué de 10 veaux traités avec 0,2 mg IVM/kg1 de poids vif et 2 mg CLS/kg1 de poids vif. Les traitements stratégiques étaient effectués en juin, octobre 1999 et en février 2000. On a relevé les poids individuels et les échantillons de fèces au début de l'étude et ensuite à trois semaines d'intervalle. Les nématodes gastro-intestinaux et les douves du foie étaient transmis aux veaux pendant toute la durée de l'étude avec une prévalence globale de 34% et 63% respectivement. Les œufs apparemment de Strongyle étaient très répandus pendant la saison des pluies, tandis que la prévalence des œufs de douve du foie était très forte durant la saison sèche. En dépit de l'infection constante par les helminthes, à la fin de l'étude : les veaux du groupe III avaient gagné en moyenne (+ Ecarts types) 157,6 ± 5,8 kg (P<0,05) par rapport aux veaux du groupe II avec un gain pondéral de 125,6 ± 6,3 kg et à ceux du groupe I avec un gain moyen de 95,7 ± 7,1 kg. D’après ces résultats, un programme qui utilise trois traitements stratégiques des bovins à IVM/CLS a permis d'obtenir un meilleur contrôle des nématodes et des douves du foie, ce qui a entraîné un gain pondéral plus élevé comparé aux veaux non-traités.

Summary

The growth rates of grazing calves were evaluated after subcutaneous strategic treatments using ivermectin (IVM) or IVM in combination with clorsulon (CLS). Thirty weaner calves harbouring infections of Fasciola gigantica and subclinical gastro-intestinal (GI) nematodosis were randomly assigned to one of three treatment groups: group I comprising 10 unmedicated controls; group II, 10 calves treated with 0.2 mg IVM kg−1 body weight; group III, 10 calves treated with 0.2 mg IVM kg−1 body weight and 2 mg CLS kg−1 body weight. Strategic treatments were undertaken in June, October 1999 and February 2000. Individual weights and faecal samples were taken at study initiation and at 3-week intervals thereafter. Both GI nematodes and liver flukes were transmitted to the calves during the entire study period with an overall prevalence of 34% and 63%, respectively. Strongyle-type eggs were most prevalent during the rainy seasons while prevalence of liver fluke eggs was highest during the dry months. Even in the face of continual helminth challenge, at study termination, group III calves had gained an average (+ S.D.) 157.6±5.8 kg (p<0.05) compared to the group II gain of 125.6±6.3 kg and the group I average gain of 95.7±7.1 kg. These results indicate that a programme using three IVM/CLS strategic treatments of cattle provided significantly better nematode and liver fluke control resulting in a better weight gain than untreated calves.

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Introduction

Fasciolois is an important disease of domestic ruminants causing serious economic losses\(^1\,^2\). It is generally accepted that acute infection with *Fasciola gigantica* can cause severe clinical disease and a high mortality rate in grazing calves, but the economic impact due to chronic infection may also be of considerable importance. This subclinical form of the disease generally remains undetected and hence may significantly reduce production without the producer’s knowledge\(^3\,^4\). Assessment of the economic cost of chronic infections remains difficult because of the multiple factors that can occur in the management system.

Clorsulon, an injectable sulphonamide is highly effective against bile duct stages of liver flukes (*F. hepatica* and *F. gigantica*) in cattle\(^5\,^6\,^7\). However, CLS must be used concurrently with nematicides as it is ineffective in controlling gastro-intestinal (GI) nematodes in cattle. Ivermectin (IVM) is highly effective against parasitic nematodes\(^8\). The use of IVM concurrently with clorsulon does not impair the efficacy of the latter anthelmintic\(^9\).

The present study was conducted to evaluate the effects of strategic dosing of IVM and CLS on the weight gain of weaner calves with naturally acquired GI nematode and *F. gigantica* infections.

Materials and Methods

Study area

The present study was conducted on a dairy farm between June 1999 and June 2000 in Kamae area of Lari Division, Kiambu District, about 70 km to the north-west of Nairobi. The area is endemic for GI nematodes and liver fluke infections\(^10\).

Experimental animals

Thirty female Friesian crossbred calves were used in the study. The calves were 8 to 10 months of age and had previously been exposed to nematode and liver fluke contaminated pastures.

Experimental designs

The calves were individually identified by ear tags and before treatment, they were weighed and rectal faeces taken from each animal. They were then assigned to one of the three treatment groups (10 calves group \(^{-1}\)) based on weight. Group I calves were the unmedicated controls; group II were treated with IVM subcutaneously at 0.2 mg kg\(^{-1}\) liveweight and group III calves treated with IVM and CLS (Ivomec® Super, MSD Agvet, at the approved dose rate of 1 ml 50 kg\(^{-1}\) liveweight). This provided dose levels of 0.2 mg IVM kg\(^{-1}\) liveweight and 2 mg CLS kg\(^{-1}\) liveweight.

Strategic treatments were undertaken in late June (29\(^{th}\) June 1999) corresponding to the end of the long rains, in October before the onset of the short rains and February 2000, corresponding to the late dry season\(^2\,^11\). The animals were grazed together on natural pastures comprising mainly Kikuyu grass (*Pennisetum clandestinum*) and had free access to water and mineral salt. Weight gains were assessed by weighing each animal at 3 week intervals. Rainfall readings were recorded throughout the study period.

Parasitological methods

Rectal faecal samples were collected at the start of the study and at a 3 week interval thereafter. A modified McMaster technique was used to determine the number of nematode worm eggs gram\(^{-1}\) (epg) of faeces\(^12\). Faecal cultures were made on pooled positive samples from each group and incubated for 14 days at 27°C and third stage larvae (L\(_3\)) identified to genus level\(^12\). A faecal semidemation procedure was used to detect the presence of *F. gigantica* eggs\(^13\). Individual faecal samples were recorded as either positive or negative with actual counts of epg for *F. gigantica* not determined.
Fig. 1 Monthly rainfall and seasonal distribution of strongyle and liver fluke infections of calves in Kamae area from June 1999 to June 2000.

Rainfall (mm)

Prevalence (%)

Month

Rainfall  L. flukes  Strongyles
Statistical analysis

Data on liveweight gains was analysed by one-way analysis of variance and differences between groups tested for significance using Students t-test. Statistical differences are reported at P<0.05.

Results

During the study, 3 calves died due to health problems unrelated to helminthosis; one in group I and two in group II died due to gastro-enteritis and pneumonia. No eggs of *Strongloides* sp., *Nematodirus* sp., and *Trichuris* sp. were found in the faecal examinations, therefore, counts on epg reflect only strongyle-type eggs. These counts were generally low throughout the study in all three groups of calves and overall, the abundance was less than 165 eggs with about 34% of the calves in the control group excreting nematode eggs at any given sampling period. Rainfall and epg trends were strikingly similar as the prevalence of strongyle eggs were higher during the two rainy peaks (Fig. 1). The pooled faecal cultures for positive epg identified *Haemonchus* sp. as the predominant nematode with an occurrence rate of 57.3% in the herd. The occurrence rate of *Trichostrongylus* sp. was 22.8%, *Cooperia* sp. 10.6% and *Oesophagostomum* sp. 9.3%.

Eighty-one percent of the calves were shedding *F. gigantica* eggs at study initiation. In December, faecal sediments showed that 6 of 9 (67%), 4 of 8 (50%) and 3 of 10 (30%) calves were positive in groups I, II and III, respectively. On study termination, these same groups had 4 of 9 (44%), 5 of 8 (63%) and 2 of 10 (20%) liver fluke eggs. The overall prevalence of liver fluke eggs was about 63% and was higher during the dry periods (Fig. 1). The average bodyweight of the calves are shown in Fig. 2. At the end of the study, group III calves had a mean liveweight gain advantage of 61.9 kg over group I (P<0.05) and 32.0 kg (P<0.05) over group II calves (Table 1).

Discussion

This study demonstrated that grazing cattle in liver fluke and nematode endemic area resulted in significantly lower weight gains of untreated calves as previously reported in sheep. When only GI nematodes were removed in the IVM treated groups, the calves gained less weight than those treated with a combination of IVM and CLS, probably due to the subclinical liver fluke infections as was reported by others.

The effect of climate on the prevalence of GI nematodes was evident, as levels of strongyle infection was higher during the long and short rains. This was in agreement with earlier observations of Waruiru and colleagues in cattle in Kiambu District. Liver flukes were also transmitted year-round with peaks during the dry months and was in accordance with the findings made by other workers in central Kenya. The occurrence of *F. gigantica* infections throughout the year is suggestive of the fact that essential requirements for the completion of the life cycle of the fluke, i.e., high moisture, moderate temperature and availability of the snail intermediate host, are continually present in the study area. Given the strongyle and liver fluke transmission patterns, combined IVM/CLS treatments were apparently required as they reduced the effect of parasitism in the calves by reducing nematode and liver fluke worm burdens, concurrently. Other broad-spectrum anthelmintics, which have efficacy against liver flukes could also be used to prevent production losses caused by fasciolosis that may be superimposed upon existing GI nematode infections. However, results from this study also demonstrated that even a single strategically timed anthelmintic treatment
Fig. 2 Mean liveweights of calves strategically treated with ivermectin or ivermectin / clorsulon compared with untreated controls.
Table 1: Mean weight gain of control (group I) and ivermectin or ivermectin/clorsulon (groups II and III) treated calves.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of animals</th>
<th>Mean initial weight (kg)</th>
<th>Mean final weight (kg)</th>
<th>Mean gain (kg)</th>
<th>Mean daily gain (kg) (g day⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>9</td>
<td>118.7± 7.4</td>
<td>214.4±8.5</td>
<td></td>
<td>95.7±7.1</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>118.5±6.7</td>
<td>244.1±8.7</td>
<td></td>
<td>125.6±6.3</td>
</tr>
<tr>
<td>III</td>
<td>10</td>
<td>118.4±8.2</td>
<td>276.2±7.9</td>
<td></td>
<td>157.6±5.8</td>
</tr>
</tbody>
</table>

Values without a common superscript letter within a column are significantly different (P<0.05).

in the face of continual parasite challenge could be advantageous. Other methods of control, for example grazing management, use of molluscicides biological control of fluke intermediate host and animal parasitic nematodes merit further consideration.

Acknowledgements

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PREVALENCE OF FOETAL WASTAGE IN SLAUGHTERED CAMELS (CAMELUS DROMEDARIUS) AT MAIDUGURI ABATTOIR, NIGERIA.

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2University of Maiduguri
P.M.B. 1069 Maiduguri, Nigeria.

PREVALENCE DES PERTES FOETALES CHEZ LES CHAMEAUX (CAMELUS DROMEDARIUS) ABATTUS A L'ABATOIR DE MAIDUGURI AU NIGERIA

Résumé

Un examen rétrospectif des documents d'abattage conservés à l'abattoir de Maiduguri a été réalisé pour la période 1990 – 1993, en vue de déterminer la prévalence des pertes foetales dues à l'abattage des chameaux gravides. Au total, 25.068 chameaux adultes étaient abattus pendant la période couverte par l'étude, parmi lesquels 49% (12.367/25.068) étaient des femelles. On a pu trouver cinq cent cinquante et un foetus à divers stades de gestation, soit une prévalence de 4,5% des femelles adultes abattues (551/12.367).

Il y avait une augmentation constante du taux de prévalence annuel pendant la période considérée. Un taux beaucoup plus élevé de pertes foetales (P < 0,05) a été constaté durant la saison des pluies par rapport à la saison sèche. Les taux les plus élevés étaient enregistrés en juillet et septembre (14%) respectivement, suivis par les mois d'août (11%), juin (7,5%) et mai (4%).

Il faudrait relancer d'urgence la pratique d'un diagnostic rapide de la gestation par la palpation rectale avant l'examen ante-mortem par des chirurgiens vétérinaires qualifiés. Par ailleurs, le Gouvernement Fédéral du Nigeria devrait prendre des mesures législatives contre l'abattage d'animaux gravides, en particulier les chameaux et ce, pour éviter l'extinction de l'espèce.

Summary

A retrospective study of slaughter records maintained at the Maiduguri abattoir, Nigeria, was conducted for the period 1990 to 1993 to determine the prevalence of foetal wastage due to slaughtering of pregnant camels. A total of twenty-five thousand and sixty-eight adult camels were slaughtered within the study period of which 49% (12,367/25,068) were females. Five hundred and fifty-one fetuses at various stages of gestation were encountered giving a prevalence of 4.5 per 100 adult females slaughtered (551/12,367).

There was a steady increase in the annual prevalence rate throughout the study period. A significantly higher foetal wastage rate (p<0.05) was observed during the rainy season than during the dry season. The month specific rates were highest for July and September (14% for each), followed by Augusts (11%), June (7.5%) and May (4%).

