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BOVINE SERUM COMPONENTS IN TAenia SAGINATA CYSTICERCi (C. BOVIS)

E.I.P. KAMANGA-SOLO, K.J. LINDQVIST and J.M. GATHUMA,
Department of Public Health, Pharmacology and Toxicology, Faculty of Veterinary Medicine, University of Nairobi, P.O. Box 29053, Kabete, Kenya.

Summary: The presence of bovine host serum albumin and immunoglo\u00f6bulins has been demonstrated in Taenia saginata cysticerci (C. bovis) using immunoelectrophoresis tests. These results are discussed with regard to the role they may play in the survival of the cyst in the immunologically competent host and in terms of the possibility of using C. bovis cysts as antigens for the serodiagnosis of bovine cysticercosis.

Introduction

Many workers have attempted to use C. bovis as the source of antigen in the serodiagnosis of bovine cysticercosis (Bugyaki, 1961, Froyd, 1963), but have encountered a high proportion of false positive reactions. Host components in parasite extracts used as antigens in many of these tests are known to be responsible for many non-specific reactions (Kamniski, 1957, Bensted and Atkinson, 1958; Chordi and Kagan, 1965; Ben-Ismail et al., 1980). These components are present in cystic stages of several cestodes (Kagan and Norman, 1961; Dineen, 1963; Kagan, 1963; Damian, 1964; Chordi and Kagan 1965; Kassi and Tanner, 1977). However, the presence of host components in C. bovis has not been critically evaluated.

The present study was undertaken to identify host-serum components in C. bovis. The results are discussed in relation to the use of the cysts as a source of antigens in the serodiagnosis of bovine cysticercosis.

Materials and Methods

Antigens

C. bovis infected meat was obtained from various slaughterhouses around Nairobi. The cysts were carefully dissected from the muscles, placed in petri dishes and washed extensively with saline. The cysts were then punctured using dissecting needles. The fluid (F) obtained from the cysts was harvested, placed in vials and stored at -20°C.

The cyst membranes and scolices were rinsed in saline several times and blotted dry with filter paper. Ten grams (wet weight) of cyst membranes and scolices were placed in a mortar cooled to -20°C and ground with a cooled pestle. The material was further homogenized using a Potter-Elvehjem tissue grinder (Kontes Glass Company, New Jersey, U.S.A.) under cooling in an ice bath. Ten millilitres of saline were added to the homogenate and the mixture was sonicated at 300 watts for 5 minutes in an ice-water bath using Braunsonic 1510 sonicator (Braunson Sonic Power Co., Danbury, U.S.A.). The homogenate was centrifuged at 2000xg. The protein content of the supernate (M) was found to be 12.30 mg/ml as determined by the method of Lowry et al. (1951). This saline extract was used as antigen in immunoelectrophoretic analysis.

Antisera

The following antisera were prepared: rabbit anti-whole bovine serum, rabbit anti-bovine IgG and rabbit anti-bovine serum albumin. All the antisera were prepared by immunization of adult New Zealand white rabbits following the method described by Newbould (1965).
Results

The results of immunoelectrophoretic analyses are shown in Figs. 1 and 2. Fluid from *C. bovis* and extract from the membrane and scolices contained several components which migrated in the albumin and gamma regions. Using rabbit anti-bovine IgG the slow migrating host components were shown to be IgG while the fast migrating components were shown to be host albumin.

Discussion

The usefulness of immunoelectrophoresis for the analysis of the antigenic mosaic of an infective agent has been reported by many workers (Biquet *et al.*, 1962; Chordi and Kagan, 1964; Norman *et al.*, 1964). Using this method we have been able to demonstrate that *C. bovis* fluid and an extract from membranes and scolices contain host albumin and IgG.

The presence of host immunoglobulins has been demonstrated in hydatid cyst fluid (Varela-Diaz and Coltorti, 1972; Coltorti and Varela-Diaz, 1972; Kassis and Tanner, 1977). Varela-Diaz and Coltorti (1972) were able to demonstrate that host immunoglobulins can penetrate hydatid cyst membranes.

Immunoglobulins present in *C. bovis* may represent antibodies adsorbed to the parasite and thus shielding it from the host immunological attack, as has been demonstrated in schistosomes (Smithers, 1968; Smithers *et al.*, 1969; Clegg *et al.*, 1970). On the other hand, these antibodies may be directed against
parasite antigens, which have no adverse effect on the cyst viability or which block the interaction of host humoral or cellular factors with antigens which are important for the survival of the cyst (Varela-Diaz et al., 1972). This observation may be true in bovine cysticercosis, since it is known that cysts may survive in an immunologically competent animal for a period of more than thirty months (Froyd, 1964, Urquhart and Brocklesby, 1965; Williams et al., 1980).

In the serodiagnosis of parasitic disease it is important to consider the characteristics of the antigen employed, since these determine the specificity, sensitivity and the feasibility of the test. One of the problems involved in the quality of some parasite antigens is the presence of host components. These components complicate the analysis, standardization and interpretation of immunodiagnostic tests (Chordi and Kagan, 1965; Oriol et al., 1971). The use of whole C. bovis cysts extract antigen in the serodiagnosis of bovine cysticercosis may cause the above mentioned problems. It is therefore important to purify specific antigens from the cyst in order to use them as diagnostic tools.

Acknowledgements

The authors wish to express their gratitude to the technical staff of the Department of Public Health, Pharmacology and Toxicology who helped in the collection of C. bovis infected meat.

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REFERENCES


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COMPARISON OF PATHOGENIC STAPHYLOCOCCI ISOLATED FROM MAN AND ANIMALS AT BODIJA ABATTOIR

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Summary: A comparative study on Staphylococci aureus isolated from man and goats at Bodija abattoir showed that both human and goat strains could be typed by bovine phages. An indication of cross infection between man, goats and cattle was shown.

There was some correlation between mercuric chloride resistance and antibiotic resistance in two strains. All human staphylococci were fibrinolytic whereas only a few goat strains were fibrinolytic. There was no correlation between phage types and antibiotic resistance.

Introduction

Staphylococcus had been identified according to its biochemical characteristics (Marandon and Oeding 1966; Moore 1960; Matsumoto et al. 1974; Oeding et al. 1966) enzyme reactions (Abramson and Friedman, 1967; Elston and Fitch, 1964; Devriese and Oeding 1975; Gillespie, 1943), serological characteristics (Choudhuri and Chakrabarty, 1969; Live and Nicholas 1965; Hahn and Blobel, 1968) and by phage typing (Davidson, 1972; Markhan and Markhan, 1966).

In Nigeria, antibiotics and antimicrobial agents are used indiscriminately in human as well as veterinary medicine. This has resulted into bacteria developing resistance to these agents, and some of the resistant bacteria have been shown to harbour R-factor, (Adetosoye 1980a, 1980b).

The work reported here deals with the characteristics of Staphylococcus aureus isolated from 27 live stock attendants and from anterior nares or 30 goats at the Bodija abattoir Ibadan.

Materials and Methods

Bacterial isolates

Clinical specimens were obtained from wounds and boils with sterile swabs from 27 livestock attendants and from the anterior nares of goats at the Bodija abattoir in Ibadan, Oyo State, Nigeria. Each sample was bacteriologically examined by seeding 5% sheep blood agar, nutrient agar and mannitol salt agar plates. The plates were incubated at 37°C for 18 h. and the presence of complete haemolysis on 5% sheep blood agar and pigmentation in nutrient agar and mannitol salt agar plate were noticed. Each bacterial isolate was stained by Gram’s method and examined for gram positive, cluster-forming cocci. This was followed by slide coagulase test (Williams and Harper, 1946) and tube coagulase test (Gillespie, 1943).

All isolates were examined biochemically (Cowan, 1974). Deoxyribonucleic acid production was catted out according to the method described by Blair et al. (1967). Each isolate was also examined for fibrinolysin production according to the method described by Marandon and Oeding (1966) and mercuric chloride resistance according to Moore (1960).

Antibiotic sensitivity

The method of Walton (1972) modified by Adegóké (1981) was used. Oxoid multitodisks (code 3857E) containing the following antibiotics oxytetracycline (OT: 50mcg), chloramphenicol (C: 50mcg) furazolidone (Fr: 10mcg), neomycin (N: 30mcg) nalidixic acid (Na: 30mcg), ampicillin (PN: 25mcg), streptomycin (S: 10mcg) and triple sulphar (S3: 300mcg) were used.

The minimum inhibition concentration (MIC) of chloramphenicol, sulphadimidine, oxytetracycline and strepto-
mycin was determined for each bacterial isolate that showed resistance to these antibiotics in the disk diffusion method, according to the method described by Garrod et al. (1973).

**Bacteriophage typing**

Each staphylococcus plate was grown in 4.0ml of nutrient broth overnight. A nutrient agar plate was flooded with thioglycollate and excess fluid was drained off with a sterile pipette. When the plate dried, 0.01 ml of bovine typing phages 78, 116, 117, 102, 84, 167 and 118 (Davidson, 1972), at routine test dilution (RTD) were respectively delivered from sterile pipettes over the squares of grid marked on the bottom of the petri dish. Care was taken not to allow the pipette to touch the surface of the agar. A sterile pipette was used for each phage dropping to prevent contamination. The plate was allowed to dry at room temperature then it was incubated in air at 37°C for 6 h. and the lytic patterns were recorded.

**Results**

The fundamental data obtained in this investigation are shown in Tables 1 and 2. All the staphylococcal isolates of human origin were fibrinolytic and were sensitive to ampicillin chloramphenical, neomycin and furazolidone. However, four isolates were resistant to nalidixic acid alone. Other isolates were resistant to oxytetracycline, triple sulphar, streptomycin and nalidixic acid or a combination thereof (Table 1). The MICs of oxytetracycline, streptomycin and sulphadimidine were 125µg/ml, 62.5ug/ml and 250ug/ml respectively for the isolates. Thirteen human staphylococcal isolates were typable with the available bovine typing phages (Table 1). *Staphylococcus aureus* isolated from goats were resistant to oxytetracycline, streptomycin and chloramphenicol in decreasing order and sensitive to ampicillin, furazolidone, triple sulphar, neomycin and nalidixic acid. The MIC of streptomycin was 125 mcg/ml while MIC of oxytetracycline was 250mcg/ml and that of chloramphenicol was 15.6mcg/ml. The *Staphylococcus aureus* were typable by the bovine phages used (Table 2).

**Discussion**

From the results obtained in this investigation it was observed that there is a good correlation between coagulase test and deoxyribonuclease activity of human strains of staphylococci. All human staphylococci investigated were fibrinolytic whereas only 5 (16.7%) of the goat strains were fibrinolytic. This finding supports the reports of Elek and Levy (1950) and Rountree (1947) that fibrinolytic activity is more often associated with staphylococcal strains of human origin than with animal strains.

It was reported by Pattison (1958) that *Staphylococcus aureus* could multiply in the environment where it caused serious pathological lesions. The isolates studied here possessed enzymatic characteristics which enhance their pathogenicity. A spread of staphylococcal strains from man to man or from animals to animals or vice versa might cause serious public health, and also economic problems in livestock especially in the dairy industry.

From our investigation, thirteen (50%) of staphylococci of human origin and 20 (67%) of goat origin were resistant to oxytetracycline. The high incidence of oxytetracycline resistance observed amongst isolates from goats might be due to the incorporation of this antibiotic into animal feed (Ojo and Ananihu, 1974) and the high incidence of oxytetracycline resistance in isolates from man might be due to indiscriminate use of this antibiotic resistant plasmids which may be transferred by transduction (Morse, 1959; Bulow, 1971; Lacey, 1975; Novic and Morse, 1967) and if this occurs it might lead to serious public health problems. Indiscriminate use of oxytetracycline both in human and veterinary practice has been shown to lead to bacterial resistance to the drug (Oeding et al. 1972). Previous reports from this laboratory Adetosoye (1980a, 1980b)
<table>
<thead>
<tr>
<th>Strain No.</th>
<th>Fibrinolysin</th>
<th>Mercuric chloride 1/27,000</th>
<th>Deoxyribonuclease</th>
<th>Coagulase</th>
<th>Antibiotic resistant Pattern</th>
<th>Phage Pattern</th>
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<td>+</td>
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<td>78, 84, 102, 107, 117, 118, 167</td>
</tr>
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<td>S</td>
<td>+</td>
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<td>OTS</td>
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</tr>
<tr>
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<td>+</td>
<td>S</td>
<td>+</td>
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<td>117</td>
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<td>26913</td>
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<td>NaOT</td>
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<td>33848</td>
<td>+</td>
<td>S</td>
<td>+</td>
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<td>NaOT₃S</td>
<td>negative</td>
</tr>
</tbody>
</table>

1 – Sensitive
2 – Resistant
3 – S₃S: Triple Sulphar, Streptomycin
* – Positive reaction
OT – Oxytetracycline
Na – Nalidixic acid
S – Streptomycin
Table 2: Characteristics of *Staphylococci* isolated from goats

<table>
<thead>
<tr>
<th>Strain No.</th>
<th>Fibrinolysin</th>
<th>Mercuric chloride (1/27,000)</th>
<th>Deoxyribonuclease</th>
<th>Coagulase</th>
<th>Antibiotic Resistance Pattern (^3)</th>
<th>Phage Pattern</th>
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<td>*</td>
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<td>TE/S/SXT</td>
<td>78, 116, 84, 118</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>*</td>
<td>+</td>
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<td>TE/S/SXT</td>
<td>78, 116, 84, 118</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>*</td>
<td>+</td>
<td></td>
<td>S</td>
<td>78, 116, 117, 102, 84, 167, 118</td>
</tr>
<tr>
<td>5</td>
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<td>*</td>
<td>+</td>
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<td>78, 116, 117, 102, 84, 167, 118</td>
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</table>

*: Not examined  
R: Resistant  
1: + Positive  
2: — Negative reactions  
3: TE — Tetracycline; SXT: Sulfamethazole/Trimethoprim (cotrimoxazole);  
S: Streptomycin
showed that *E. coli* isolated from livestock showed resistance to antibiotics including oxytetracycline, the resistance of which was found to be infectious.

In Nigeria, cattle, sheep and goats are transported from the Northern States of Nigeria to the South in railway, truks and trailers. In the markets the animals are kept in the same environment especially at Bodija abattoir in Ibadan. The close association enhances spread of staphylococci strains among livestock and possible cross transmission also occurs to livestock attendants.

From this investigation it was possible to phage type 17 of the isolates from man with bovine phages belonging to group II, III, IV. Some miscellaneous phages were also effective on the staphylococci (Davidson, 1972). Of these typable isolates, 8 were typed by phage 117, of group IV. On the other hand, the goat strains were also lysed by phages belonging to groups II, III, IV (Table 2). That staphylococci isolated from human and goats were lysed by bovine phages suggests a cross infection and cross association between man, cattle and goats (Live and Nicols, 1961).

An attempt was made to correlate mercuric chloride resistance and antibiotic resistance patterns. It was observed that 2 strains of *Staphylococcus aureus* isolated from man were mercuric chloride resistant and also resistant to oxytetracycline and nalidixic acid. Seven strains isolated from goats were tested for mercuric chloride sensitivity (Moore, 1960). They were either resistant to oxytetracycline only or to both oxytetracycline and streptomycin. One isolate from goat was resistant to mercuric chloride but sensitive to all the antibiotics. Thus it could be concluded that mercuric chloride resistance was not dependent on a particular antibiotic.

Lytic pattern of phages on strains studied was also related to antibiotic resistance. It was observed that the staphylococci strains studied in this investigation were resistant to either oxytetracycline alone or to oxytetracycline and streptomycin and oxytetracycline and nalidixic acid. The resistant isolates were lysed by phage 117 only or by mixed phages including 117. Other isolates were lysed by mixed phages including phage 117. Such isolates were sensitive to all the antibiotics used in this study. Thus, it could be concluded that lytic patterns of phages was not related to antibiotic resistance pattern.

In order to prevent cross infection from animals to animals it is suggested that animals should be kept far apart in separate pens. Veterinary laws should be made to prohibit indiscriminate use of antibiotics in livestock and judicious use of antibiotics in food animals should be practised. Bambermycins, a good growth promoter and an antibiotic to which enteric organisms such as *E. coli* has not been found to show resistance and harbour R-factor should be substituted for the tetracyclines as feed additive (Bauer and Dost, 1965).

**Acknowledgement**

We are indebted to Dr. Dosu Adekeye who kindly gave us the bovine phages.

**REFERENCES**


Received for publication on 19th July, 1983.
BRUCELLA OVIS AS A POSSIBLE CAUSE OF INFERTILITY AND ABORTION IN TWO SHEEP RANCHES IN NIGERIA

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Veterinary Surgery and Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria

Summary: Brucella ovis infection in sheep at two state-owned ranches, L and T respectively, in Kaduna State of Nigeria is reported. Sera from ewes and rams were tested for Brucella spp. infections by the Rose Bengal plate test (RBPT), serum agglutination test (SAT) and complement fixation test (CFT) using B. abortus, B. canis and B. ovis antigens. No reactor to B. abortus SAT antigen was detected at either ranch. The overall reactor rate to B. ovis CFT antigen was 69.6% at ranch T but 36.8% at ranch L while the lambing percentage dropped to 42.2% and 61.6% of the previous year’s values at T and L respectively. Correlation was observed between reactors detected by B. ovis CFT antigen and B. canis SAT antigens. Investigation revealed that staff and animal movements between both ranches may have accounted for the simultaneous occurrence of B. ovis infection. This is believed to be the first report of B. ovis infection in sheep in Nigeria.

Introduction

Small ruminants, particularly sheep and goats have for long had socio-economic significance in Nigeria. Brucellosis which was recognised as far back as 1934 in Nigeria (Eze, 1977) is one of the major causes of abortions cattle, sheep and goats in Nigeria.

Prevalence rates for brucellosis in sheep in various parts of Nigeria ranged from 0.9% to 14.5% using B. abortus RBPT, CFT or SAT antigens (Falade et al., 1967; Morrison et al., 1975, Falade et al., 1975, Okoh, 1980).

To the best of our knowledge, there is no published work of serological or cultural detection of B. ovis in Nigeria. This paper reports B. ovis infection in two sheep ranches experiencing poor conception rates and cases of abortion.

Flock History

About mid-October 1982, an unusual number of abortions, stillbirths, orchitis and arthritis were observed in sheep at a state-owned sheep project situated about 300 km North-west of Zaria, Nigeria. Until the present episode, the project had apparently relatively good reproductive performance, hence the observation of the excessive number of abortions and other signs of reproductive problems prompted a request for an investigation.

The project contained over 2,800 sheep in two ranches, Ranch L and T, situated about 30 km apart but under the same management. The latter fact meant that there was extensive and constant traffic of personnel, animals and materials between the two ranches. The sheep, mostly local breeds – Uda, Balami, Yankasa with some crosses – were kept in Australian-style open polebarns in “flocks” which grazed in extensive fenced pastures.

Each ranch maintained a flock of breeding rams and these were put among the flocks of ewes during the breeding “seasons”. Artificially-induced estrous synchronisation was not practised and the “season” had been varied more or less in an attempt to find the most acceptable one. Up till 1979, the breeding seasons had been January and September. In 1980, three breeding seasons – January, September and December – were used. In 1982, these were changed to April, May, June and July, primarily to avoid lambing during the rainy season. Repeat breeders, those ewes not bred in one round, were simply put with the next group until they got bred or the breeding season was over. Abortion was observed for the first time at either ranch in 1981 when two ewes aborted at Ranch L. There was no

*Department of Veterinary Public Health and Preventive Medicine.
brucellosis vaccination at either ranch, as this is not routinely practised in sheep and goats in Nigeria.