There is the urgent need to reactivate the practice of prompt pregnancy diagnosis, through rectal palpation during ante-mortem examination by qualified veterinary surgeons. Furthermore, the Federal Government of Nigeria should take an urgent and positive action by legislating against the slaughter of pregnant food animals particularly camels to avoid liquidation of the species.

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Introduction

The endemic acute protein malnutrition plaguing the vast population of developing countries, including Nigeria, is attributed to several factors such as inadequate development of the livestock industry, low productivity of indigenous breeds of animals, poor nutrition and improper management practices, among others. Recently inadequate meat inspection practices (especially the absence of ante-mortem examination to detect pregnancy) and lack of government policy or law prohibiting the slaughter of pregnant animals for meat have been identified to have further worsened the situation.

Available reports in Nigeria indicate a high proportion of female animals in their reproductive live being slaughtered for meat. The slaughter of camels for meat is gaining popularity in Nigeria presently due to the high cost of beef. The camel whose population is estimated at only 90,000 heads in Nigeria is the lowest of the major food animal species. Consequently, slaughter of female camels will further deplete the population and endanger the species. The present study was aimed at determining the prevalence of foetal wastage in camels slaughtered for meat at the Maiduguri abattoir and to recommend appropriate measures to check the wastage.

Materials and Methods

The slaughter records on camels maintained at the Maiduguri main abattoir were reviewed from 1990 to 1993. Relevant data on daily slaughter of camels, sex and presence of foetuses were extracted. The data were classified and analysed on the basis of seasons: the dry season (October – April) and the rainy season (May – September). The yearly and monthly trends in slaughter of female camels were analysed. Chi-square was applied to determine significance of relationships.

Results

A total of 551 foetuses were recovered from the 12,367 heads of female camels slaughtered within the study period, giving a prevalence rate of 4.5%. About an equal number of male (51%) and female (49%) camels were slaughtered during the period (Table 1). A significantly higher number of foetuses (P<0.05) were recovered during the rainy season than during the dry season.

There was a progressive increase in the annual prevalence rates throughout the study period (Table 2; Fig. 1). The month specific rate (percent) was highest for July and September (14% for each), followed by August 11%, June 7.5%, May 4%), January and April (2% for each) respectively (Table 3; Fig1).

Discussion

The problem of foetal wastage in slaughtered food animals had previously been reported by different authors in different parts of Nigeria. The present report confirms the on-going practice, though at a lower rate, of slaughtering female camels in their reproductive lives. The 1:1 ratio of male to female camels being offered for slaughter at the abattoir agrees with an earlier report. Several other smaller slaughter slabs and even clandestine slaughter points do exist in the study area, and the slaughter of pregnant camels may be occurring on a larger scale. In other parts of the world, female animals offered for slaughter are usually in their old age having outlived their reproductive lives, except in emergency slaughters. Since the camel is monogamous, and with a relatively long calving interval, the rate of pregnancy wastage due to slaughtering of
Table 1. Prevalence of foetal wastage in camels at Maiduguri abattoir (1990-1993)

<table>
<thead>
<tr>
<th>Season</th>
<th>No. Slaughtered</th>
<th>No. Pregnant</th>
<th>% Pregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Rainy Season</td>
<td>5491</td>
<td>5419</td>
<td>460</td>
</tr>
<tr>
<td>(May-September</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Season</td>
<td>7310</td>
<td>6948</td>
<td>91</td>
</tr>
<tr>
<td>October - April</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12,801</td>
<td>12,367</td>
<td>551</td>
</tr>
</tbody>
</table>

Figure 1. Monthly Distribution of Foetal Wastage in Slaughtered Camels at Maiduguri Abattoir (1990-1993)
**Table 2: Annual Prevalence of Foetal wastage In Slaughtered Camels At Maiduguri Abattoir (1990-1993)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>2624</td>
<td>3416</td>
<td>2991</td>
<td>3336</td>
<td>12,367</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slaughtered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>69</td>
<td>92</td>
<td>117</td>
<td>273</td>
<td>551</td>
</tr>
<tr>
<td>Foetuses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Foetuses</td>
<td>2.6</td>
<td>2.7</td>
<td>3.9</td>
<td>8.2</td>
<td>4.5</td>
</tr>
</tbody>
</table>

**Table 3: Monthly Distribution of Foetal wastage In Slaughtered Camels At Maiduguri Abattoir (1990-1993)**

<table>
<thead>
<tr>
<th>Month</th>
<th>1990</th>
<th>1991</th>
<th>1992</th>
<th>1993</th>
<th>Total</th>
<th>Month</th>
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<tbody>
<tr>
<td></td>
<td>No. of Cases</td>
<td>No. of Cases</td>
<td>No. of Cases</td>
<td>No. of Cases</td>
<td>Monthly Cases</td>
<td>Specific Rates(%)</td>
</tr>
<tr>
<td>Jan</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>17</td>
<td>2.0</td>
</tr>
<tr>
<td>Feb</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>10</td>
<td>0.8</td>
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<tr>
<td>March</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>23</td>
<td>1.4</td>
</tr>
<tr>
<td>April</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>13</td>
<td>35</td>
<td>2.0</td>
</tr>
<tr>
<td>May</td>
<td>15</td>
<td>14</td>
<td>0</td>
<td>52</td>
<td>81</td>
<td>4.0</td>
</tr>
<tr>
<td>June</td>
<td>9</td>
<td>18</td>
<td>24</td>
<td>59</td>
<td>110</td>
<td>7.5</td>
</tr>
<tr>
<td>July</td>
<td>9</td>
<td>31</td>
<td>40</td>
<td>69</td>
<td>149</td>
<td>14.0</td>
</tr>
<tr>
<td>Aug.</td>
<td>6</td>
<td>15</td>
<td>27</td>
<td>50</td>
<td>98</td>
<td>11.0</td>
</tr>
<tr>
<td>Sept.</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>22</td>
<td>14.0</td>
</tr>
<tr>
<td>Oct.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Nov.</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Dec.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>92</td>
<td>117</td>
<td>273</td>
<td>551</td>
<td></td>
</tr>
</tbody>
</table>
reproductive animals is definitely a cause for serious concern.

The progressive annual foetal wastage rate evident in the study may be attributed to ignorance on the part of the camel rearers (who in most cases are incompetent in recognising pregnancy in the early stages) on one hand, and the prolonged absence of pregnancy diagnosis as a major component of ante-mortem examination of animals prior to slaughter at most abattoirs nation-wide on the other. There is therefore an urgent need to reactivate this major veterinary public health activity at the abattoirs. Furthermore, the government must take an urgent and positive action through legislation and policies concerning the slaughter of pregnant animals. Such policies should include adequate compensation to the owners of animals detected to be pregnant at ante-mortem examination, and the subsequent retention of such pregnant animals until after parturition. The detection and retention of pregnant animals by the original owners or by female recovery schemes would contribute considerably towards meeting the meat production target for Nigeria.

The significantly higher month specific rates recorded during the rainy season months may be related to better nutrition and hence higher conception rates. The need to avoid indiscriminate offer of female camels for slaughter especially during the rainy season months could be re-emphasized to camel rearers as part of the veterinary extension service. The wastage of urgently needed meat through slaughtering of pregnant camels is of considerable economic and public health significance through the financial losses incurred and the loss of animal protein that could have otherwise been utilized.

Acknowledgements

The authors do appreciate the kind gesture of the staff of Federal Livestock Department and Pest Control Services Maiduguri, and the staff of Veterinary Division, Borno State Ministry of Agriculture who allowed us access to their slaughter records.

References


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EFFECTS OF AGE AND COLLECTION TIME ON THE CHARACTERISTICS OF RAM SEMEN IN AKURE, NIGERIA.

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EFFECTS DE L'ÂGE ET DE L'HEURE DE COLLECTE SUR LES CARACTERISTIQUES DU SPERME DES BELIERS A AKURE AU NIGERIA

Résumé
Deux groupes de béliers Yankasa âgés de 12 - 14 mois (environ un an) et de 24 - 48 mois (adultes) étaient utilisés pour la présente étude. Les animaux étaient soumis à un système d'élevage semi-intensif. La circonférence scrotale (CS) des béliers était relevée au début et à la fin de l'expérience. Les béliers étaient éjaculés deux fois par jour (7 h - 10 h et 16 h - 19 h) pendant soixante jours à l'aide d'un électro-éjaculateur. Il y avait une pause d'une journée entre chaque jour d'éjaculation. Le sperme était examiné après chaque collecte pour déterminer la concentration de sperme, le taux de motilité du sperme, les spermatozoïdes vivants et le taux de difformité du sperme.

La circonférence scrotale initiale et finale était en moyenne de 22.67 ± 3.48 cm et 25.67 ± 3.84 cm; 27.67 ± 0.33 cm et 29.67 ± 0.33 cm pour les béliers d'un an et les béliers adultes respectivement. La concentration moyenne de sperme, le taux de motilité du sperme, le taux de spermatozoïdes vivants et le taux de difformité du sperme pour les béliers d'un an et les béliers adultes étaient respectivement de 2.07 ± 0.52 x 10^9/ml et 2.31 ± 0.41 x 10^9/ml; 72.06 ± 1.64 et 77.68 ± 0.98; 79.81 ± 1.72 et 85.03 ± 1 et 8.83 ± 0.82 et 8.47 ± 0.67. La moindre différence significative de Fisher (LSD) a montré qu'il y avait une différence notable relative à l'âge (P < 0.05) en ce qui concerne la concentration de sperme, la motilité progressive et les spermatozoïdes vivants, tandis que le taux de difformité du sperme n'était pas beaucoup influencé par l'âge. Les béliers adultes étaient nettement supérieurs pour ce qui est des caractéristiques du sperme comparé à celles des béliers d'un an. Les caractéristiques du sperme, à savoir : la concentration de sperme, le taux de motilité du sperme, le taux de spermatozoïdes vivants et le taux de difformité du sperme à 7 h - 10 h et 16 h - 19 h étaient en moyenne de 2.28 ± 0.48 x 10^9/ml et 2.10 ± 0.46 x 10^9/ml, 77.50 ± 1.23 et 72.24 ± 1.39; 85.24 ± 1.20 et 79.60 ± 1.52; et 6.94 ± 0.69 et 10.37 ± 0.61 pour les deux périodes respectivement. Les différences entre les deux périodes de collecte étaient significatives (P < 0.05) pour toutes les caractéristiques du sperme. Le sperme recueilli à 7 h - 10 h était de loin supérieur quant à leurs caractéristiques par rapport aux ejaculats collectés à 16 h - 19 h. La présente étude révèle que la collecte de sperme devrait être faite dans la matinée (7 h - 10 h) avec les béliers adultes qui seront utilisés pour les programmes d'insémination artificielle.

Summary
Two groups of Yankasa rams, aged 12-14months (yearlings) and 24-48months (adults) were used for this study. The animals were kept under semi-intensive management system. Scrotal circumference (SC) of rams were taken at the beginning and end of the experiment. The rams were ejaculated twice per day (7.00-10.00AM and 4.00-7.00PM) for sixty days using an electro-ejaculator. A day was left free in between each ejaculation day. The semen was evaluated after each collection for sperm concentration, percent sperm motility, live spermatozoa and percent sperm abnormalities.

The mean initial and final scrotal circumference were 22.67 ± 3.48 cm and 25.67 ± 3.84 cm; 27.67 ± 0.33 cm and 29.67 ± 0.33 cm for yearling and adult rams respectively. The mean sperm concentration, percent sperm motility, percent live spermatozoa and percent sperm abnormalities for the yearling and adult rams were 2.07 ± 0.52 x 10^9/ml and 2.31 ± 0.41 x 10^9/ml; 72.06 ± 1.64 and 77.68 ± 0.98; 79.81 ± 1.72 and 85.03 ± 1.00 and 8.83 ± 0.82 and 8.47 ± 0.67, respectively. The Fisher's Least Significant Difference (LSD) showed that there was significant age difference (P<0.05) in sperm concentration, progressive motility and live spermatozoa while the percent sperm abnormalities was not significantly influenced by age. The adult rams were significantly superior in their semen characteristics compared to those of the yearlings. The mean semen characteristics: sperm concentration, percent sperm motility, percent live-spermatozoa and percent sperm abnormalities at 7.00-10.00AM and 4.00-7.00PM were 2.28 ± 0.48 x 10^9/ml and 2.10 ± 0.46 x 10^9/ml; 77.50 ± 1.23 and 72.24 ± 1.39; 85.24 ± 1.20 and 79.60 ± 1.52; and 6.94 ± 0.69 and 10.37 ± 0.61 for the two periods respectively. Differences between the two periods of collection were significant (P<0.05) for all the semen characteristics. Semen collected at 7.00-10.00AM were significantly superior in their characteristics compared to ejaculates collected at 4.00-7.00PM. This study suggests that semen collection could be done in the morning hours (7.00-10.00AM) from adult rams to be used in artificial insemination programmes.

* Corresponding Author.
Introduction

Fertility of males intended for breeding (natural mating or Artificial insemination) programmes is dependent on age of sexual maturity\textsuperscript{1,2}. At sexual maturity or puberty, spermatozoa production and release are two gradual processes. However, studies have shown that rams could be used in natural breeding programmes as early as 6 months of age with some good fertility results\textsuperscript{3,4}. While some studies have shown high correlations between age at puberty and testicular size\textsuperscript{5,6}, one study with yearling and adult bulls\textsuperscript{7} showed significant differences only in ejaculate volume of the two types of bulls.

Epididymal sperm reserve in yearling Yankasa rams has been estimated as 24.0x10\textsuperscript{9} spermatozoa\textsuperscript{8,9}. The increase in total sperm out-put per ejaculate which is dependent on epididymal sperm reserve has been attributed to increase in testicular size\textsuperscript{9,10,11} and since age and testicular size have been highly correlated\textsuperscript{8,6}, the age at which a ram’s semen could be collected, could influence the quality of the semen.

Apart from age, some other factors that could influence the quality of semen collected from male animals include management procedures, housing and ambient temperature. The importance of optimum environmental factors such as housing, feeding, health management in enhancing reproductive efficiency in cattle has been stressed\textsuperscript{12}. Many workers\textsuperscript{13,14,15} have reported seasonal effects on some semen characteristics. One study in a tropical environment has shown that the season of semen collection influences sperm concentration but not progressive motility and semen volume\textsuperscript{16}.

In the tropics, ambient temperatures are generally above the thermoneutral zone for most tropical animals. These temperatures change with the periods of the day. The effects of such diurnal temperature changes on semen characteristics are not known. This study was designed to investigate the effects of age of rams and period of semen collection on the characteristics of the semen.

Materials and Methods

The study was carried out at the small ruminant unit of the Federal University of Technology, Akure, Teaching and Research Farm. A total of six Yankasa rams were used for the study. Three were yearlings (12-14 months of age) while the other three were mature adult (above 24 months of age). The animals were managed under a semi-intensive system. They were taken out for grazing (mixture of Guinea and Elephant grasses and some weeds) in the morning after semen collection and brought back in the afternoon for the second semen collection. No supplementary feed was given.

Semence collection was done by electro-ejaculation every other day for a period of sixty days covering the spermatogenic cycle\textsuperscript{17}. The scrotal circumference was also measured at the beginning and end of the experiment using a measuring tape. The rams were ejaculated twice, that is in the morning (7.00-10.00AM) and afternoon (4.00-7.00PM) on the day of semen collection. The semen was collected into graduated test-tubes in a flask containing warm water at 37\degree C. The semen was taken to the laboratory in this flask. Semen was preserved in Cornell University Extender (CUE) and refrigerated for three days. In the artificial insemination (AI) laboratory, the semen samples were analysed for the following characteristics: semen volume, sperm concentration, sperm motility, live-dead ratio and sperm abnormalities.

Semence volume was measured directly from the graduated test-tube but only used in concentration calculation due to established inconsistency of volume in the
electro-ejaculation method of collection. Sperm concentration was measured with an haemocytometer using the steps outlined by Bearden and Fuguay and by Sorensen. Sperm motility was estimated by observing the movement of the spermatozoa under an X40 objective microscope. Semen smears stained with eosin-nigrosin were made for live-dead ratio and sperm abnormalities determinations. The percentage of normal morphology was determined by using the unclered slides, under the microscope using X40 objective.

All parametric data, were subjected to analysis of variance (ANOVA) using MINITAB (V.10.1, Minitab Inc. USA) statistical package while comparisons between means were by Fisher's Least Significant Difference (LSD).

Results

The mean scrotal circumferences (SC) of the yearling and adult rams at the beginning and end of the experiment were 22.67±3.48cm and 27.67±0.33cm for the yearling and 25.67±3.84cm and 29.67±0.33cm for adult rams respectively. The change in SC were 3.00cm and 2.00cm for the yearling and adult rams respectively for the period of study. Tables 1 and 2 show the effects of age and period of collection on semen characteristics: concentration, motility, live-spermatozoa and sperm abnormalities.

Sperm concentration

The mean sperm concentration by age were 2.18±0.53x10^9/ml versus 2.39±0.42x10^9/ml during the morning collection while the afternoon collection with corresponding age groups were 2.00±0.52x10^9/ml versus 2.24±0.41x10^9/ml. Age and period of collection significantly (P<0.05) influenced the concentration of ejaculates from rams used in this study. The overall mean ejaculates from yearling rams were significantly (P<0.05) lower than the ejaculates from the adult rams. In addition, ejaculates during the morning collection from yearling and adult rams had significantly (P<0.05) higher sperm concentration than ejaculates collected in the afternoon period. No interaction was observed between age and period of collection (Table 1).

Progressive motility

The mean progressive sperm motility in yearling and adult rams were 73.96±1.66% versus 81.04±0.80% during the morning collection while in the afternoon collection, the corresponding motility in the yearlings and adults were 70.16±1.62% versus 74.32±1.15%. Age and period of collection significantly (P<0.05) influenced the progressive motility of the sperm from the rams used in this study. The overall mean motility of ejaculate from yearling rams were significantly (P<0.05) lower than the motility of ejaculate from the adult rams. In addition the motility of the ejaculates during the morning collection from yearling and adult rams had significantly (P<0.05) higher progressive motility than ejaculates collected in the afternoon period. No interaction was observed between age and period of collection.

Live-spermatozoa

The mean live-spermatozoa by age were 81.90±1.67% versus 88.58±0.73% during the morning collection while in the afternoon collection, the corresponding live spermatozoa in yearling and adult rams ejaculation were 77.72±1.77% versus 81.48±1.27% respectively. Age and period of collection significantly (P<0.05) influenced the live-spermatozoa in the ejaculates from the rams used in this study. The overall mean live spermatozoa in ejaculates from yearling rams were significantly (P<0.05) lower than the mean live spermatozoa in ejaculates from the adult rams. In addition, live spermatozoa in ejaculates during the morning collection from yearling and adult rams had significantly
Table 1: Summary of Analysis of Variance

<table>
<thead>
<tr>
<th>SOURCE OF VARIANCE</th>
<th>DEGREE OF FREEDOM df</th>
<th>MEAN SQUARES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Concentration</td>
</tr>
<tr>
<td>PERIOD OF COLLECTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(MORNING OR AFTERNOON)</td>
<td>1</td>
<td>22500.0***</td>
</tr>
<tr>
<td>AGE OF RAM</td>
<td>1</td>
<td>39027.0***</td>
</tr>
<tr>
<td>PERIOD X AGE</td>
<td>1</td>
<td>551.0</td>
</tr>
<tr>
<td>ERROR</td>
<td>272</td>
<td>1533.0</td>
</tr>
</tbody>
</table>

***P<0.001

(P<0.05) higher live-spermatozoa than in ejaculates collected in the afternoon period. No interaction was observed between age and period of collection.

Sperm abnormality

The mean sperm abnormality by age were 7.33 ± 0.80% versus 6.54 ± 0.57 during the morning collection while in the afternoon collection, the corresponding percent sperm abnormalities in yearling and adult ejaculates age groups were 10.33 ± 0.84% versus 10.41 ± 0.77%. The percent sperm abnormality was not influenced by age, although it was higher in yearlings. The overall mean percent abnormalities in ejaculates from yearling rams were slightly higher than in ejaculate from adult rams. In addition, ejaculates during the morning collection from the yearling and adult rams had significantly (P<0.05) lower sperm abnormalities than in ejaculates collected in the afternoon period. No interaction was observed between age and period of collection.

Discussion

It was evident from the semen characteristics data presented in Table 1 that the age of the animal significantly affects all the semen characteristics under study. The higher sperm concentration, percent motility and live-spermatozoa observed in the adult rams were in line with other studies. However, the percent sperm abnormalities were higher in the yearling, albeit not significant. These significant effects of semen characteristics in relation to age is attributable to the larger scrotal circumference of sexual maturity in the adult rams. Semen characteristics increase appreciably with increase in scrotal size. Lower sperm production in yearling rams as compared with older rams had been reported. This was corroborated by another work which showed significant differences between yearling and adult ram semen in ejaculate volume, sperm concentration, sperm motility and total sperm output per ejaculate except for
percent morphologically normal sperm. Unlike most of these workers, another report \(^7\) revealed that there was no significant change in sperm concentration, sperm number per ejaculate and sperm motility for the yearling and mature bulls with the exception of ejaculate volume. The observed higher gain in scrotal circumference in the yearling rams than in the adult though not significant, is expected. This can be attributed to the fact that the yearling rams are still in the early stage of growth during which the growth of various body parts are occurring at a faster rate \(^21\). The observed smaller rate of change in scrotal size of the adult rams is in line with other reports and also in line with the assertion that as organisms mature in age, there is progressive decline in vital capacities, terminating in death and that this process occurs at all levels from macromolecules to the intact animal following cessation of growth \(^1\).

Seminal production efficiency was highest in the adult ram. This is similar to the results of other workers including Colas \(^13\), Schinckel et al. \(^22\), Pisselet et al. \(^23\) and Haley et al. \(^24\) which have all shown that sperm production in rams is significantly correlated with testis weight and the area.

### Table 2: Effect of age and period of collection on some semen characteristics (X ± Se)

<table>
<thead>
<tr>
<th>SEMEN CHARACTERISTICS</th>
<th>PERIOD OF COLLECTION</th>
<th>YEARLING</th>
<th>ADULT</th>
<th>MEAN±SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPERM</td>
<td>7.00-10.00 (A.M.)</td>
<td>2.18 ± 0.53(^a)</td>
<td>2.39 ± 0.42(^a)</td>
<td>2.28 ± 0.48*</td>
</tr>
<tr>
<td>CONCENTRATION (x10^{9}/\text{ml})</td>
<td>4.00-7.00 (P.M.)</td>
<td>2.00 ± 0.52(^a)</td>
<td>2.24 ± 0.41(^a)</td>
<td>2.10 ± 0.46</td>
</tr>
<tr>
<td></td>
<td>MEAN ± S.E.M</td>
<td>2.07 ± 0.52</td>
<td>2.31 ± 0.41</td>
<td>4.39 ± 0.91</td>
</tr>
<tr>
<td>PROGRESSIVE</td>
<td>7.00-10.00 (A.M.)</td>
<td>73.96 ± 1.66(^a)</td>
<td>81.04 ± 0.80(^a)</td>
<td>7.750 ± 1.23*</td>
</tr>
<tr>
<td>MOTILITY (%)</td>
<td>4.00-7.00 (P.M.)</td>
<td>70.16 ± 1.62(^a)</td>
<td>74.32 ± 1.15(^a)</td>
<td>72.24 ± 1.39</td>
</tr>
<tr>
<td></td>
<td>MEAN ± S.E.M</td>
<td>72.06 ± 1.64</td>
<td>77.68 ± 0.98</td>
<td>149.74 ± 2.62</td>
</tr>
<tr>
<td>LIVE SPERMATOZOA (%)</td>
<td>7.00-10.00 (A.M.)</td>
<td>81.90 ± 1.67(^a)</td>
<td>88.58 ± 0.73(^a)</td>
<td>85.24 ± 1.20*</td>
</tr>
<tr>
<td></td>
<td>4.00-7.00 (P.M.)</td>
<td>77.72 ± 1.77(^a)</td>
<td>81.48 ± 1.27(^a)</td>
<td>79.60 ± 1.52</td>
</tr>
<tr>
<td></td>
<td>MEAN±S.E.M</td>
<td>79.81 ± 1.72</td>
<td>85.03 ± 1.00</td>
<td>164.84 ± 2.72</td>
</tr>
<tr>
<td>SPERM ABNORMALITY (%)</td>
<td>7.00-10.00 (A.M.)</td>
<td>7.33 ± 0.80(^a)</td>
<td>6.54 ± 0.57(^a)</td>
<td>6.94 ± 0.69*</td>
</tr>
<tr>
<td></td>
<td>4.00-7.00 (P.M.)</td>
<td>10.33 ± 0.84(^a)</td>
<td>10.41±0.77(^a)</td>
<td>10.37 ± 0.81</td>
</tr>
<tr>
<td></td>
<td>MEAN± S.E.M</td>
<td>8.83 ± 0.82</td>
<td>8.47±0.67</td>
<td>17.31 ± 1.50</td>
</tr>
</tbody>
</table>

Means along the same column with different superscripts differ significantly (P<0.05)

*Overall mean of each semen characteristics during morning collections were significantly (P<0.05) superior.
of the walls of the seminiferous tubules. This study also confirms the results of other researchers in various animal species who have reported that testicular weight and size are highly correlated with sperm output.\(^{25, 26}\)

It has been shown that animals with small testes and thus small scrotal circumferences are often not as fertile as others with higher scrotal circumferences.\(^{28}\) Therefore, from these results it could be said that the small scrotal circumferences of the yearling rams could be responsible for their poorer semen characteristics when compared to those of the adult rams.