Materials and Methods

During two visits to the farms, all the available records were examined and the record keeper, attending veterinarians and herdsmen were interviewed concerning their observations on the abortion episodes. At each ranch, serum samples and blood in EDTA were collected from all the breeding rams and all aborted ewes. A randomly selected cross-section of ewes that lambed normally, pregnant ewes and non-breeding rams were also bled. The genital organs of all breeding rams were examined. The testes were palpated for consistency and evidence of inflammatory or degenerative changes. Preputial washings were taken for microscopic examination.

Laboratory Investigation

Blood in EDTA was used for routine hematological examinations. The serum samples were screened for antibodies to Brucella and Toxoplasma organisms while the preputial washings were microscopically examined for Vibrios and Trichomonas.

Serum samples were screened for *B. abortus* and *B. canis* agglutinins using the Rose Bengal plate test (RBPT) for *B. abortus* alone and serum agglutination test (SAT) for both, as described by Morgan et al., (1971). The *B. abortus* and *B. canis* antigens and control negative and positive sera were gifts from Dr. E.N. Eze of the National Veterinary Research Institute, Vom, Nigeria. Reactions at 1:20 which is equivalent to 40 or more international units (i.u.) per ml. were considered as positive.

Sera were also screened for antibodies to *B. ovis* by the RBPT as described by Corbel et al., (1979). All samples positive by RBPT were tested by complement fixation test (CFT) for confirmation. Both the *B. ovis* RBPT and CFT antigens and control sera were kindly provided by Dr. Corbel of the Central Veterinary Laboratory, Weybridge, England.

The CFT was performed in microtitre plates using the methods of Casals (1967). The complement was obtained as fresh guinea-pig serum from a healthy guinea-pig, and sheep red blood cells (sRBC) was obtained from a local sheep. Hemolysin used was obtained from GIBCO (Grand Island, NY, USA). All dilutions were made in veronal buffered saline. Initially, the antigen and antisera were standardised in a checkerboard titration in which all appropriate controls were included (Corbel et al., 1979). The optimum antigen dilution (containing 4 CF units) determined in this manner was used to test field serum samples. Samples with reactions at dilutions of 1:4 or higher were considered positive.

Antibodies to *Toxoplasma gondii* were assayed by the indirect fluorescent antibody technique (IFAT) as described by Karim and Ludlam (1975).

Results

The reproductive performance of sheep at the two ranches in 1981 and 1982 based on available records and discussion with the personnel, is presented in Table 1. The number of live-births and lambing rate dropped drastically in 1982 when compared with the figure for 1981, even after correcting for the fact that they were only half-way through the breeding season. Similarly, there was a clear increase in the number of abortions for 1982 at both ranches. Comparison of the two ranches showed that ranch T had lower lambing and abortion rates than ranch L. Rams in T serviced more ewes than those in L.

The monthly distribution of abortion cases is shown in Table 2. The abortion outbreak started in L in July, one month before it was observed at T although in both ranches, the peak occurred in August.

The results of the serological examination for brucellosis are displayed in Table 3. The overall reactor rate was 51.5%. In ranch T, breeding rams had
<table>
<thead>
<tr>
<th>Table 1: Reproductive performance of sheep at ranch T and ranch L during 1981 and 1982 breeding seasons.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Ranch T</td>
</tr>
<tr>
<td>No. of sheep</td>
</tr>
<tr>
<td>Breeding ewes</td>
</tr>
<tr>
<td>No. of ewes bred</td>
</tr>
<tr>
<td>Livebirths</td>
</tr>
<tr>
<td>Lamming percentage</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>No. of breeding rams</td>
</tr>
<tr>
<td>Mean No. of ewes serviced per ram</td>
</tr>
<tr>
<td>No. of abortion</td>
</tr>
<tr>
<td>Abortion ratio (No. of bred sheep-abortion)</td>
</tr>
</tbody>
</table>

*Data collected up to 26-10-82.
**Rate corrected for only half the breeding season.
NA – Not available.

<table>
<thead>
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<th>Table 2: Monthly incidence of abortion at ranches T and L.</th>
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<tbody>
<tr>
<td>Ranch T</td>
</tr>
<tr>
<td>Month</td>
</tr>
<tr>
<td>June</td>
</tr>
<tr>
<td>July</td>
</tr>
<tr>
<td>August</td>
</tr>
<tr>
<td>September</td>
</tr>
<tr>
<td>October*</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

*Data on monthly incidence of livebirths at ranch L were not available.
**Data collected as of 16-10-82.
**Abortion at ranch L. represented 9.7% of livebirths.
Table 3: Serological evidence of *B. ovis* agglutinins in sheep at both ranches

<table>
<thead>
<tr>
<th>Category</th>
<th>Ranch T²</th>
<th>RBPT reactors</th>
<th>CFT reactors</th>
<th>No. tested</th>
<th>Ranch L¹</th>
<th>RBPT reactors</th>
<th>CFT reactors</th>
<th>No. tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeding rams</td>
<td>13</td>
<td>13(100.0)</td>
<td>12(92.3)</td>
<td>9</td>
<td>4</td>
<td>4(44.4)</td>
<td>2(22.2)</td>
<td>9</td>
</tr>
<tr>
<td>Aborted ewes</td>
<td>11</td>
<td>9(81.8)</td>
<td>9(81.8)</td>
<td>18</td>
<td>14</td>
<td>14(77.8)</td>
<td>13(72.2)</td>
<td>18</td>
</tr>
<tr>
<td>Pregnant ewes</td>
<td>7</td>
<td>7(100.0)</td>
<td>6(85.7)</td>
<td>10</td>
<td>9</td>
<td>9(90.0)</td>
<td>4(40.0)</td>
<td>10</td>
</tr>
<tr>
<td>Normal ewes</td>
<td>10</td>
<td>7(70.0)</td>
<td>4(40.0)</td>
<td>10</td>
<td>6</td>
<td>6(60.0)</td>
<td>1(10.0)</td>
<td>10</td>
</tr>
<tr>
<td>Non-breeding rams</td>
<td>5</td>
<td>3(60.0)</td>
<td>1(20.0)</td>
<td>10</td>
<td>5</td>
<td>5(50.0)</td>
<td>1(10.0)</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>39(84.8)</td>
<td>32(69.6)</td>
<td>57</td>
<td>38</td>
<td>38(66.7)</td>
<td>21(36.8)</td>
<td>57</td>
</tr>
</tbody>
</table>

Overall reactor rate = 51.5%

¹One normal ewe was an RBPT reactor with *B. abortus* antigen but a non-reactor by S.A.T.
²Two aborted ewes were RBPT reactors with *B. abortus* antigen but non-reactors by S.A.T.
³No history of vaccination against brucellosis (*B. abortus* or *B. ovis*) at both farms ( ) Percent reactors.

Table 4: A comparison of S.A.T. reactors detected with *B. canis* antigen and CFT reactors with *B. ovis* antigen in sheep sera from both ranches

<table>
<thead>
<tr>
<th>Category</th>
<th>No. tested</th>
<th><em>B. ovis</em> antigen</th>
<th><em>B. canis</em> antigen</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>CFT reactors</td>
<td>S.A.T. reactors</td>
</tr>
<tr>
<td>Breeding rams</td>
<td>22</td>
<td>14(63.6)</td>
<td>22(100.0)</td>
</tr>
<tr>
<td>Aborted ewes</td>
<td>29</td>
<td>22(75.9)</td>
<td>29(100.0)</td>
</tr>
<tr>
<td>Pregnant ewes</td>
<td>17</td>
<td>10(58.8)</td>
<td>10(58.8)</td>
</tr>
<tr>
<td>Normal ewes</td>
<td>20</td>
<td>5(25.0)</td>
<td>16(80.0)</td>
</tr>
<tr>
<td>Non-breeding rams</td>
<td>15</td>
<td>2(13.3)</td>
<td>3(20.0)</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>53(51.5)</td>
<td>80(77.7)</td>
</tr>
</tbody>
</table>

( ) Percent reactors

the highest reactor rate followed by pregnant ewes and aborted ewes. In ranch L, the highest reactor rate was in the aborted ewes, followed by pregnant ewes and breeding rams. The reactor rate was higher in T than in L. Normal ewes and non-breeding ram populations also showed some reactors.

A comparison of the SAT with *B. canis* antigen and CFT with *B. ovis* antigen is presented in Table 4. Overall, *B. ovis* CFT antigen detected 53(51.5%) reactors while *B. canis*, SAT antigen showed 80 (77.7%) sheep to be reactors.

At ranch T, two breeding rams showed clinical orchitis while at L, one non-breeding ram and two breeding rams showed epididymo-orchitis, all being positive for *B. ovis* agglutinins. All preputial washings were negative for *Trichomonas* spp. and *Vibrio* spp. One aborted ewe at ranch L had a titre of 1:32 for *T. gondii* antibody with the IFAT.

**Discussion**

The detection of *B. ovis* antibody in sheep at both ranches with no vaccination history is evidence of *B. ovis* infection. *B. ovis* infections have hitherto, not been reported in sheep in Nigeria, as previous studies serologically and culturally demonstrated *E. melitensis* and *B. abortus* (Okoh, 1980; Palade et al., 1975; Bale, 1980). Also, during the same period, there was a clear evidence of poor reproductive performance.
at both ranches. Therefore, the findings of a good correlation between the incidence of *B. ovis* reactors and poor reductive performances of affected animals is highly suggestive that *B. ovis* was responsible for the increased abortion and infertility cases observed. *B. ovis* has been known to cause orchitis and epididymitis in rams, infertility and late abortions in ewes. The agent is not usually associated with abortion 'storms' typically seen with *B. abortus* infections (Anon, 1971).