The period of collection effects were significantly different (P<0.05) for all the sperm characteristics studied. The observed differences in semen characteristics (concentration, percent motility, percent live-spermatozoa and percent sperm abnormalities) in relation to the period of collection in both the yearling and adult rams could be due to the effects of environmental factors on sperm production and sperm metabolic activities.\(^{29, 30, 31}\) The spermatozoa concentration, percent motility, percent live-spermatozoa and sperm abnormalities were highest in the morning collections. The superior spermatozoan characteristics in the morning ejaculates can not be easily explained. However, this superiority could be attributable to a number of factors of the environment. First, in the morning collections the animals have just passed through the cool night and this probably explains the superior spermatozoan characteristics in the morning collections. Whereas in the afternoon collections in addition to probable uncontrolled sexual encounters, high ambient temperatures could exert stress on the animal which could adversely affect sperm qualities. This is in line with the report of some workers which have shown that increased ambient temperature decreases sperm production and modifies the characteristics of the sperm.\(^{29, 30, 31}\) However, the degree of change in semen characteristics is dependent on the duration and intensity of the thermal stress.\(^{29}\)

Additionally, the high ambient temperatures when the afternoon collections were made could have caused increased sperm activity and faster rate of sperm metabolism leading to depletion of nutrients in the semen, sperm stress and gradual death. This could explain the higher number of sperm abnormalities in the afternoon collections. Rams develop a variety of severe sperm cell deformities when exposed to high ambient temperatures.\(^{29}\) This finding is also in line with another work which showed that scrotal heating in rams adversely affected semen characteristics, fecundity and embryonic mortality.\(^{32}\)

It has been shown in this study that the ages of rams and periods of semen collection significantly affect most of the semen characteristics in rams. The semen characteristics were better in adult than in yearling rams and that semen collected in the morning were significantly superior in their characteristics than semen collected in the afternoon in both ages. It is therefore suggested that semen collection be done in the morning hours when the weather is cool and should be restricted to the adult rams. However, yearling rams could be used on the basis of their sperm quality and output per ejaculate.\(^{9}\) Further studies are suggested to establish the ideal time of the day for semen collection in rams under tropical conditions.

References


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PHYTOCHEMICAL SCREENING AND PHARMACOLOGICAL ACTIVITIES OF THE STEM-BARK OF TERMINALIA AVICENNIOIDES

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ETUDES PHYTOCHIMIQUES ET ACTIVITES PHARMACOLOGIQUES DE L’ECORCE DE TERMINALIA AVICENNIOIDES

Résumé

L’écorce de Terminalia avicennoides (Guill et Pers.) était extraite avec l’ether de pétrole, le méthanol et l’eau distillée à l’aide d’un extracteur Soxhlet. Les extraits étaient concentrés in vacuo et l’extrait aqeous donnait un rendement de 11,3% w/w. L’examen phytochimique des trois fractions d’extraits a révélé la présence de stérol, de triterpène, de flavone, de saponine, de tanin, d’alcaloïde, de faiblement composés et de glycoside stéroïde. L’extrait aqueux a été administré par voie intrapéritonéale à quatre groupes de cinq rats chacun, afin de déterminer la toxicité aigue à des doses différentes, à savoir : 50, 100, 200, 300 et 400 mg/kg. La faible dose (FD50) avec un intervalle de confiance à 95% était estimée à 350 mg/kg. Les signes cliniques observés avant la mortalité comprenaient la léthargie, l’inappétence, la paralysie des pattes de derrière, qui atteignait aussi peu à peu les pattes de devant, la respiration difficile, le sommeil profond, le coma et la mort. L’extrait a également permis d’accroître la durée du sommeil avec l’amylbarbitone, puis il provoquait l’anesthésie locale chez les cobayes et développait une intense activité de décontraction des muscles (P < 0,05) chez les rats.

Summary

The stem-bark of Terminalia avicennoides (Guill and Pers.) was extracted with petroleum ether, methol and distilled water using a Soxhlet extractor. The extracts were concentrated in vacuo and the aqueous extract gave a yield of 11.3% w/w. Phytochemical studies of the three fractions of the extracts showed the presence of sterols, triterpenes, flavone, saponin, tannins, alkaloids, reducing compounds and steroidal glycosides. Using four groups of five rats each, the aqueous extract was administered intraperitoneally (i.P.) to determine the acute toxicity at various dosages, 50, 100, 200, 300 and 400mg/kg. The LD50 with a confidence interval of 95% was estimated to be 350mg/kg. The clinical signs observed before mortality included lethargy, loss of appetite, paralysis of hindlimbs which progressed to the forelimbs, difficulty in respiration, deep sleep/coma. The extract also potentiated the sleeping time of amylobarbitone in a dose-dependent association, induced local anaesthesia in guinea pigs and showed significant muscle relaxant activity (p<0.05) in rats.

*Corresponding Author.
Introduction

Research on natural substances has remained essential both in the developed as well as developing countries. About 60% of medicines sold in pharmacies still come directly from natural sources. These natural resources provide us with the model of active molecule which serve as the 'keys for the locks' to enable copying or modification of the substances and to study their chemical as well as pharmacological activities.

In tropical countries, it is important to know the therapeutic potential of substances from natural sources. Developing local medicines may be of greater value than importing the generally expensive synthetic medicines. Therefore, research on parasitic diseases and chemical means of curing them is particularly vital. Thus the need to find cheaper and pharmacologically active substances from natural sources has defined the research goals of developing nations as encouraged and recommended by the World Health Organisation (WHO). In the last decade the human population has become increasing aware of the use of medicinal plants for the treatment of various diseases. Plants are an indispensable source of chemical compounds and plant physiologists in collaboration with chemists and biochemists have been able to isolate and characterize a myriad of chemical compounds from the plants.

Terminalia avicennoides (Guill and Pers.), a member of the combretaceae family is well known in African traditional medicine. A tree of about 9 m high, it is known as 'bauche' in Hausa, 'kumanda' or 'barbar' in Kanuri and 'Igi odan' in Yoruba. The extract of T. avicennoides has been applied as treatment for syphilistic sores and cancer. Its decoction is reported to be effective against yellow fever, cough, diabetes, skin infection and pneumobronchial troubles. There have been reports on the anti-microbial activity of T. avicennoides root bark.

In a preliminary investigation of the psychotrophic activity of T. avicennoides, it was observed that the plant extract caused depression of nikethamide-induced stimulation of CNS, as well as produced a decrease in blood pressure of mongrel dogs.

This paper reports a detailed study of the plant's chemical constituents as well as some of its specific pharmacological activities.

Materials and Methods

Sample collection and identification

Fresh samples of the stem-bark and leaves with stalk of T. avicennoides were collected in the month of December 2000 from Konduga town situated in the Eastern part of Borno State, Nigeria.

T. avicennoides is commonly found in sandy sites of southern sahel zone and adjoining savannas. The plant was identified by Dr. S.S. Sanusi of the Department of Biological Sciences University of Maiduguri, Maiduguri, Nigeria and voucher specimens were deposited in the Department of Chemistry Research Laboratory. The samples were air-dried in the laboratory and ground to powder.

Extraction technique and chemical analysis

About 500g of the air-dried powdered sample were extracted in a Soxhlet extractor continuously for 6 hrs with 2 litres of the following solvents: petroleum ether, methanol and distilled water. The extract yield of the various fractions were determined and the extract concentrates were stored in the refrigerator at 4°C until used.

The extract concentrates of the different fractions were subjected to various chemical analysis using standard procedure as reported in the literature. The different chemical constituent tested for included sterols, triterpenes, steroided glycosides, flavones, anthracenosides,
saponins, tannins, alkaloids and reducing compounds

**Pharmacological studies**

*Acute toxicity testing*

Four groups of five rats each (total 20) were randomly selected and used for this study. The extract in aqueous solution were administered intraperitoneally with varying doses of 50, 100, 300 and 400 mg/kg. The rats were allowed access to food and water *ad libitum* and were observed for clinical signs and death over a period of 24 hrs. The LD<sub>50</sub> with a confidence interval of 95% was determined using the arithmetic method of Kaber.<sup>20</sup>

*Local anaesthetic effect of aqueous extract*

Four identical, symmetrical and circular region were shaved on the dorsum of three male guinea pigs with two shaved circles on the thoracic region and the other two on the lumbar region, 24 hr before the commencement of the experiment.<sup>21</sup>

Two concentrations (1.0 mg/ml and 0.3 mg/ml) of xylocaine and the extract (25mg/ml and 100mg/ml) were prepared then 0.2ml each of 0.3mg/ml and 1.0mg/ml of xylocaine were injected intradermally in the right thoracic and left lumber shaved region respectively, to form wheals which were encircled with a marker. Likewise 0.2 ml each of the 2 extract concentrations of *T. avicennoides* were injected intradermally in the the shaved right lumbar and left thoracic regions respectively to form wheals which were also encircled with a marker.

The encircled regions were each pricked with a needle ten times at five minutes interval for 30 minutes starting with zero time. The number of responses to pain by the guinea pigs when pricked with the needle were recorded.

**Effect of aqueous extract on muscle relaxant activity by inclined board method.**

Twenty rats of both sexes were divided into four equal groups. The rats were placed one after the other on the smooth surface of a board inclined at 35° to the horizontal before and 30 minutes after treatment with varying doses (100, 200, 300 mg/kg I.P.) of the extract. The rats were allowed a minimum of 10 seconds to remain on the board. The rats that slipped down the board before 10 seconds were considered as being positive for muscle relaxation.

**Effect of aqueous extract on hindlimb grip reflex**

Four groups of rats (A-D) containing five rats per group were used for this study using the technique described by other.<sup>23</sup> A steel wire (18 cm long and 0.2 cm thick) was supported between two poles. Each rat in the control group was gripped at the base of its tail and suspended above the wire until it grasped the wire with both forepaws. The maximum time allowed for this to take place was 15 seconds.

After the control experiment, the other groups of rats were dosed intraperitoneally with 100, 200 and 250 mg/kg respectively of the aqueous extract. Thirty minutes later each rat in the various groups was gripped at the base of its tail and suspended above the wire until it grasped it with both forepaws. The rats were given a maximum of 15 seconds to pull up and grasp the wire with all the paws. Rats unable to grasp the wire with the hind-paws within 15 seconds were recorded as positive for loss of the hindlimb grip reflex or muscle relaxation.

**Effect of aqueous extract on amylobarbitalone sleeping time**

Twenty rats of both sexes were randomly divided into four groups. The rats were treated as follows:
Group A was the control which were given amylobarbitone 12 mg/kg intraperitoneally (IP) only.

In Group B the rats were treated with 100 mg/kg I.P. of extract 30 minutes before the administration of amylobarbitone (12 mg/kg IP). Group C rats were dosed with extract 200 mg/kg IP, 30 minutes before amylobarbitone administration by the same route. Group D rats were treated similarly but with 250 mg/kg extract IP, 30 minutes before treatment with amylobarbitone (12 mg/kg IP).

All the rats were given food and water ad libitum during the experiment. The time of amylobarbitone administration, onset of sleep and the time of awakening were all recorded. The observations recorded were analysed using one-way ANOVA.

**Results**

**Plant extraction**

The aqueous extract of *T. avicennoides* gave a yield of 11.3% w/w, had a brick-red colour and was odourless. The chemical constituents of the extracts of the various fractions of the stem-bark of *T. avicennoides* are shown in Table 1.

**Acute toxicity**

Thirty minutes after the administration of the extracts the rats were sedated and grouped together. Those that received 300 mg/kg and above were deeply sedated and slept. Clinical signs observed before death included loss of appetite, paralysis of hind limbs, difficult respiration and coma. Mortality was recorded (3.5 hr) after treatment of the rats that had received the highest dose of 400 mg/kg of the extract. The LD$_{50}$ (95% confidence limit) of the extract was 350 mg/kg (300-400 mg/kg).

**Local anaesthesia**

The aqueous extract of *T. avicennoides* showed 93% and 100% local anaesthetic effect at 25 mg/ml and 100 mg/ml, respectively while xylocaine at 0.3 mg/ml and 1.0 mg/ml showed 97% and 100% anaesthesia respectively (Table 2).

**Muscle relaxant effect and hindlimb grip reflex**

About 60% of the rats treated with 300 mg/kg of the extract slid down the board, while only 40% and 30% of the rats treated with 200 and 100 mg/kg slid down the board respectively (Table 3). About 60% of the rats treated with 200 mg/kg of extract and 80% of rats treated with 300 mg/kg were unable to grasp the wire with the hindlimbs (Table 4).

**Amylobarbitone sleeping time**

*Terminalia avicennoides* increased the sleeping time of amylobarbitone dose-dependently (Fig. 1) with the rats sleeping longer at a higher doses of the extract (P<0.05).

**Discussion**

The phytochemical studies on *Terminalia avicennoides* furnished useful classes of chemical compounds such as sterols triterpenes, saponins, tannins, flavones, alkaloids, reducing compounds, anthracenosides and steroidal glycosides. These classes of chemical compounds have been known to exert pharmacological and antagonistic effects and still some are capable of protecting the active ingredients in herbs from decomposing either chemically or physiologically\(^2\). The toxicity studies show that this plant has high toxicity level, the LD$_{50}$ being 350 mg/kg. There have been reports that plant extractives with LD$_{50}$ of 1500 mg/kg and above are of low toxicity\(^3\). The extract showed some peripheral nerve action which was observed as local anaesthesia in guinea pigs. The local anaesthetic effect commenced 10 minutes after injection and was similar to that
Table 1. Chemical constituents of the petroleum ether, methol and distilled water extracts of *Terminalia avicennoides*

<table>
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<tr>
<th>Chemicals</th>
<th>Constituents</th>
<th>Extracts</th>
<th>Petroleum Ethers</th>
<th>Methol</th>
<th>Distilled Water</th>
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<tr>
<td>Sterol and triperpenes</td>
<td>+</td>
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</tr>
<tr>
<td>Anthracenosides</td>
<td>+</td>
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<td>-</td>
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<tr>
<td>Alkaloids</td>
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<tr>
<td>Flavoncides</td>
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<tr>
<td>Steroidal glycosides</td>
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<td>-</td>
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<tr>
<td>Saponins</td>
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<td>Reducing compounds</td>
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<td>+</td>
<td>+</td>
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</tr>
</tbody>
</table>

+ Present  
- Absent

Fig. 1. The effect of a queous extract of *T. avicennoides* on amylobarbitone sleeping time; Group A = Control, B = 100mg/kg, C = 200mg/kg D = 250mg/kg N = 5
Table 2. The local anaesthetic effects of *T. avicennoides* stem-bark extract

<table>
<thead>
<tr>
<th>Drug / Extract</th>
<th>Concentration (mg/ml)</th>
<th>Number of positive responses over time minutes</th>
<th>Time response out of 70</th>
<th>Anaesthesia (%)</th>
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<tr>
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<td></td>
<td></td>
</tr>
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<td>68 97</td>
</tr>
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<td>0</td>
<td>10 10 10 10 10 10 10</td>
<td>70 100</td>
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<td>8 10 8 10 10 10 9</td>
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<tr>
<td></td>
<td>100.0</td>
<td>0</td>
<td>10 10 10 10 10 10 10</td>
<td>70 100</td>
</tr>
</tbody>
</table>

Table 3. Effects of *T. avicennoides* aqueous extract on muscle relaxation (inclined board method)

<table>
<thead>
<tr>
<th>Group</th>
<th>Dosage of extract</th>
<th>No. of rats that slid down the board (%)</th>
<th>No. of rats used</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Control</td>
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</tr>
<tr>
<td>B</td>
<td>100</td>
<td>30%</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>200</td>
<td>40%</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>300</td>
<td>60%</td>
<td>5</td>
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</table>
Table 4. Effects of *T. avicennoides* aqueous extract on hindlimb reflex in rats

<table>
<thead>
<tr>
<th>Group</th>
<th>Dosage of extract (mg/kg)</th>
<th>No. of rats unable to grasp wire with 4 paws (%)</th>
<th>No. of rats used</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Control</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td>40%</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>200</td>
<td>60%</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>300</td>
<td>80%</td>
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</table>

observed for xylocaine. The anaesthetic effect lasted for 70 minutes, a significant observation even at the lowest concentration of 25 mg/kg of the extract. The increased local anaesthetic effect of xylocaine in the animal for up to 70 minutes may be due to the presence of epinephrine in the drug which may have prolonged the period of anaesthesia, since epinephrine is a vasoconstrictor.

Some central nervous action of the aqueous extract was also observed by its effect on amylobarbitone sleeping time and the muscle relaxant activity. The extract appeared to potentiate amylobarbitone induced sleeping time in a dose-dependent pattern, suggesting a pharmacological interactional synergism. It shows that the extract had a depressant or sedative action on the central nervous system which agrees with similar experiments in mice. Rats actually went to sleep 10 minutes after the administration of the extract and with those given the highest dose sleeping longer.

In conclusion, the result of the present study provide supportive scientific evidence in favour of the view that extracts of *Terminalia avicennoides* do possess some active chemical constituents as well as some degree of central nervous system depressant effects. This may be the reason that this plant extract is utilized by natives in psychotherapy. Furthermore, future work should involve identification of the active principle and its mechanism of action.

Acknowledgements

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References


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EVALUATING BIOCHEMICAL TESTS FOR ISOLATION/IDENTIFICATION OF CLOSTRIDIUM PERFRINGENS IN FECAL SAMPLES OF SMALL RUMINANTS IN NIGERIA

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EVALUATION DES TESTS BIOCHIMIQUES POUR L'ISOLEMENT/L'IDENTIFICATION DE CLOSTRIDIUM PERFRINGENS DANS LES ECHANTILLONS FECAUX DES PETITS RUMINANTS AU NIGERIA

Résumé

Trois cent quarante-trois échantillons fécaux recueillis des petits ruminants (des chèvres et des moutons nains de l'Afrique de l'ouest) ont été mis en culture en vue de l'isolement biochimique et de l'identification de Clostridium perfringens, la bactérie pathogène qui provoque l'entérotoxémie. Les résultats des tests biochimiques obtenus variaient entre 73% avec le test à l'indole et une moyenne de 96% avec le test de fermentation de l'hydrate de carbone.

Les tests au substrat, au lactose, au maltose, au mannitol, au saccharose, à l'indole, à la phosphatase acide ainsi que le test de motilité ont été réalisés en utilisant de plus faibles volumes de milieux de culture définis chimiquement avec une manipulation facile sur le banc et strictement dans des conditions anaérobes. Les souches de référence ATCC 8504 D et NCTC 3180 C étaient utilisées comme témoins.

L'accord moyen global pour les test biochimiques était de 79%. C'est ainsi que ces huit tests biochimiques étaient appropriés pour l'identification de C. perfringens isolés des échantillons fécaux des petits ruminants. Ces tests étaient simples, reproductibles et peuvent facilement être faits dans la plupart des laboratoires pour petits ruminants, en particulier au Nigeria où ces animaux revêtent une importance économique.

Summary

Three hundred and forty three faecal samples collected from small ruminants, the West African Dwarf goats and sheep (WAD) were cultured in order to biochemically isolate and identify Clostridium perfringens, the cause of the disease enterotoxaemia. The biochemical results evaluated ranged from 73% in indole test to an average of 96% in the carbohydrate fermentation tests.

The substrates, lactose, mathose, mannitol, saccharose, indole, nitrate, acid phosphatase and motility tests were carried out using smaller volumes of chemically defined media with ease of manipulation on the bench and strictly under anaerobic conditions. Reference strains, ATCC 8504 D and NCTC 3180 C were used as control.

The overall mean agreement for the biochemical tests was 79%. Thus, these eight biochemical tests were adequate for identification of C. perfringens isolated from faecal samples of small ruminants. These tests are simple, reproducible and can easily be performed in most laboratories for small ruminants, especially in Nigeria where these animals are of economic importance.

* Corresponding Author.
Introduction

Clostridium perfringens is an anaerobic bacteria which is among the most dominant microorganisms in faecal samples on human and animals\(^1\). C. perfringens are the causes of enterotoxaemia in small ruminants especially by ingestion of the spores from contaminated foods or feeds and also when the animals are fed with excess of carbohydrates and or proteins in the diet\(^2,3\).

It has been emphasized that the number of biochemical tests that must be performed for definitive identification of clinical isolates has generally ranged from 12 to 20 even with gas-liquid chromatography GLC analysis and that those test required relatively large volumes of conventional media\(^4\). The speciation of Clostridium perfringens which requires such a high number of biochemical tests and probably GLC analysis is generally impractical especially in Nigeria where facilities are limited. However, presumptive identification and the gram stain procedures have reduced the high number, cost and the need for large volumes of media in the conventional identification tests.

In this study, different biochemical test were evaluated for their speciation in isolation and identification of C. perfringenes. The tests used here share the properties for simplicity, use of small volumes of substrates, more rapid results, reactivity patterns that are reproducible and correlate well with those patterns known as essential for isolation and identification of C. perfringens and other anaerobes. Thus cases of enterotoxaemia in small ruminants in Nigeria can easily be examined using these eight tests without GLC Analysis.

Materials and Methods

Three hundred and forty three faecal samples were collected from goats and sheep, devoid of contamination by normal flora derived from extraneous and mucocutaneous surfaces\(^5,6\). In each instance, the duration of exposure from the time of collection to placement in the universal containers used, was restricted to a few minutes\(^7\).

The isolation was performed under standard bacteriological methods where the faecal samples were weighed asceptically and the supernatants were prepared 1:4 (weight: volume) dilution in sodium chloride buffer salines\(^8,9,10\) with some modifications. This study was carried out at the Freic Universitat Berlin Institute of Animal and Environmental Hygiene in Germany. Specimens were transported by flight from Nigeria in Universal containers.

One gramme of cooked meat (Oxoid) was placed in 10ml of aqua distilled in each test tube and autoclaved for 15 minutes and after cooling to room temperature 1ml faecal sample supematant was dispensed into each test tube and incubated in an anaerobic glove box or gas jar in an atmosphere of 80% nitrogen, 10% hydrogen and 10% carbon dioxide\(^5,10\) at 37% for 18 to 24 hours. From the incubated supematant, streaks were performed inoculating sheep blood glucose agar plates prepared with 100ng of Neomycin sulfate per ml\(^7\). The inoculated plates were incubated at anaerobic conditions for 18 to 24 hours.

All well grown colonies of the required organisms were picked with bacteriological loop or cotton swab and transferred into cooked mean medium test tubes again\(^11\) and incubated for 18 to 24 hours. From the test tubes, inoculation was again performed on blood glucose agar plates and incubated overnight for colonial morphology and characterization. Gram stain procedures were performed thereafter\(^1,12\).

Suspensions of all pure cultures of C. perfringens isolates that were identified microscopically were subjected to different
biochemical tests using smaller volumes of media and chemically defined solutions in test tubes which were easy for manipulation with reasonable speed at the bench. Four rapid carbohydrates fermentation tests were performed with modifications\textsuperscript{6,10,13}.

Motility test was performed thereafter\textsuperscript{6,14}. Nitrate reduction test was performed as in Muller laboratory using GRISS-ILOVAY’S reagents. Indole test was performed\textsuperscript{14} and as described in Muller’s Laboratory using 0.5cc Kovacs reagents. Phosphatase test was performed later\textsuperscript{15, 16, 17} with some modifications.

A total of eight biochemical tests were performed including the four carbohydrate fermentation tests. Two references strains ATCC 8504 D and NCTC 3180 C were used as control during the study.

Results and Discussions

From the analysis, \textit{C. perfringens} isolates were recovered in 156 (45\%) of the samples collected in this study. Neomycin which was incorporated into blood glucose agar plates inhibited the growth of \textit{Proteus} and \textit{Escherichia coli} bacteria that usually swarm the surface of the incubated agar plates.

The pattern of colonial growth observed in this study was typical of \textit{C. perfringens}, showing double zones of haemolysis, flat and olive butyrous colouration. \textit{C. perfringens} is a gram positive bacteria. A phase microscope

\textbf{Table 1:} Summary of Biochemical tests for \textit{C. perfringens} suspected Isolates variables.

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>M</th>
<th>P</th>
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</table>
observation confirmed these organisms as non-motile and having necrotic background without intact inflammation cells and relatively large “box car” rod shape. They were either single or scattered or chained. Out of 156 isolates of the suspected C. perfringens strains, after subculture, 102 (71%) were positive in gram stains procedure thus the biochemical tests were used as confirmatory tests of the isolates.

The results in Table 1 show the summary of the biochemical tests including carbohydrate fermentation. Of the suspected isolates, 74% were non-motile. Motile Clostridia include C. botulinum which non-motile Clostridia include C. innocuum and C. ramosum. Most of the inoculated test tubes containing the required medium showed no diffused zone of growth glaring out of the line of inoculation (stab), this confirmed that there is no motility in the test. Of the tested isolates 79% showed diazonium red, confirming that nitrate had been reduced to nitrite, therefore agreed with earlier findings. Over 77% of the isolates showed a dark violet coloration when the solution of acid phosphatase was dropped on each colony of the organism, therefore agreed with earlier observations.