The possibility of management practices playing contributory role in the observed decrease in reproductive performance and introduction of *B. ovis* to the ranches cannot be ignored. Prominent among these factors are the change to four breeding seasons in 1982 which could cause additional stress on the breeding flock, the practice of allowing rams to attend agricultural shows and returning to the ranches without quarantine, and the introduction of newly acquired rams to the ranches without prior screening for abortifacient agents or quarantine. All these factors may have played some role in the clinical picture in this study. Unrestricted movement of personnel, animals and materials between the two ranches may have been responsible, in part, for the almost simultaneous occurrence of cases of abortion and infertility at ranches L and T despite the fact that they are 30 km apart.

Of diagnostic relevance is the finding of good correlation between the number of reactors detected with *B. canis* SAT antigen and *B. ovis* CFT antigen. All serum samples, were, however, negative for *B. abortus* agglutinins. It is therefore imperative for investigators to be aware of differences in results of serological studies using rough strain (*B. ovis* and *B. canis*) antigens and smooth strain (*B. abortus*) antigen. Previous studies in this country have routinely employed *B. abortus* RBPT and either SAT or CFT antigens to demonstrate brucellosis (Falade *et al.*, 1975; Esuruoso, 1974; Adam and Mckay, 1966; Bale, 1980).

It is possible that cases of ovine brucellosis due to *B. ovis* may have been missed in the past as a result of this practice.

**Acknowledgements**

The authors are very grateful to Dr. R. Bradley, Dr. M.J. Corbel and Mr. Bell, all of the Central Veterinary Laboratory, Weybridge, England, for their useful suggestions and for supplying *B. ovis* CFT and RBPT antigens with positive and negative antisera. We also thank Dr. E.N. Eze of the National Veterinary Research Institute, Vom, Nigeria for supplying *B. abortus* RBPT and SAT antigens and *B. canis* SAT antigen with positive and negative control antisera. The technical assistance of members of both departments in the faculty is appreciated.

**REFERENCES**


Received for publication 11th July, 1983.
RINGWORM IN A HORSE CAUSED BY TRICHOPHYTON VERRUCOSUM

A. FADL ELMULA and UM EL ALIM A. IDRIS,
Veterinary Research Administration, P. O. Box 8067, El-Amarat, Khartoum, Sudan.

Introduction

Equine ringworm is commonly caused by Trichophyton equinum and T. verrucosum is an occasional cause of the disease in horses (Ainsworth & Austwick, 1973). Although ringworm of domestic animals in the Sudan has been described over many years (Anon, 1922-1979), attempts to isolate and identify the causative dermatophytes have been rare. Ringworm in horses caused by T. equinum was reported (Abu Samra, 1974). An abnormal outbreak of ringworm among calves probably caused by T. verrucosum was described, but the fungus was not isolated in culture (Abu Samra et al., 1976).

This paper reports the isolation of T. verrucosum, from horses in the Sudan.

Materials and Methods

Case History: An adult male horse was presented to Omdurman clinic with a skin infection. The lesions looked like inflamable swellings with some pus oozing out of them. Skin scrapings were examined microscopically after being digested in 10% potassium hydroxide solution. Other parts were streaked onto Mycobiotic agar (DIFCO) and Sabouraud’s glucose agar slants enriched with 1 mg/100 ml of thiamine hydrochloride. The specimens were cultured in duplicate slopes, incubated at 26°C and 37°C and examined daily for growth. Fragments of the growth were mounted in a drop of lactophenol cotton blue in a slide and examined.

Confirmatory Examination: Representative samples of the skin scrapings were sent to Mycological Reference Laboratory, London School of Hygiene and Tropical Medicine, for confirmation.

Ineffectivity to Guinea Pigs: Parts of these scrapings were ground and homogenised in a mortant and used for infectivity trials. The lateral sides of two guinea pigs were shaved and scarified by a sandpaper until hyperaemia occurred. The infective material was applied to the shaven areas and fixed by an adhesive tape. A third guinea pig was left as control. These laboratory animals were examined daily for any clinical symptoms. Seven days post-infection (P.I.) the guinea pigs were sacrificed and skin sections were fixed in 10% formaline, embedded in paraffin and stained with H & E and P.A.S. for histological examination.

Results

Direct microscopic examination of the scrapings revealed large ectothrix spores arranged in long chains coating the hair-shaft. Slow-growing colonies approximately 10 mm. in diameter, were recovered in two weeks. They were heaped, folded and white in colour. Microscopic observation of tea-seed cultures of colonies showed many chlamydospores. The Mycological Reference Lab. confirmed the isolate to be a dermatophyte on direct examination and isolated T. verrucosum in pure culture from this specimen.

The skins of the two infected guinea pigs became rough and thick with whitish-grey scales. Some parts of the infected skin recovered spontaneously prior to sacrifice. Histological examination revealed hypertrophy of the dermal layer with leucocytic infiltration. Hyphae and spores were detected in the infected hair follicle. No clinical symptoms or histopathological changes were detected in the control guinea pigs.

Discussion

This paper reports the first isolation of T. verrucosum in pure culture
from a horse in the Sudan. Abu Samra, Imbabi and Mahgoub (1976) in their previous report of ringworm in calves, attributed their failure to isolate the causative agent \( T. verrucosum \) to the fact that it was non-viable at the time of sampling. In this study we managed to isolate the organism in culture and confirmed identification in a reference laboratory. The organism was demonstrated to infect guinea pigs. These findings confirm those of Dvorak and Otcenasek (1969). The infectivity trial in guinea pigs was carried out using the scrapings after being maintained for 14 months at room temperature in the laboratory.

Acknowledgements

The authors are grateful to Professor D.W.R. MacKenzie and Dr. C.K. Campbell, of the Mycological Reference Lab., London School of Hygiene and Tropical Medicine, for studying the skin scrapings and confirming the diagnosis. Thanks are due to Dr. M.I. Abu Bakr for revising the manuscript. This paper is published with the permission of the Under Secretary of Animal Resources.

REFERENCES


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PARATUBERCULOSIS IN A HERD OF JERSEY CATTLE: A CASE REPORT

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Summary: Paratuberculosis was observed in a dairy herd at Livestock Training Institute (L.I.T.I) Tengeru, Arusha in November 1981 in 2 out of 5 clinically ill and debilitated cows among the original stock of Jersey cattle imported from New Zealand in 1976 as incaff heifers.

The disease was diagnosed from the clinical history and findings, acid fast stained smears of rectal pinches and faecal samples, postmortem and histopathological findings and later on supported by a johnin test of the herd.

Introduction

Paratuberculosis, synonymously known as Johne's disease, is a chronic specific infectious enteritis of cattle, sheep and goats that is caused by Mycobacterium paratuberculosis. The disease is also known to occur in waterbuffaloes, captive wild ruminants including deers, antelopes, llamas, yaks and pigs (Blood and Henderson, 1968). Paratuberculosis is characterized by progressive emaciation in all species affected, and in cattle by chronic diarrhoea and a thickening and corrugation of the wall of the intestine (Blood and Henderson, 1968).

Paratuberculosis is widespread in cattle in Europe and has been carried to many countries by the export of pure bred stock. It has been reported in New Zealand, United States, Canada, Iceland, Britain, Netherlands, Germany, Italy, Turkey, Israel, Yugoslavia, Russia, Pakistan, India and Japan (Animal Health Yearbook FAO-WHO-OIE-Italy, 1970).

In Tanzania several incidences of paratuberculosis have been reported in a number of government established livestock farms. Such farms included: Mbimba and Mitalula in Mbeya Region; Seatondale in Iringa Region; Chambesi in Coast Region; Tanga in Tanga Region; Ngarenairobi in Kilimanjaro Region; Tengeru in Arusha Region; Mpwapwa in Dodoma Region; and several others (Tanganyika Veterinary Quarantine Notice on Johne's Disease, 6th November, 1963). Other farms included Marangu Farm and Lyamungu Coffee Research Station, Moshi (Veterinary Investigation Centre, Arusna unpublished reports 1960, 1965); Ubena Prison Farm Morogoro (Regional Veterinary Office, Morogoro unpublished report, 1968); Kitengele Ranch, Kagera Region (Tanzania, Ministry of Agriculture report, 1972) and Uyole Agricultural Centre, Mbeya (Regional Veterinary Office, Mbeya unpublished report, October 1971). The disease was successfully controlled or kept under insignificant levels in all the above mentioned farms after the imposition of strict quarantine measures, test and slaughter of positive reactors and improved hygiene to minimize environmental contamination.

This paper reports a case of paratuberculosis in Arusha, Tanzania, and discusses its possible source of infection.

Materials and Methods

Clinical examination of 5 sick cattle with a clinical history of progressive emaciation, intermittent or profuse diarrhoea and good appetite. The 5 sick cattle appeared debilitated, bright and afebrile, and 2 of them had a marked profuse diarrhoea. From the sick cattle the following specimens were collected: Blood and lymph node smears fixed in methanol for one minute and stained with giemsa stain; faecal samples were examined for internal parasites by the floatation and sedimentation techniques (Coles, 1974), rectal pinch and faecal sample smears were heat-fixed and stained by the acid fast technique (Coles, 1974). Post mortem examination on 2 of the 5 cows was performed. One of the two cows had died on her own while the other was
sacrificed after showing terminal weakness. Sections from lung, heart, liver, spleen, kidney, ileum, ileocaecal valve, colon, caecum and mesenteric lymph nodes were fixed in 10% buffered formalin, embedded in paraffin wax and sectioned at 6 microns thickness. One set of sections was stained with haematoxylin and eosin (H&E) and the other set by the acid fast technique. Pieces of lung, heart, liver, spleen, kidney, intestines and mesenteric lymph nodes were cultured in blood agar and Gasner agar media at 37°C for 48 hours. The resulting bacterial colonies were tested biochemically. A single intradermal johnin test using johnin PPD* was later on carried out on the herd of 291 cattle.