From the above results, lactose produced the highest correlation of 97%, while maltose and saccharose produced 96% respectively, showing decreasing agreement with mannitol having the least percentage, as reported in past findings. The carbohydrates used in this study were selected as being representatives and each showed the same approximate degree of accuracy in the evaluation. Therefore the boundary between calling a reaction negative, weak acidic or strong acidic often becomes arbitrary.

Intensive coloration in the tests indicated positive, greenish-yellow indicated weak positive, while blue indicated negative results. These differences in the enzymatic activity serve as one of the important characteristics by which the different species of the organisms are recognized. Therefore, four tests of carbohydrate fermentation tests with motility, nitrate, indole and acid phosphatase tests are adequate to distinguish C. perfringens from all other species of clostridia except C. absonum which atypically reduces nitrate to nitrates. Therefore the emphasize by Starrett et al. that a definitive number of

<table>
<thead>
<tr>
<th>Carbohydrates</th>
<th>No. of Isolates tested</th>
<th>No. of Isolated positive</th>
<th>% positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose (1)</td>
<td>102</td>
<td>101</td>
<td>97%</td>
</tr>
<tr>
<td>Maltose (ml)</td>
<td>102</td>
<td>100</td>
<td>96%</td>
</tr>
<tr>
<td>Saccharose (sa)</td>
<td>102</td>
<td>100</td>
<td>96%</td>
</tr>
<tr>
<td>Mannitol (mn)</td>
<td>102</td>
<td>98</td>
<td>95%</td>
</tr>
</tbody>
</table>

100% ATCC 8504 D AND NCTC 3180 C
biochemical tests for identification of clinical isolates should generally range from 12 to 20 and even GLC analysis to be included is not a strict requirement as shown in this study, where we were able to use only eight biochemical tests including the gram stain procedures.

The Overall mean agreement of these biochemical tests after presumptive identification procedures was about 79%. This result was therefore in agreement with a past study where AP1, MICRO and the CONV were used to evaluate biochemical testing of anaerobic bacteria.

Acknowledgements

The authors are indeed indebted to DAAD who funded the study. Also acknowledged is the University of Benin Authority who released me for the period of the analysis of the material used in this investigation in Freic University of Berlin.

References


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SHORT COMMUNICATION

WORM CONTROL PRACTICES AND IMPLICATIONS FOR THE DEVELOPMENT OF ANTHELMINTIC RESISTANCE ON COMMERCIAL PIG HERDS IN THIKA DISTRICT, KENYA

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Apart from African Swine Fever, parasitic infections are estimated to be the most important diseases in domestic pigs in Africa¹,²,³. Two recent surveys conducted in Kenya have shown that helminthosis is the major problem in the pig industry, and is mainly caused by Oesophagostomum spp., Ascaris suum, Trichuris suis and Strongyloides ransomi⁴,⁵. Irrespective of the type of production systems, regular use of anthelmintics is the most common method of control of these worms. The most efficient drugs for control of A. suum, Oesophagostomum spp., T. suis and S. ransomi, are the benzimidazoles, levamisole and avermectins⁶. The use of these anthelmintics is currently under threat due to development of anthelmintic resistance (AR). In a preliminary study, occurrence of resistant Oesophagostomum spp. (against levamisole and piperazine) and T. suis (against levamisole) isolates was recorded in two farms in Thika District⁷.

Factors that promote the development of AR are known to be the repeated use of anthelmintics with similar modes of action for several years, underdosing of animals, frequent treatments and lack of treatment of new animals introduced into the herd⁷. Studies on the occurrence of these risk factors, which potentially contribute to development of AR, have been undertaken in pigs in Denmark⁸ and sheep in Kenya⁹. The occurrence of such factors in piggeries in Kenya has not been investigated. The present investigation was carried out to examine the possible existence of risk factors for the development of AR in commercial pig farms in Thika District, Kenya.

The study was conducted between November 1999 and April 2000 on commercial pig herds in Thika District, located in the southern part of Central Province of Kenya and lies between latitudes 1.45S - 3.53S and between longitudes 36.350E - 37.250E⁹. The farms used in this study belonged to farmers who supplied their animals to the Farmers Choice Company, which processes 70-80% of pigs produced in Kenya. An initial survey showed that 99.4% of the farms were affected by at least one nematode genus. Oesophagostomum spp. A. suum, T. suis and S. ransomi were the only nematodes detected with prevalences of 27.6%, 8.3%, 6.8% and 2.3%, respectively⁹. The low prevalences recorded in this study may have been attributed to in-door rearing of the pigs in all.

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the farms sampled. It was also observed that farmers in the district used anthelmintics on routine basis rather than due to knowledge of the occurrence of helminth parasites.

Thirty-five pig herds were randomly selected from a list of all pig herds in the district. Farms with more than 30 pigs were included in the study. The population of pigs in the farms ranged from 31-60. The study involved visits to the farms during which a questionnaire about different management practices thought to be risk factors for the development of AR were administered. The questions included: the types of anthelmintics used by the farmer between 1997-99, rate of change of these anthelmintics, anthelmintic treatment strategy, method of body weight estimation, whether new animals are treated before introduction and frequency of pig faecal material removal and cleaning of pens. Descriptive statistics were calculated using the statistical software package Statistix® version 4.0.

A description of the anthelmintics used by farmers in the study area is given in Table 1. On average, 81.1% of the farmers used group 3 (piperazine and avermectins), 28.6% used group 2 (levamisole) and 14.3% used group 1 (benzimidazoles) type of anthelmintics.

Most farmers (70.2%) did not change the drug they were using between 1997 to 1999. Farmers using Ascarex® (piperazine citrate) mostly belonged to this category. Twenty percent of the farmers changed the anthelmintic groups in a period of one year or less. Five (14.3%) farmers exchanged the use of piperazine with levamisole in the same year. It was only 5.4% of the farmers who changed the class of drugs after every 2-3 years.

The study showed that 65.7% of the farmers regularly treated their animals for worms, while it was only 31.4% who did not treat them regularly. Fifty four percent of the farmers treated the animals after every three months while only 11.4% treated animals every month. Fifty one percent of the farmers did not treat the newly introduced animals in their farms. Only 17.2% treated the animals before introduction, while 11.4% treated them sometime after introduction. A substantial number (20%) did not keep the records or could not remember whether they had treated the animals brought to the farms. Majority of the farmers (94.3%) estimated the body weight of individual animals by visual appraisal. Only 5.7% of the farmers actually weighed the animals.

Slightly over half of the farmers (51.4%) removed pig faecal material from the pens every day. Those who removed the material after every 2-3 days were 42.8%, while it was only in a small number of farms (5.7%) where the material was not removed at all. Most farmers (40%) were not cleaning the pens. About a third (31.4%) of those who cleaned the pens did it on a weekly basis, while only 11.4% cleaned the pens on daily basis.

The study showed that there was extensive use of anthelmintics by the farmers to control gastrointestinal parasites. However, it should be noted that, on 70.2% of the farms, the same anthelmintic (piperazine citrate) was used without being changed. The prolonged and extensive use of the same class of anthelmintic could select effectively for AR. The manufacturer of the piperazine citrate based Ascarex®, which was used by most farmers did not include the concentration of the drug on the label.

Most farmers in the present study were not treating their animals on strategic basis opting to treat the animals after every three months. This is different from other
Table 1: Anthelmintics (classes and groups) used by farmers between 1997-99

<table>
<thead>
<tr>
<th>Group</th>
<th>Drug</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of herds</td>
<td>%</td>
<td>Number of herds</td>
<td>%</td>
<td>Number of herds</td>
</tr>
<tr>
<td>III</td>
<td>Piperazine</td>
<td>24</td>
<td>68.6</td>
<td>25</td>
<td>71.4</td>
</tr>
<tr>
<td>II</td>
<td>Levamisole</td>
<td>5</td>
<td>14.4</td>
<td>8</td>
<td>22.9</td>
</tr>
<tr>
<td>III</td>
<td>Ivermectin</td>
<td>2</td>
<td>5.7</td>
<td>3</td>
<td>8.6</td>
</tr>
<tr>
<td>III</td>
<td>Doramectin</td>
<td>1</td>
<td>2.9</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>I</td>
<td>Benzimidazoles</td>
<td>2</td>
<td>5.7</td>
<td>4</td>
<td>11.4</td>
</tr>
<tr>
<td>I &amp; II</td>
<td>Benzimidazoles</td>
<td>2</td>
<td>5.7</td>
<td>2</td>
<td>5.7</td>
</tr>
</tbody>
</table>

countries where strategic treatments are followed by most farmers\textsuperscript{12,13}. Lack of proper advice on pig helminth control to Kenyan farmers could have contributed to this observation. About 11.4\% of the farmers dosed their animals at intervals of one month, an interval shorter than the pre-parent period of most pig nematodes, a factor which increases selection pressure for AR\textsuperscript{14}.

On most of the farms visual appraisal rather than actual weighing was used to determine the body weights. The same method of determination of bodyweight was observed in 69\% of pig farms in Denmark\textsuperscript{7}. Majority of the farmers use this method due to the high costs of the other methods as well as the convenience involved. The use of this method is thought to increase the possibility of underestimating weights and therefore underdosing, which may lead to development of AR\textsuperscript{15}.

It was also evident that risk of introducing resistant worms into a herd may be high, because of the lower priority given to anthelmintic treatment when new animals are introduced into the herd. This observation is similar to the one made in Danish pig farms\textsuperscript{16}. Preventing the introduction of resistant strains with new animals by quarantine, monitoring and treating all replacement stock is regarded as a critical management practice\textsuperscript{6}.

Over half of the farmers in the present study removed faecal material from the pens on daily basis, while only a few cleaned the pens daily. If the two methods are followed vigorously, the risk of development of resistance is increased due to the decrease in parasite refugium. This is because worms which are resistant and survive treatment would be major contributors to subsequent populations\textsuperscript{6,17}.

It can be concluded that the potential risk factors for the development of AR are common in sow herds represented in the survey. A concentrated effort by the relevant authorities has to be made to inform the farmers about the importance of carefully planned control strategies against gastrointestinal nematodes so that the increasing potential of development of AR can be stemmed.
Acknowledgements

This study was supported by the University of Nairobi and the authors are most grateful. Thanks are also extended to Ms Virginia Mumbi and Mr Richard Otieno for their technical assistance.

References


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SHORT COMMUNICATION

PREVALENCE OF BOVINE FASCIOLIOSIS IN THE NGAOUNDERE GUDALI CATTLE WITHIN THE ABATTOIR CATCHMENT AREA OF NGAOUNDERE DISTRICT, ADAMAWA PROVINCE, CAMEROON

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The Adamawa Province produces up to 28% of the national cattle population of Cameroon1. The predominant breed of cattle is the Ngaoundere Gudali, peculiar to this province and noted for high beef quality. However, the productivity of the Ngaoundere Gudali cattle in the Adamawa Province is seriously affected by various forms of helminthoses, trypanosomosis or "pial"2 and other factors such as inadequate nutrition and water shortage during the dry season3. These are associated with weight loss, anaemia, emaciation, weakness and general morbidity. These derangements are also associated with fasciolosis4. Furthermore fasciolosis has been associated with low response to treatment against dermatophilosis in the Ngaoundere Gudali cattle and their crosses5. Although livestock farmers in the Adamawa Province are aware of cattle helminthosis on their farms, they are mostly not aware of the economic importance of helminthosis in general and fasciolosis in particular in cattle production. Thus helminthosis is generally given little attention2. Apart from two reports5,6 there is no other evidence of studies on fasciolosis in the Ngaoundere Gudali cattle under extensive management. Therefore it was extremely necessary to generate the present data as a basis for creating more awareness and development of appropriate and integrated control strategies against fasciolosis for better productivity of the Ngaoundere Gudali cattle.

The study was carried out during the dry season (November-March) and rainy season (April-October), covering a period of twelve months. The cattle examined were adult zebu Ngaoundere Gudali (90%) and "Akou" (10%) bought by butchers from various cattle markets namely Dibi, Likok, Nyambaka, Tourningal, Tello, Martap and Ngaoundere, in the Vina Division of the Adamawa Province. The slaughter system is well organised in the Adamawa Province; animals are slaughtered in the central abattoir of each Division. This offers an opportunity to sample animals from various localities in the Vina Division.

Livers from a total of 13,536 animals were examined in the central abattoir in Ngaoundere. All animals slaughtered each day were included. Each liver was carefully examined for adult flukes. Occasionally worm burdens were estimated by counting individual worms in the liver. Fasciola gigantica was identified by simple morphological features4. A Chi-Square test and a one-way ANOVA7 were used to determine the association between season and the number of infected livers and the significance in the mean quarterly infection rate respectively. Statistical analysis were carried out at the 1% and 5% probability level.

* Corresponding Author.
Fig. 1: Monthly trend in the rainfall (mm) and prevalence of *F. gigantica* in Ngaoundere Gudali cattle slaughtered in Ngaoundere Municipal abattoir.

**Key**

- Prevalence (%)
- Rainfall (mm)
Fig. 2: Quartely trend in the prevalence of *F. gigantica* in Ngaoundere Gudali cattle slaughtered in Ngaoundere Municipal abattoir.

**Key**
- Jan- March (1st Qter)
- Apr - June (2nd Qter)
- Jul - Sept (3rd Qter)
- Oct - Dec (4th Qter)
Out of a total of 13,536 livers examined, 2,908 (21.5%) were infected with F. gigantica. The parasite was present throughout the year, with the highest percentage of livers infested during the month of June (Fig. 1). Up to 18.9% of the 5409 livers examined during the dry season were infected while 23.2% of the 8127 livers inspected during the rainy season were infected. A significant association (P<0.01) between the number of infected livers and the season of the year was recorded. The quarterly trend in the proportion of infected livers is shown in Fig. 2. A significantly higher (P<0.05) proportion of the infected livers were found during the second quarter of the year than during the other quarters.

Individual worm counts ranged from 57-170 adult worms in the bile ducts of a few livers in which worm counts were taken.

The annual prevalence of fasciolosis in the Ngaoundere Gudali cattle on the Adamawa Plateau (21.5%) is less than the prevalence (62%) in zebu cattle in Central African Republic and in cattle (28%) observed in Lolde abattoir, Senegal and 31.7% in Northern Nigeria. The prevalence (45.3%) in Maroua, a low lying and more northern province of Cameroon is also higher. The value (21.48%) for Adamawa is nonetheless economically important. Though the reasons for variability in prevalence are not quite clear this can be associated with differences in environmental factors, relative vector abundance and challenge and livestock farming systems which could play a major role in the epidemiology of bovine fasciolosis. Thus results from various localities should be interpreted and applied with caution because they are not directly universally applicable. Snail vector populations are known to rise during the rainy season compared with the dry season. A significantly higher (P<0.05) mean infection rate during the second quarter of the year (early rainy season) may be attributed to rapid multiplication of snails.

Studies by IRZ, Wakwa and Birgi and Graber reveal that F. gigantica is ingested from pasture around vast stagnant water bodies, such as lakes, where animals graze during the dry season. Congregation of animals around common grazing points during the dry season is typical of transhumant production systems which is quite common (63.5%) in the Adamawa Province of Cameroon. This practice which leads to increase in infection and parasite burdens may account for up to 18.9% infection rate recorded during the dry season in the present study. Losses due to fasciolosis can be very serious particularly when the environmental conditions are favourable for high and persistent rates of transmission. A high prevalence rate seen in the present work during the dry season also implies that chronic fasciolosis is common in the Ngaoundere Gudali cattle on the Adamawa Plateau.

It is suggested that livestock management practices should include use of fasciolicides prior to and after the transhumance period (October and April respectively). Snail vector population dynamics should be well investigated in order to increase the understanding of the major factors favouring the prevalence of fasciolosis on the Adamawa Plateau.

Acknowledgements

We express gratitude to Mr. Adamou Dangbar of the Delegation of Livestock, Fisheries and Animal Industries (MINEPIA) Adamawa Province for his assistance at the abattoir. We also thank Messrs Mesine Ombionyo of IRZV Wakwa and Hans Hockey, the Biometrician of IRZV for proof reading the manuscript.
References


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SHORT COMMUNICATION

EFFECTS OF SKIP-A-DAY FEEDING PROGRAMME ON THE GROWTH AND HAEMATOLOGICAL PARAMETERS OF BROILER CHICKENS

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Over the past 2 or 3 decades, breeding and improved levels of nutrition have increased the market weight of broiler chickens by an average of 40g each year1. However, this fast growth rate seems to be accompanied by an increased mortality rate as a result of skeletal and metabolic diseases, such as Sudden Death Syndrome (SDS)2,3 and ascites. Limited feeding programmes, such as short term feed restriction have been found to reduce mortality by decreasing the incidence of skeletal and metabolic disorders4. The objective of this study was to assess the effect of different modalities of skip-a-day feeding programme on growth and haematological parameters of broiler chicken. Haematological parameters are readily available and fast means of assessing clinical and nutritional health status of animals on feeding trials5.

A completely randomized experimental design was used with five treatment levels that is 1, 2, 3, 4, 5, with treatment 1 as control. The birds were raised conventionally on commercial feed up to three weeks of age. They were then weighed and randomly allocated into the five treatment groups of 60 birds with 2 replicates of 30 birds each. The average initial weight of the chicks in the five groups were 329.20g, 337.35g, 325.24g, 331.65g and 327.65g for treatments 1, 2, 3, 4 and 5 respectively. The feeding regime adopted were ad libitum feeding for treatment 1, while 2, 3, 4 and 5 were deprived of feed every other day, after every 2 days, after every 3 days and after 4 days respectively. The birds were weighed at weekly interval to monitor the growth pattern.

Blood was first collected from the wing vein of 2 birds per replicate at 5 weeks of age into sampling bottles containing ethylene diamine tetra-acetic acid (EDTA; 1mg/ml blood) as anti-coagulant and analysed within 2 hours of collection. Packed cell volume (PCV) was determined using haematocrit method6. At the end of 5 weeks, birds were mixed up and regrouped into pens, having an equal number of birds with the following average initial weight: 876.5g, 888.93g, 887.97g, 874.11g and 888.26g for treatments 1, 2, 3, 4 and 5 respectively, and continued on the feeding regime already described for the different groups. Blood samples were again collected at 6 and 9 weeks of age from 2 birds per replicate, and analysed as previously described. Data on body weight were subjected to analysis of variance7. Duncans Multiple-Range Test was used to separate differences between means at 5% levels8.

The growth patterns of the birds are presented in Table 1. Growth at 5 weeks of age seemed to be depressed below the level of the control in all the skip-a-day treatment groups, but more prominent in treatment 2 (skip every other day), and was

* Corresponding Author.
### Table 1: Performance of broiler chickens in the experiment

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Ad libitum (feed every day)</td>
</tr>
<tr>
<td>Mean liveweight</td>
<td>329.20, 594.03±17.36, 873.53±97.73, 824.05±101.42, 758.62±110.77, 1444.16±352.80, 1194.26±320.82, 1342.26±300.24, 1134.54±279.54, 1329.82±204.39</td>
</tr>
<tr>
<td>At 3 weeks of age (g)</td>
<td></td>
</tr>
<tr>
<td>Mean liveweight at 5</td>
<td></td>
</tr>
<tr>
<td>weeks of age (g)</td>
<td></td>
</tr>
<tr>
<td>Mean liveweight at 9</td>
<td></td>
</tr>
<tr>
<td>weeks of age (g)</td>
<td></td>
</tr>
<tr>
<td>Column means bearing the same subscripts are not significantly different (P&lt;0.05)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Effects of treatment on Haematological values of broiler chickens

<table>
<thead>
<tr>
<th>Performance Characteristic</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Ad libitum (feed every day)</td>
</tr>
<tr>
<td>5 weeks of age (PCV)%</td>
<td>28.00±8.49</td>
</tr>
<tr>
<td>Haemoglobin (Hb) G/dl</td>
<td>8.45±0.00</td>
</tr>
<tr>
<td>6 weeks of age (PCV)%</td>
<td>30.00±2.00</td>
</tr>
<tr>
<td>Haemoglobin (Hb) G/dl</td>
<td>9.53±0.29</td>
</tr>
<tr>
<td>9 weeks of age (PCV)%</td>
<td>29.25±2.63</td>
</tr>
<tr>
<td>Haemoglobin (Hb) G/dl</td>
<td>9.38±0.35</td>
</tr>
<tr>
<td>Column means bearing the same subscripts are not significantly different (P&lt;0.05)</td>
<td></td>
</tr>
</tbody>
</table>
significantly lower than all other treatments (P<0.05) whereas treatments 3, 4 and 5 were not significantly different from treatments 2, 3 and 4.

The results of the blood samples collected and analysed at 5, 6 and 9 weeks of age are presented in Table 2. The PCV for treatment 1 and treatment 2 for 5 weeks old broilers were similar (28%) and were numerically the lowest. Treatment 4 had the highest PCV of 31%. There was no significant difference (P<0.05) in the mean PCV values observed across the treatment groups. The lowest mean haemoglobin concentration of 8.45g/dl was recorded for the control group and the difference was not significant (P>0.05). Although treatment 2 had the highest value numerically, there was no significant difference (P>0.05) across the treatments. The haemoglobin concentration showed that treatment 5 had the lowest value of 28.5% and there were no significant differences across the treatments (P>0.05).

In normal animals, PCV is directly related to the erythrocyte count and haemoglobin content. Chicken have a PCV value between 30 and 33%, although the PCV value in male chickens may reach 35 to 40%. Normal haemoglobin concentration in chickens has been reported to be in the range of 6.5-9g/100ml. Although the different regimen of skipping feed affected growth, particularly up to 5 weeks of age, the blood analysis results obtained for the 3 periods of collection showed that the various treatment regimens had no significant effect on PCV and haemoglobin content, which agrees with previous reports on similar studies.

Although exercise and nutritional status are among factors influencing haemoglobin concentration, no such effect was observed in this study. Blood analysis is reported to be a fast and readily available means of assessing clinical and nutritional health status of animals in feeding trials but the results in the present study suggest that the treatment regime or modalities applied did not adversely affect the clinical and nutritional health status of the birds. The results contradict findings by previous workers who observed that broiler chickens and layers on restricted feeding showed reduced haemoglobin and PCV among the parameters examined. No clinical metabolic disorders was observed in any of the treatments in the present study even though the biochemical constituents that would have aided the determination of metabolic status of the birds were not measured. In similar study, no significant differences were observed for blood cholesterol, total protein, serum glutamic oxaloacetic transaminase (S.G.O.T.) and PCV levels when broiler birds were restricted daily for 3 to 6 hours during the late growth phase (6-10wks). The blood values in this study indicated that the feeding methods applied did not adversely affect the clinical and nutritional health status of the birds in the experiment.

References


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SHORT COMMUNICATION

A SURVEY OF CRYPTOSPORIDIUM PARVUM INFECTION IN CALVES, GOAT KIDS AND LAMBS IN IBADAN, NIGERIA

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The prevalence of gastrointestinal Cryptosporidium parvum infection in calves, goat kids and lambs in Ibadan, Nigeria was determined by faecal examination. Single faecal specimens were collected from a total of 200 young animals and examined by wet mounts and confirmed morphologically by a modified Ziehl-Neelsen Carbol Fuchsin (ZN) stain.

Cryptosporidium parvum oocysts were seen in 61/200 (30.5%) of the sampled animals. The species prevalence rates were as follows: calves, 25.4%; goat kids, 37.5%; and lambs, 43.3%. The prevalence rate was significantly higher in lambs than in the other two groups (X², p<0.05). There was little difference in the sex prevalence rate as 32.5% of the sampled females were infected while 29.2% of the males were infected. Infection with Cryptosporidium parvum was not significantly associated with diarrhoea (X², p<0.05) although 58.7% of the animals with diarrhoea were infected. Although more of these young ruminants (calves, goat kids and lambs) aged < 4 wks were infected (51.5%), the difference was not significant (X², p<0.01).

There is need for further investigation into cryptosporidiosis, as causes of pre-weaning morbidity and mortality and its zoonotic potential from these and other species of animals in Nigeria.

Cryptosporidium parvum is a small protozoan parasite which may cause morbidity and mortality in several species of animals including calves, goat kids and lambs 1,2. In addition the parasite is of known zoonosis first recognized in 1976 as an important gastrointestinal disease in man 3.

In affected young ruminants, the infection may result in anorexia, weight loss, diarrhoea and subsequently death in medically unmanaged and complicated cases 1,2. Many outbreaks of the disease have been traced to water contamination 4 and recently sheep were incriminated in the contamination of a municipal water supply 5.

In Nigeria, there has been a report of neonatal diarrhoea in calves due to cryptosporidiosis 6. Generally a pre-weaning mortality of up to 40% has been recorded for goat kids and lambs in Nigeria 7 and Cryptosporidium parvum infection may be a contributing factor that should be considered. However, there is little information on the prevalence rate of Cryptosporidium parvum in calves, goat kids and lambs and the clinical picture and host factors that should be considered.

This report presents the prevalence rate of Cryptosporidium parvum in calves, goat

* Corresponding Author.
kids and lambs and the clinical picture and host factors associated with the infection in Ibadan, Nigeria. Between September and December, 2000, single faecal samples (about 5g) were collected from 130 calves, 40 goat kids and 30 lambs whose owners consented to the sampling. All sampled animals were in Ibadan and the surrounding villages. The animals were < 16 weeks of age. The age, sex, and breeds of the animals were recorded. Also, major clinical findings, especially evidence of diarrhoea were recorded. A house to house search for goat kids and lambs was done since most owners of these small ruminants keep them within their compounds.