Results

No haemoparasites were observed in the blood and lymph node smears. Liverfluke eggs were found in the faecal samples by the sedimentation technique. Rectal pinch and faecal sample smears of the two cattle with profuse diarrhoea stained by the acid fast technique revealed acid fast bacilli in singles, pairs and clumps. Post mortem findings of both carcasses included: carcass emaciation, pale yellow mucous membranes and body fat; numerous *Thelaria* spp. under the third eyelid of both eyes; gelatenuous body fat atrophy; bronchopneumonic lesions of both apical and intermediate lung lobes; icteric liver with thickened bile ducts containing thick mucoid dark brown bile and liverflukes (*Fasciola gigantica*); few paramphistomum worms were found attached to the rumen mucosa; thickened intestinal wall with corrugated and oedematous mucosa, areas of mucosal congestion and petechiations, particularly the ileum, ileocaecal valve, colon and caecum; and swollen and oedematous mesenteric lymph nodes. Acid fast stained smears of ileocaecal valve scrapings revealed acid fast bacilli similar to those observed in the rectal pinch and

*faecal sample smears. *Escherichia coli* was isolated from lung, heart, liver, spleen, kidney, intestines and mesenteric lymph nodes. Histologically the acid fast stained sections of the ileum, ileocaecal valve, colon and caecum revealed marked diffuse infiltration of mononuclear cells, red blood cells, eosinophils and oedema of the lamina propria and clumps of acid fast bacilli in the mucosal epithelial cells. The H&E sections of lungs indicated a purulent bronchopneumonia and those of the liver a marked fibrosis of the portal triads with bile capillary proliferation and thickening of bile ducts supportive of chronic fascioliasis. Mesenteric lymph nodes showed a marked oedema. No significant microscopic changes were observed in the spleen and kidney H&E and acid fast stained sections. Out of 291 cattle tested by the single intradermal johnin test, 51 (17.5%) reacted positively to the test with skin fold thickness differences between the first and second readings of 4-20 mm.

Discussion

Sporadic cases of intermittent and profuse diarrhoea have been known to occur at L.I.T.I., Tengeru, among the original stock of cattle from New Zealand since 1977 (L.I.T.I., Tengeru, personal communication). Quite often these cases were associated with lush pastures and the possibility of chronic fascioliasis was also incriminated. The response to antibacterial, antidiarrhoeal and anthelmintic treatment appeared to be variable.

In 1977 and 1979, the farm was routinely screened for tuberculosis by the Single Intradermal Comparative Tuberculin Test using avian and mammalian tuberculins. Some few animals showed non-specific reactions, but failure to isolate *Mycobacterium paratuberculosis* in faecal samples and rectal pinches and the lack of facilities to do a johnin test and CFT limited confirmation of the disease. Probably some of the positive cases of the outbreak under discussion were incubating the

* purified protein derivate manufactured by C.D.I. Lelystad
disease or appeared as non-specific reactors of the 1977 and 1979 tuberculin testings.

It is generally believed that under natural conditions, the common route of infection is by ingestion of feed and water contaminated by faecal material of clinically infected animals (Gilmour, 1961), incubating animals and apparently healthy carriers. Calves may be infected during suckling from contaminated teats or from milk or clinically infected dams (Taylor et al., 1982). Congenital infection through the uterus has also been reported to be important (Lawrence, 1956; and Kopecky et al., 1967). There is some evidence that infected bulls shed the organisms in semen (Larsen et al., 1982). Young animals are known to be more susceptible with most infections occurring early in life and developing to the clinical disease after 2 years of age or more (Blood and Henderson, 1968). Paratuberculosis is known to have a long incubation period and to take a chronic course (Blood and Henderson, 1968). Considering the epizootiological information available and the nature of the previous paratuberculosis outbreaks in Tanzania which have been associated with animal importations, it is probable that the animals were infected early in life at their point of origin. Nevertheless, as the exact details of the effect of exposure to infection in adults are not available, it could be possible that the animals were exposed for the first time as adults from an old silent disease at the institute that was controlled for sometime to develop the disease, while others only developed a sensitivity for short periods as indicated by the 1977 and 1979 tuberculin screenings. Such animals could as well become carriers of the disease without manifesting clinical signs and the stress of parturition, transport and nutritional deficiencies or excesses could influence the development of clinical signs (Chandler, 1961) which could also have been the case with the outbreak under discussion.

This paper is published with the permission of the Director of Veterinary Services, Ministry of Livestock Development, Dar-es-Salaam, Tanzania.

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NOCARDIOSIS IN A FRIESIAN COW

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Summary: A case of generalized nocardiosis due to *Nocardia asteroides* in a friesian cow is presented. It began as an acute nocardial mastitis. The subsequent pulmonary involvement resulted in chronic pneumonia and emaciation which necessitated culling the animal when it failed to respond to antibiotic treatment. The importance of early diagnosis of the infection in herds in tropical countries is stressed because suitable drugs for immediate treatment are not often available.

Introduction

*Nocardia asteroides* disease in a dairy cow is usually of considerable economic importance (Pier et al. 1961 (2) & (3)) because management and control measures are not often successful when its diagnosis and specific treatment are late in the course of infection (Blood and Henderson 1977, Soltys (1963)). An occurrence of nocardiosis due to *Nocardia asteroides* in a milking cow is presented. It began as an acute mastitis and progressed to chronic mastitis and pneumonia. This kind of bovine nocardiosis is seldom reported.

History

An eight year old cow in a herd of 32 British Friesian cattle at Butura cattle Ranch in Plateau State, had an acute mastitis of the udder four months after calving the animal had a temperature of 40°C and was anorexic. The affected quarter was treated with terramycin intramammary ointment and combiotics was given parenterally. The udder lesion subsided a bit and the system effect became intermittent. However the animal rapidly lost weight and started coughing. The cow was not sensitive to avian and mammalian tuberculin testing and did not respond to further antibiotic treatment with combiotics and terramycin. The progressive emaciation and coughing necessitated the culling of the cow by slaughter two months after the onset of the disease.

Gross Pathology

The lesions found were in the lungs and udder mainly and on the heart. The lung lesions consisted of masses of nodules of variable sizes which on incision contained cheesy material or frank pus in some nodules. The Mammary gland showed in its substance scattered granulomatous lesions and fibrosis. There were punctate necrotic foci both on the epicardium and endocardium.

Bacteriology

The bacteriological examination of the udder and lungs yielded pure culture of *Nocardia asteroides* which was pathogenic to two inoculated guinea pigs on experimental pathogenicity test.

Discussion

The drastic deterioration in the general condition of the cow was due to the ineffectiveness of the drugs administered against nocardial mastitis and to the pulmonary involvement via metastatic spread from the affected quarters (Pier et al. 1961). Therefore early drug sensitivity is indicated in some cases of mastitis to effect cure and prevent serious sequelae which can lead to
substantial loss. The choice drugs in this condition is sulphadiazine alone or in combination with sulphamethazine (Soltys 1963).

Exotic dairy cows in Nigeria are culled on account of their poor productivity. *Nocardia asteroides* infection has been identified as one of the underlying causes for culling, as the latter factors in many cases are rarely ascertained before the animals are removed.

**Acknowledgement**

We thank Dr. A.G. Lamorde, the Director of National Veterinary Research Institute, Vom for the permission to publish the case report.

**REFERENCES**


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DISPHARYNX NASUTA IN DOMESTIC FOWL: (GALLUS GALLUS DOMESTICUS): A CASE REPORT FROM ARUSHA, TANZANIA

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Summary: Two indigenous domestic free range fowl carcasses from two different areas in Arusha town were brought to the Veterinary Investigation Centre (V.I.C.) Arusha for laboratory examination. A large number of Dispharynx nasuta was found in the proventriculus of both fowls. In one of the fowls other helminths which included Tetramerex americana from the proventricular wall, Ascaridia galli and Rallietina (Rallietina) tetragona from the intestinal lumen were also found.

Introduction

The spiral stomach worm D. nasuta synonymously known as Acuaria (Dispharynx) spiralis and Dispharagus spiralis occurs in the glandular stomach of its host among galliform, passeriform and columbiform birds. The occurrence of the parasite is world wide but its importance in Tanzania in poultry production and in wild birds has never taken a keen interest.

This paper deals with two cases of D. nasuta in domestic fowl from Arusha, Tanzania.

Materials and Methods

Post mortem examination of the 2 carcasses was done by the conventional methods. The worms were helminthologically examined in lactophenol preparations at the V.I.C. Arusha and another set of the parasites sent to the Commonwealth Institute of Parasitology for identification.

Results

The significant post mortem findings of one of the carcasses included carcass emaciation, gelatnous body fat atrophy; numerous Tetramerex spp. in proventricular wall; short rolled roundworms about 7-10mm in length in the proventricular lumen and others firmly attached to eroded and petechiated nodules of the proventricular mucosa; and numerous ascarids and tapeworms in the intestinal lumen. The other carcass had more marked pathological changes which included carcass emaciation and jaundice; pulmonary congestion and oedema; congested and flabby heart with bilateral ventricular dilatation; pale spleen and liver; petechiation and erosion of proventricular mucosa with short rolled roundworms similar to those seen in the first carcass; thickened and congested intestinal mucosa with pinpoint haemorrhages and few occasional erosions; ulceration of caecal tonsils; and congestion of kidneys.

Microscopic examination of lactophenol preparations of the short rolled roundworms revealed four wavy cuticular bands (cords) originating from the base of the lips and extending for a short distance posteriorly and then turning forward for a short distance. The cords did not anastomose. The nematodes were identified as Dispharynx nasuta whose anterior and posterior parts are shown in Fig. 1 and Fig. 2 respectively. The other worms were identified as Tetramerex americana, Ascaridia galli and tapeworms. The tapeworms and spiral stomach worms were identified by the Commonwealth Institute of Parasitology as Rallietina (Rallietina) tetragona and Synhimantus (Dispharynx) nasuta respectively.