The faecal samples were collected into clean bottles and labelled appropriately. The samples were refrigerated at 4°C and processed soon after collection. The faecal specimens were examined by the direct smear method as earlier described. All the smears were also stained with ZN stain using 2% sulphuric acid as a destaining agent. Cryptosporidium parvum was identified by morphological measurements and by the ZN stain (positive red). Results were analysed using the chi-square test.

In this study 61/200 (30.5%) of the animals were positive for Cryptosporidium parvum. Lambs constituted 13/30 (43.3%), goat kids 15/40 (37.5%) and calves 33/130 (25.4%) of the infected animals (Table 1). Significantly more of the lambs (X², P<0.05) were positive than the other two species. There was no age predisposition to infection (X², P<0.01) although the neonatal animals (calves, goat kids and lambs) <4 weeks had the highest prevalence rate of 51.5% (Table 1).

A slightly higher percentage of female animals were infected (32.5% compared with 29.2% for males). More than half (58.7%) of the animals with diarrhoea were infected with Cryptosporidium parvum (Table 2). However, there was no significant difference in infection in animals with diarrhoea and those without (X², P>0.01). Infection with other gastrointestinal pathogens such as Strongyloides and Trichuris spp. were also seen in some animals.

All the goat kids and lambs sampled were of the West African Dwarf breed while the calves were mainly White Fulani and their crosses.

The overall prevalence of Cryptosporidium parvum in this survey was high and the infection appeared to be endemic in the animals surveyed. In several parts of the world Cryptosporidium parvum alone or in combination with other gastrointestinal parasites is emerging as a major enteropathogen of calves and other ruminants.

The reason(s) why there is a higher prevalence rate in the lambs has not been established. The three groups appear to be equally susceptible to Cryptosporidium parvum infection although some animals may be intermittent shedders of the oocysts. Environmental factors may also play a major role in the spread of infection to man. Contaminated water could also be a risk factor in the spread of cryptosporidiosis and infection in these animals may be through water or contact with other infected animals.

Neonatal ruminants are particularly at risk to Cryptosporidium parvum infection and infection in this stage group may approach 70%. In this work, < 4 weeks old ruminants had a prevalence rate of over 50% although, they constituted less than 20% of the sampled population. However, there was no age predisposition to infection.

In the present study, diarrhoea was not a consistent finding in Cryptosporidium parvum infected animals with only about 50% of the infected animals having
Table 1: Age distribution to *Cryptosporidium parvum* in sampled animals

<table>
<thead>
<tr>
<th>Age (Weeks)</th>
<th>Calves</th>
<th>Goat kids</th>
<th>Lambs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Examined</td>
<td>No. Positive (%)</td>
<td>No. Examined</td>
<td>No. Positive (%)</td>
</tr>
<tr>
<td>1-4</td>
<td>15</td>
<td>7(46.67)</td>
<td>10</td>
<td>5(50.00)</td>
</tr>
<tr>
<td>5-8</td>
<td>20</td>
<td>6(30.00)</td>
<td>4</td>
<td>1(25.00)</td>
</tr>
<tr>
<td>9-12</td>
<td>60</td>
<td>9(15.00)</td>
<td>10</td>
<td>3(30.00)</td>
</tr>
<tr>
<td>&lt;12</td>
<td>25</td>
<td>5(20.00)</td>
<td>12</td>
<td>5(41.67)</td>
</tr>
<tr>
<td>unknown</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>130</td>
<td>33(25.37)</td>
<td>40</td>
<td>15(37.50)</td>
</tr>
</tbody>
</table>

Table 2: *Cryptosporidium parvum* distribution among diarrhoeic and non-diarrhoeic animals.

<table>
<thead>
<tr>
<th>Diarrhoea Status</th>
<th>Sex</th>
<th>Calves</th>
<th>Goat kids</th>
<th>Lambs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Examined</td>
<td>No. Positive (%)</td>
<td>No. Examined</td>
<td>No. Positive (%)</td>
<td>No. Examined</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>M+F</td>
<td>25</td>
<td>16(64.00)</td>
<td>10</td>
<td>6(60.00)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>14</td>
<td>9</td>
<td>4</td>
<td>1(25.00)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>11</td>
<td>7</td>
<td>10</td>
<td>3(30.00)</td>
</tr>
<tr>
<td>No diarrhoea</td>
<td>M+F</td>
<td>105</td>
<td>17(16.19)</td>
<td>30</td>
<td>9(30.00)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>66</td>
<td>9</td>
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<td></td>
<td>F</td>
<td>39</td>
<td>8</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>130</td>
<td>33(25.37)</td>
<td>40</td>
<td>15(37.50)</td>
<td>30</td>
</tr>
</tbody>
</table>
diarrhoea. A similar survey of neonatal calf diarrhoea had revealed similar trends. It is possible that other causes of diarrhoea were present in the sampled population. Concurrent infections with other enteropathogens are also possible contributors to the diarrhoea. The absence of scouring in some *Crypto-sporidium parvum* infected ruminants in this study may be as a result of a carrier state or low oocyst load which did not result in actual diarrhoea in these animals although minimal numbers of ingested oocyst, (about 30 oocysts), are required to establish clinical disease.

There is need for clinical investigation into cryptosporidiosis in these ruminants as the organism could contribute to scouring thereby leading to considerable economic loss.

Acknowledgements

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References


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SHORT COMMUNICATION

AMYLOBARBITONE-INDUCED ANAESTHESIA IN RABBITS MAY BE CORTICALLY MEDIATED

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Anaesthesia has often been explained as a progression of decreasing central nervous system excitability causing depression and if uncontrolled finally leads to death. In the anaesthetized state when loss of righting reflex is commonly used to determine central nervous system depression, depth and duration of anesthesia, level of excitability and location in the brain is yet to be established.

Although the reticular formation is known to respond to the wake-sleep cycle and to anaesthetic agents, the cerebral cortex is believed to be depressed before subcortical diencephalon as part of progression in general anaesthesia. A gain, the midbrain is thought to be involved in anaesthesia because one of the signs of a progressive rostral midbrain lesion is sleep or coma.

Decorticate animal preparations have commonly been used to study cortical functions, regulation of sub-cortical pathways as well as the organization of neural network. The possible involvement of the cerebral cortex in mediation of anaesthesia has been alluded to the suggestion that connections between the midbrain reticular formation and cortex are necessary for the induction of cortical desynchronization during early stages of anaesthesia.

The hallmark of the human decerebrate state is marked extension and hyperpronation of the upper extremities. In addition, distinct spasticity and hyperreflexia usually occur. A steady state of severe decerebrate posture is almost uniformly associated with abnormal respiratory patterns and a grave prognosis.

Barbiturates in general, including amyllobarbitone are thought to produce stages I (analgesia) and III (surgical) anaesthesia prior stage IV (medullary depression) in animals but not stage II (delirium). Posterior hypothalamic pressor response has been reported to be depressed by amyllobarbitone anaesthesia and co-administration with chloroquine suggested that some sub-cortical structures interact with amyllobarbitone. Also, the decorticate rat preparation has been reported to be resistant to ketamine hydrochloride anaesthesia.

The objective of this study was therefore to find out the extent to which the presence or absence of cerebral cortical tissues influences amyllobarbitone-induced anaesthesia in rabbits.

Twelve Newzealand rabbits aged 5 to 10 months old were used for the study. They were anaesthetized with amyllobarbitone (120mg/kg, body weight) intraperitoneally. The cortex was removed along posterior to anterior strip using scalpel blade directed at the dorsal cortex (medial cortex, frontal cortex, parietal cortex and lateral cortex). The decortication procedure used was based on methods reported earlier.

A semicircular dorsal craniotomy was performed. The head was clipped, shaved and disinfected. A craniocaudal midline

* Corresponding Author.
incision was made on the skull. The scalp was cut along the midline and retracted along with the temporal muscle in order to reveal nearly all the frontal and parietal bones and as much of the temporal bone as possible. All the subcutaneous tissues were carefully scraped away.

The skull was cut with a scalped blade along the fissures between the parietal and maxillary and the parietal and occipital bones. The entire parietal bone and part of the frontal bone were removed to expose almost the entire brain. A strip of bone was left along the frontal bone to protect the olfactory lobes, to provide some support for the scalp on closure and protect the brain. Care was taken to avoid injury to the eye of the optic nerve.

The cortex was exposed by cutting the dura on each side of the sagittal sinus and gently retracting it. Decortication was achieved by cutting the attachment of cerebral cortex from the pineal body and cerebellum caudally, olfactory lobes cranially and corpus callosum ventrally using a scalpel blade. Removal was begun along the caudal aspect and proceeded ventrally and cranially. The more posterior cortex was then removed with care not to damage the pineal body and cerebellum. The removal then extended to involve the frontal cortex. Care was also observed not to incise deeper than subcortical white matter.

Finally, much of the midline cortex and most of the medial and frontal cortex were removed although this was difficult due to the remaining strip of skull. The skin was closed using silk suture in a simple interrupted pattern and the surgical site was dressed with gentian violet. Procaine penicillin (400,000 I.U.) was administered intramuscularly to the decorticate rabbits for three days to minimize postoperative infection. Postoperatively, the rabbits were carefully nursed until they were able to eat and were in good condition. Seven days postoperation, the rabbits were anaesthetized with amylobarbitone sodium (120mg kg, body weight) intraperitoneally and were observed for 24 hours for possible signs of anaesthesia.

Following decortication, the rabbits had difficulty in feeding, poor balance and showed signs of self-neglect. Some of the observed behavioral changes in decorticate rabbits included involuntary micturation, defaecation, neck stiffness, respiratory paralysis, paralysis of the hindlimbs in some rabbits, dragging of one or two limbs and death of three rabbits and some of the rabbits recovered postoperatively (Figure 1).

In decorticate rabbits (seven days postoperation) amylobarbitone (120mg/kg, body weight) given intraperitoneally did not cause sleep. Furthermore, additional dose of amylobarbitone (120mg/kg, body weight) administered to the rabbits failed to induce anaesthesia in the decorticate rabbits.

The behavioral changes in the decorticate rabbits in this study agreed with previous descriptions of the condition of decorticate rats\textsuperscript{15,16}. In particular, these results showed that spontaneous grooming and response to touch were inefficient and poorly coordinated\textsuperscript{16,17}. Also, some of the observed behavioral changes in some decorticate rabbits included involuntary micturation, defaecation, neck stiffness, respiratory distress, paralysis of the hindlimbs of some rabbits and dragging of one or two limbs. These findings support earlier observations\textsuperscript{18} that bilateral extensive removal of the cerebral cortex in a monkey with little if any involvement of the basal ganglia results in decorticate rigidity with evident flexion of the extremities. Similarly, removal of the left and right cerebral hemispheres led to destruction of neuronal pathways of the cebrum which consequently in
Figure 1: Some decerebrate rabbits after recovery from surgery
humans, destroyed the left superior temporal gyrus which has a speech function. Affected also are neuronal connections from the medial geniculate nucleus of the thalamus responsible for hearing and in humans the left superior temporal gyrus has a speech function. In the same manner, the neuronal pathways of the dorsal portions of areas of the post central gyrus of the parietal lobe which receives fibres from the ventral posterior lateral nucleus of the thalamus appeared to be destroyed and is a higher center for somatosensory sensations relayed from the trunk, arms and legs. Visual function was similarly affected in some decorticate rabbits. That was probably due to the destruction of the neocortex of the occipital pole which surrounds the calcarine sulcus which is the primary visual cortex that receives projections from the lateral geniculate area. Areas 18 and 19 (the visual association on areas) which lie anterior to area 17 were equally destroyed. A steady state of severe decorticate posture is almost uniformly associated with abnormal respiratory patterns and a grave prognosis.

As observed earlier in the preliminary experiment, the onset of sleep in the amylobarbitone (120mg/kg, body weight) treated rabbits was 7.3±0.1 minutes in normal rabbits. However, in rabbits that survived decerebration, administration of amylobarbitone when administered did not induce anaesthesia in the decorticate rabbits. These results could be explained by the fact that bilateral removal of the cerebrum may be associated with sleep alteration or sleep mechanism in rabbits. This is particularly obvious because the brain contains the control mechanisms for sleep especially the cerebral cortex for which sleep seems to be most vital. The present findings indicate that a large proportion of the cerebrum when removed alters anaesthetic effect of amylobarbitone in rabbits.

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References


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Deux exemplaires des articles doivent être adressés à Monsieur le Rédacteur 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 fera l'objet de quelques modifications par le Comité de Rédaction.

Genres d'articles publiés dans le Bulletin
- des communications originales.
- des brèves communications.
- analyse des articles proposés par le Rédacteur.
- des éditoriaux.
- le courrier des lecteurs.
- analyse d'ouvrages.
- informations et annonces.

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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 brièvement.
Un débat sur l'importance de l'article.
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