Discussion

The nematode D. nasuta has an indirect life cycle involving weevils, beetles and grasshoppers as intermediate hosts. In an experimental infection conducted by Cram (1931a) the pill bug (Armadillium vulgare) and the sow bug (Porcellia scaber) served as intermediate hosts and
Fig. 1: *Dispharynx nasuta* anterior part

Fig. 2: *Dispharynx nasuta* posterior part
young baby white quail and pigeons (Columba livia domestica) as final hosts of the parasite.

The pathogenicity of *D. nasuta* is moderate to severe and assumes importance when the parasites appear in large numbers. In young birds, dispharynxiasis is fatal. Goble *et al.* (1954b) and Madsen (1952) considered *D. nasuta* as the most important parasite of the ruffed grouse. Bump (1935) expressed the importance of dispharynxiasis among the wild birds in New York and Allen (1952) concluded that this nematode was the chief cause of the grouse disease in north eastern and southern United States. Cram (1928) and Hwang *et al.* (1961) stated that this worm resulted in death of many pigeons in the United States. The nematode may therefore be regarded as a very successful parasite among the wild birds. In chickens, the effects of this parasite vary with the severity of the infection. In severe infections, deep ulcers in which the anterior extremities of the worms are embedded may be seen in the prove ntricus and therefore causing extensive destruction of the glands of this organ and cause severe losses.

Satisfactory treatment of the parasite is unknown though tetrachloroethylene or carbon tetrachloride may be useful. The best known prophylactic measure is to confine birds on bare ground and fight the intermediate hosts (Soulsby 1968).

Acknowledgement

The authors wish to thank Dr. A.G. Hunter of the Centre for Tropical Veterinary Medicine, University of Edinburgh, for sending the parasite specimens (spiral stomach worms and tape worms) to the Commonwealth Institute of Parasitology for identification and Drs. A. Jones and L.M. Gibbons for identification of the parasites.

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REFERENCES


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SUSCEPTIBILITY OF CELL CULTURES TO ISOLATION OF MALIGNANT CATARRHAL FEVER VIRUS FROM INFECTED ANIMAL TISSUES

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The positive diagnosis of the wildebeest derived type of bovine malignant catarrhal fever (MCF) involves virus isolation and identification in bovine calf thyroid (BTh) monolayers (Plowright, 1968). This cell culture system is not easy to propagate and as such BTh cells are not routinely available in all laboratories. Furthermore, the cytopathic effect (CPE) of MCF virus (MCFV) in BTh cells is not clear cut since very few, small syncytia develop and often detach and the cell sheet grows to cover the area where syncytia were initially. The purpose of this study was to test various readily available cell cultures for their ability to support the propagation of cell-associated MCF virus.

Bovine calf thyroids, kidney, lung and testis roller tube cultures were prepared as described by Plowright and Ferris, (1959, 1961). Bovine posterior vena cava (BPVC) cell cultures were prepared by dispersing the cells with a solution of 1% pronase. These cells were grown in Eagle’s minimum essential medium (MEM) supplemented with 10% calf serum. RK13 and Madin Darby bovine kidney (MDBK) cells were also grown in MEM supplemented with 10% calf serum.

The infectivity of a batch of MCFV infected rabbit spleen harvested on the second day of pyrexia after inoculation with the C500 strain of MCFV (Plowright et al., 1975) was determined after the roller tubes with respective cell types had been inoculated with a 10% spleen suspension. No specific cytopathic changes were observed in calf kidney, MDBK, embryonic calf lung or RK13 monolayers which were inoculated with MCFV infected rabbit spleen (Table 1). The same inoculum induced a titre of 10^3.6 TCID_{50}/ml when it was inoculated into secondary BTh cell cultures. In this case the CPE was detected as early as 4 days post inoculation (p.i.) and consisted of globose syncytia with a tendency to detach leaving a ragged hole in the cell sheet. Sometimes the hole was covered by an outgrowth of cells; so it was important to examine the monolayers regularly to avoid missing infected tubes. Most tubes had developed syncytia by day 12 p.i.

Bovine testis monolayers developed very clear CPE consisting of syncytia. Similarly, the BPVC monolayers produced syncytia. In these two cell types the CPE was similar to that induced in BTh cell cultures but appeared later than in Bth cells. Both Bth and Bt cell cultures were almost equally susceptible and since calf testis cell cultures are easier to grow than BTh cell cultures, BT

Table 1: Susceptibility of various cell cultures to MCFV infected rabbit tissues.

<table>
<thead>
<tr>
<th>Cell strain</th>
<th>virus titre (10^5 TCID_{50}/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf kidney</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>MDBR</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Embryonic calf lung</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>RK13</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Calf thyroid</td>
<td>3.6</td>
</tr>
<tr>
<td>Calf testis</td>
<td>3.3</td>
</tr>
<tr>
<td>Calf posterior vena cava (BPVC)</td>
<td>3.0</td>
</tr>
<tr>
<td>Rabbits</td>
<td>4.0</td>
</tr>
</tbody>
</table>
cell cultures should be used for MCF virus isolation from cattle and rabbits.

The titrations performed in rabbits and the examination of the rabbits for the development of MCF clinical signs yielded results which were comparable to the assays conducted in calf thyroid and testis monolayers (Table 1). Therefore, in laboratories without cell culture facilities a tentative diagnosis of bovine MCF can be obtained by inoculating suspected materials intravenously or intraperitoneally into rabbits.

In laboratories with cell culture facilities secondary BTH or BT monolayers should be inoculated with either buffy coat or cell suspensions from lymphoid organs such as lymph nodes and spleen and observed for the development of the above CPE. The virus can be identified either by fluorescent tests with MCF positive serum or by inoculating trypsin-versene dispersed infected cells into rabbits and observing the rabbits for the development of clinical signs of MCF. Virus identification in neutralisation tests are not feasible for MCFV is strictly cell-associated in its early passages.

Acknowledgements
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REFERENCES

Received for publication on 6th September, 1983.
ISOLATION AND DRUG SENSITIVITY OF BACTERIA FROM BOVINE MILK SAMPLES WITH CLINICAL MASTITIS AT ARUSHA VETERINARY INVESTIGATION CENTRE BETWEEN 1975 AND 1982

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Arusha, Tanzania

Summary: In an eight years period a total of 475 mastitis quarters were examined bacteriologically at the Veterinary Investigation Centre (V.I.C.) Arusha. A total of 482 bacterial isolates were recovered from the milk samples. The isolates included Staphylococci (36.5%), Coliforms (26.1%), Streptococci (18.7%), Diplococci (7.1%), Corynebacteria (3.5%), Pasteurella (2.7%) and other micro-organisms (5.8%). Bacterial sensitivity test of 186 bacterial isolates representing Staphylococci, Coliforms, Streptococci, Diplococci, Corynebacteria and Pasteurella to penicillin G, chloramphenicol, colistin, nitrofurantoin, sulphafurazole, kanamycin, ampicillin, tetracycline, streptomycin, sulphanethoxazole/trimethoprim, carbencillin and cephaloridine showed multiple resistance of most bacteria to sulphafurazole, tetracyclines, penicillin G and streptomycin but high sensitivity to carbencillin and cephaloridine. Coliforms appeared to be the most resistant bacteria while Pasteurella appeared to be very sensitive bacteria to the drugs tested.

Introduction

A number of bacteria have been associated with cases of bovine mastitis all over the world. Salajaka (1968) isolated 44 strains of gram negative rods from cows with peracute and acute mastitis. Out of these strains 41 were found to have a common O antigen which was related to Escherichia coli antigen O 19 while 3 strains were related to Aerobacter aerogenes. Similarly Ramise et al. (1982) in France found out of 330 mastitis quarters of cattle studied, incidences of Staphylococcus aureus to be 8.2%, E. coli 13.7%, Strep. uberis 10.4%, Strep. agalactiae 7.6% and yeasts 11.7%. In Tanzania a study carried out by Mahlau in 1974 on mastitis outbreaks in dairy farms of Iringa and Mbeya regions of Tanzania showed Staph. aureus and Strep. spp. to account for 54.5% of the outbreaks, Diplococci and Diplo-streptococci 40% and E. coli 5.5% (Mahlau, 1974 Unpublished report).

This paper reports the isolation and drug sensitivity of bacteria recovered from milk samples of dairy cattle with clinical mastitis at the V.I.C. Arusha between 1975 and 1982.

Materials and Methods

About 5-10 mls of quarterly milk samples from cows with suspected clinical mastitis aseptically collected into sterile McCartney bottles were submitted to the V.I.C. Arusha as fresh as possible for bacteriological examination. In the laboratory, the milk was inoculated onto blood agar and McConkey agar plates and incubated at 37°C for 18-24 hours. Individual colonies were subcultured onto the same media and identified using the methods by Cowan and Steel (1965).

Bacterial sensitivity test was carried out on 186 bacterial isolates representing Staphylococci (65), Coliforms (60), Streptococci (35), Diplococci (17), Corynebacteria (6) and Pasteurella (3) by streaking each organism tested densely and uniformly on duplicate blood agar plates. Oxoid multodisks+ containing chloramphenicol (50 µg), colistin (200 µg), nitrofurantoin (200 µg), sulphafurazole (500 µg), kanamycin (30 µg), ampicillin (25 µg), streptomycin (25 µg) and tetracycline (50 µg) were applied on one plate of the pair and Oxoid multodisks++ containing gentamycin (10 µg), cephaloridine (25 µg), colistin sulphate (10 µg), sulphafurazole (500 µg), ampicillin (25 µg),

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+The 'Multodisk' for determining bacterial sensitivity to antibiotics and sulphonamides, Oxoid, England Code 30 – 44K.
<table>
<thead>
<tr>
<th>Year</th>
<th>Total bacterial isolates tested</th>
<th>P</th>
<th>C</th>
<th>CS</th>
<th>F</th>
<th>SF</th>
<th>K</th>
<th>PN</th>
<th>TE</th>
<th>S</th>
<th>SXT</th>
<th>PY</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>Staphylococci</td>
<td>65</td>
<td>48/17</td>
<td>57/8</td>
<td>37/28</td>
<td>36/29</td>
<td>25/40</td>
<td>52/13</td>
<td>37/28</td>
<td>31/34</td>
<td>40/25</td>
<td>63/2</td>
<td>65/0</td>
</tr>
<tr>
<td></td>
<td>Coliforms</td>
<td>60</td>
<td>39/21</td>
<td>49/11</td>
<td>34/26</td>
<td>27/33</td>
<td>21/39</td>
<td>48/12</td>
<td>25/35</td>
<td>28/32</td>
<td>33/27</td>
<td>57/3</td>
<td>58/2</td>
</tr>
<tr>
<td></td>
<td>Streptococci</td>
<td>35</td>
<td>19/16</td>
<td>33/24</td>
<td>24/11</td>
<td>20/15</td>
<td>14/21</td>
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<td>13/22</td>
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<td></td>
<td>Diplococci</td>
<td>17</td>
<td>14/3</td>
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<td>11/6</td>
<td>8/9</td>
<td>7/10</td>
<td>13/5</td>
<td>16/1</td>
</tr>
</tbody>
</table>

KEY: P = Penicillin; SF = Sulphafurazole; S = Streptomycin; CR = Cephaloridine; C = Chloramphenicol; K = Kanamycin; SXT = Sulphamethoxazole/Trimethoprim; CS = Colistin; PN = Ampicillin; F = Nitrofurantoin; TE = Tetracycline; PY = Carbenicillin; Numerator = drug sensitive isolates; Denominator = drug resistant isolates.

carbenicillin (100 ug), sulphamethoxazole/trimethoprim (25 µg) and tetracycline (50 µg) on the other plate of the pair. The plates were incubated at 37°C for 18–24 hours and the diameter of the zone of inhibition was measured. The Oxoid guide was used to determine whether an organism was sensitive or resistant to the respective drugs.

Results

A total of 482 bacterial isolates were recovered from the 475 bovine milk samples. The findings revealed a high incidence of Staphylococcal isolates (176) followed by coliforms (126), Streptococci (90), Diplococci (34) and least were Providentia (1), Proteus (1) and Micrococcus (1). A summary of the findings is shown in Table 1.

Bacterial sensitivity test of the 186 bacterial isolated exhibited multiple resistance to most of the antibacterial agents tested. Most bacteria were resistant to sulphafurazole, tetracycline, ampicillin, streptomycin and penicillin. G. Coliforms showed multiple resistance to all the antibacterial agents tested followed by Staphylococci which were resistant to all antibiotics tested with the exception of carbenicillin. Pasteurella spp. were found to be sensitive to
all antibiotics tested but resistant to only penicillin G. Except for 2 isolates of Coliforms, all the bacterial isolates tested were sensitive to carbenicillin while 3 isolates of Coliforms and one of Staphylococci were resistant to cephaloridine. The bacterial sensitivity results are summarized in Table 2.

Discussion

The observations made from Table 1 have suggested that cocci and coliforms were the most prevalent microorganisms isolated in the cases of mastitis examined. While coliform mastitis is rare in cattle, bacteriological surveys of mastitis in cattle often have shown surprisingly high incidence of this group of organisms in non-clinical situations (Murphy and Hanson 1943). Anderson et al. (1983) examined 119 isolates and found that 49% were gram positive organisms and 12% were yeasts. The gram positive organisms isolated included Staph. aureus (11%), Staph. epidermidis (14%), Strep. agalactiae (1%) and other Streptococcus spp. (9%). Coliform organisms accounted for 35% of the total isolates and were the single most important cause of acute mastitis. Of the 42 cows with coliform mastitis 6 died despite intensive antibiotic, fluid and electrolyte therapy. None of the cows with mastitis caused by gram positive organisms died. The high incidence of coliforms from the isolations observed at the V.I.C. Arusha might have been associated with poor hygiene and milking technique and teat injuries causing wounds and cracks facilitating infection. Bramley et al. (1982) suggested that penetration of the teat duct by E. coli occurred in the period before contamination and milking.

The multiple resistance acquired by the majority of the microorganisms isolated to sulphafurazole, tetracycline, ampicillin, streptomycin and penicillin G was probably due to the indiscriminate and frequent use of these drugs in the field at low levels encouraging the development of resistant strains of bacteria. Carbenicillin, cephaloridine and sulphanmethoxazole/trimethoprim appear to have been the drugs of choice probably because of their almost unknown field use in the treatment of mastitis and other bacterial diseases in Tanzania. Chloramphenicol also appears to have been effective due to its relatively infrequent use in the field for animal treatment. Coliforms have been observed to be the most resistant bacteria probably due to their efficient ability to develop resistance through the episomal resistance transfer factor (RTF) carrying genes for resistance to several drugs (Watanabe 1963). The observation made on drug sensitivity by Pasteurella spp. was made on 3 isolates only and it is therefore difficult to make any realistic conclusions. As regards Staphylococci and Streptococci, Simetskii (1982) studied changes in sensitivity of these micro-organisms from cows with mastitis in certain collective farms for a 9 year period (1967-76). His findings suggested that the sensitivity did not change very rapidly even with prolonged use of antibiotics. However, the results of treatment in the majority of mastitis cases in Tanzania have often been disappointing and often induration of quarters or total loss of udder function have occurred. It is suggested therefore that more studies on the epizootiology of mastitis in Tanzania are essential.

Acknowledgement

This paper is published with the permission of the Director General, Tanzania Livestock Research Organization, Dar-es-Salaam, Tanzania.

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AETIOLOGY OF BOVINE MASTITIS IN TANZANIA

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Summary: Field studies on aetiological causes of mastitis were conducted among improved grades of dairy cattle in the rural areas of Northern Tanzania. Over 80% of the infections were caused by Staphylococcus aureus, Streptococcus agalactiae, Streptococcus dysgalactiae, Streptococcus uberis and coliforms. Rare pathogens like Streptococcus pyogenes and Corynebacterium pyogenes were encountered less frequently. C cocci and bacilli organisms accounted for 74% and 26% of the mastitis incidences respectively. The prevalence of coliform mastitis was 15% and Staphylococcus aureus 19%. The significance of the isolates was discussed in relation to the epizootiology of mastitis and underlined why a single technique could not provide effective control for all the pathogens.

Introduction

Mastitis exists in many dairy cows raised in the rural areas of Northern Tanzania (Anon, 1976). Apparently, the magnitude varies with intensification of the dairy units; the majority of which have 1-3 cows in a shelter of approximate area of 4m², either loose or tethered and usually zero-grazed.

The majority of the shelters are made of fenced posts. The floors became boggy with the animal faeces and rains since they are not made up of concrete. Roofs are thatched either with dry banana leaves or corrugated iron sheets. Bedding is inadequate and comprises of materials such as dry banana leaves, poor quality straw and saw dust. The whole unit hardly protects the animals from inclement climatic factors. As a result, mastitis is the most underestimated single disease affecting dairy cows in the area and elsewhere (Dobbins, 1977). Due to its insidious and unspectacular nature many farmers fail to understand its full importance.

The purpose of the study was to isolate and characterize the bacteria involved in clinical mastitis.

Materials and Methods

Specimens were collected from quarter milk samples into sterile MacCartney bottles from cows with clinical mastitis and sent to the diagnostic laboratory.

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Table 1: Relative frequency of Bacterial species isolated from 194 bovine cases of clinical mastitis.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Number isolated</th>
<th>% Relative frequency</th>
<th>% Cocci</th>
<th>% Bacilli</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>18</td>
<td>18.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus epidermidis</em></td>
<td>11</td>
<td>11.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Streptococcus agalactiae</em></td>
<td>7</td>
<td>7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Streptococcus dysgalactiae</em></td>
<td>16</td>
<td>16.7</td>
<td>74</td>
<td>NA</td>
</tr>
<tr>
<td><em>Streptococcus pyogenes</em></td>
<td>8</td>
<td>8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Streptococcus uberis</em></td>
<td>2</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterococci spp.</td>
<td>9</td>
<td>9.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>8</td>
<td>8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Klebsiella pneumonia</em></td>
<td>2</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Enterobacter aerogenes</em></td>
<td>2</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Corynebacterium pyogenes</em></td>
<td>8</td>
<td>8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>1</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Proteus mirabilis</em></td>
<td>2</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bacillus cereus</em></td>
<td>2</td>
<td>2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Samples yielding bacteria</strong></td>
<td>47</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Samples yielding no bacteria</strong></td>
<td>119</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Samples unfit</strong></td>
<td>28</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>194</td>
<td>96</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

NA - not applicable.

isolates recovered. This comprises cocci and bacilli in the ratio of 70% and 30% respectively; which is consistent with the work of Bar-Moshe (1964) and Eberhart (1977). A total of 119 (62%) samples had no demonstrable bacterial growth. Majority originated from animals which had been repeatedly subjected to treatment. Hence the milk samples had antibiotics which inhibited bacterial growth on the laboratory culture media. Twenty eight (14%) samples were unfit owing to presence of cow dung particles.

The percent relative frequency of *Staphylococci* spps. was 30. Whereas *Staphylococcus aureus* was isolated from 19% of the mastitis, *S. epidermidis* had a frequency of 12%. The observed figure for *S. aureus* was comparable to that reported elsewhere (McDonald, 1977). *S. aureus* was isolated invariably from mammary glands having lesions ranging from pustules, cuts and exudative dermatitis. It has been shown to cause most of these lesions (Davidson, 1963, Schalm, 1971 and Dodd and Jackson, 1971). The primary aetiological agents for teat cuts were barbed wires, tick bites and strong solutions used to wash the udder and teats. These provided avenues for the opportunistic *S. aureus* residing on the udders and teats to invade the injured sites and cause dermatitis and mastitis secondarily (Sharpe et al, 1962). Blair and Williams (1961) confirmed the identity of *S. aureus* isolated from milk and corresponding teat and udder lesions.

Hence the lesions were the potential source of the increased *S. aureus* mastitis. Majority had been difficult to treat successfully probably due to neglecting the lesions. *S. epidermidis* occurred less frequently and was associated with low grade mastitis as reported also by Carter (1982).

The observed incidence of *Streptococci* mastitis was 44%. *Streptococcus agalactiae*, a highly contagious obligate parasite maintained only in the udder, had an incidence of 7%. It was encountered frequently in chronic mastitis either alone or mixed with other bacteria. Other Streptococci isolated were *Strept. dysgalactiae*, *Strept. pyogenes* and *Strept. uberis*; each with a relative frequency of 17%, 8% and 2% respectively.
Like Staphylococci, these reside in the cow’s environment and caused mastitis where hygiene was poor. *Strept. pyogenes* has been occasionally reported to cause mastitis (Carter, 1982). The high incidence reported here was probably a reflection of spread from milkers with common cold to the udders. It coincided with the cold-rainy months of March – July which is also the season for common cold in humans.

Enterococci organisms in the mastitis accounted for 9.5% of the isolates. They were isolated mainly from inflamed udders persistently baked with dung. Mastitis caused by these organisms has not been reported in Tanzania although severe cases have been cited elsewhere (Cullen and Hebert, 1967; McDonald, 1977). The slow growth rate into tiny colonies and frequent coexistence with other robust growing pathogens in mastitis could result in their being overlooked in many ordinary laboratory culture media.

Gram negative bacteria accounted for 26% of the isolates with coliforms dominating. Our results support Eberhart (1977) that incidences of coliform mastitis are less common than those caused by gram positive cocci. Furthermore, data derived from clinical mastitis gives a more realistic assessment of their importance than data from herd surveys. Therefore, it could be concluded that the incidence of coliform mastitis in the study area was 15%.

The percent relative frequency of *Escherichia coli*, *Klebsiella pneumonia* and *Enterobacter aerogenes* were 8.5%, 2% and 2% respectively. This is similar to the findings of McDonald et al. (1970). And Jasper et al., (1975). Although Neave et al., (1970) observed the organisms in the reverse ratio, Eberhart (1970) observed the organisms in the reverse ratio, Eberhart (1977) attributed the differences to the climatic and farm management practices. The data showed that *E. coli* is the main pathogen in the study area which caused majority of the coliform mastitis. The remaining cases were caused by *K1. pneumonia* and *Ent. aerogenes*.

The rare pathogens isolated were *Corynebacterium pyogenes* 8.5%, *Pseudomonas aureginosa* 1%, *Proteus mirabilis* 2% and *Bacillus cereus* 2%. Majority were isolated from mastitis refractory to treatment. The observed high incidence of *C. pyogenes* might imply that in poorly managed mastitis, the udders are vulnerable to invasion by the pathogen.

The open herd system and poor housing were the main factors which favoured prevalence of the mastitis pathogens. Most dairy herds were expanded by introduction of stock from outside the farms. This practice has been found to favour introduction of different bacterial flora also (Newbould, 1965; Neave et al., 1969). The animal shelters were poorly planned and managed. Manure was irregularly and incompletely removed from the pens. Hence the floors were good breeding sites for the bacteria. The weight of the teat exposure to such an environment and the trauma caused to the teats by the poor quality beddings contributed significantly to the incidence of mastitis especially coliform type (McEwen & Cooper, 1947; Murphy, 1959). Since the majority of the pathogens get on teats by direct contact with the dung, constant removal and proper disposal of manure, provision of adequate quality bedding and construction of suitable shelters would greatly reduce the incidence of mastitis.

Acknowledgements

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NOTES ON SALMONELLAES ISOLATED FROM POULTRY IN ACCRA, GHANA

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Summary: Nine different Serotypes of Salmonellae indentified from forty two strains of Salmonellae recently isolated from Poultry at Postmortem examination in Accra, Ghana. Two serotypes S. Birkhenhead and S. Wippra are being reported for the first time in Ghana. S. Bredeney and S. Infantis which had previously been isolated from man and the former also from cattle are being reported for the first time in Poultry. The Antibiotic sensitivity and resistance patterns of the Isolates are discussed.

Introduction

There has been a considerable expansion of the poultry industry in Ghana in recent years. The relative decline in livestock production and the consequent high prices of beef and mutton have increased public demand for poultry products.

The presence of Salmonellae potentially Pathogenic to man and or poultry is of concern both to the producer and consumer and information on the serotypes and antibiotic sensitivity of these Salmonellae in poultry population is of importance. Avian Salmonellosis and its public health implications have attracted a great deal of attention for many years. Edwards (1939) reported that fowls were the greatest reservoir of paratyphoid infection. In U.S.A. Sanders et al. (1969) reported that in 1963 about 61% of all non-human isolates of Salmonella were obtained from chickens, turkeys and other wild and domestic fowls. In Ghana Voros et al. (1976) isolated 72 strains of Salmonella from animal sources out of which 47 were from poultry. The relative frequency of certain serotypes both from human and animal sources indicates a link between animal and human infections as Hughes (1958), Zwart (1962) and Collard et al. (1962) stated in Ghana nad Nigeria respectively. King and Gellaty (1955) reported the infection of newly hatched chicks at Pokuase (near Accra) from human carriers of Salmonella Paratyphi 'C'.

This paper records the recent isolation of Salmonellae from Poultry in Accra Ghana at post mortem examinations and their antibiotic sensitivity.

Materials and Methods

Specimens

Specimens were obtained from poultry at postmortem examinations. These were carcasses submitted to the Veterinary Laboratory in Accra by farmers in Greater Accra Region of Ghana for routine Laboratory investigations between July, 1981 and December, 1982. The intestines, liver with the gall bladder and in some cases, the ovary were separately and aseptically dissected. Isolation was attempted from each of these organs using the method described by Chu (1960). Samples were first put in an enrichment medium of Selenite broth (Oxoid cm 395) and incubated at 37°C for 48 hrs. Samples were subcultured on Selective medium MacConkey agar (Oxoid CM7) after 24 hrs, and 48 hrs, and incubated at 37°C for 24 hrs.

The cultures were screened by the rapid serum agglutination test using Salmonella Polyvalent —O— antiserum (Wellcome Ltd.). Motility was demonstrated in each case, after inoculating nutrient broth and incubating at 37°C for 4 hrs.

Differential media - Triple Sugar Iron agar (Oxoid CN 272) and Urea agar (Oxoid CM 53) were inoculated in
each case. Additional biochemical tests performed were Indole test, and fermentation tests for lactose, glucose, arabinose, maltose, sucrose and dulcitol. The isolates which appeared to be salmonella were subcultured on nutrient agar and sent to the Public Health reference Laboratory, Korle-Bu, Accra, for identification.

Antibiotic Sensitivity Test

This test was carried out on most of the isolates. The strains were grown in peptone water for 6 hrs and poured over the surface of dried Sensitest agar plates (Oxoid CM 409). Multidisks (OXOID) containing Chlorotetracycline 19 μg, Chloramphenicol 10 μg, Furazolidone 50 μg, Sulphafurazole 100 μg, Neomycin 10 μg, Streptomycin 10 μg and Oxytetracycline 10 μg respectively were placed on the surfaces of the plates. The plates were left at room temperature for 1 hour then incubated overnight at 37°C.

Results

The Salmonella serotypes isolated and their antigenic types are shown in table 1. The results of the antibiotic sensitivity test on the isolates are shown in table 2. All the isolates tested were sensitive to furazolidone and all but one were sensitive to Chloramphenicol. Approximately 50% of the isolates tested were resistant to oxytetracycline, Chlorotetracycline and Streptomycin, but 23 out of 27 were sensitive to Neomycin.

<table>
<thead>
<tr>
<th>Serotype</th>
<th>Antigenic Formula</th>
<th>Number Isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. S. Anatum</td>
<td>3, 10: ch: 1, 6</td>
<td>1</td>
</tr>
<tr>
<td>2. S. Brikenhead*</td>
<td>6, 7: c: 1, 6</td>
<td>1</td>
</tr>
<tr>
<td>3. S. Bredeney o</td>
<td>1, 4, 12, 27: LV: 1, 7</td>
<td>5</td>
</tr>
<tr>
<td>4. S. Infantis o</td>
<td>6, 7: r: 1, 5</td>
<td>3</td>
</tr>
<tr>
<td>5. S. Labadi</td>
<td>8, 20: d: Z6</td>
<td>1</td>
</tr>
<tr>
<td>6. S. Sekondi</td>
<td>3, 10: ch: Z6</td>
<td>19</td>
</tr>
<tr>
<td>7. S. Typhymurium</td>
<td>4, 5, 12: i: 1, 2</td>
<td>27</td>
</tr>
<tr>
<td>S. Typhymurium Var zCopenhagen</td>
<td>4, 12: i: 1, 2</td>
<td>9</td>
</tr>
<tr>
<td>8. S. Poona</td>
<td>13, 12: Z: 1, 6</td>
<td>1</td>
</tr>
<tr>
<td>9. S. Wippra*</td>
<td>6, 8: Z 10: Z6</td>
<td>1</td>
</tr>
</tbody>
</table>

Total number of Poultry Carcasses examined = 2,240
Total number of Serotypes isolated = 9
Total number of Strains isolated = 49

* — Salmonella being reported for the first time in the country.

o — Salmonellae being reported for the first time in Poultry in Ghana.
Discussion

Two new serotypes *S. Birkenhead* and *S. Wippra* are hereby reported for the first time in Ghana. *S. bredaney* and *S. infantis* infections have been reported in Man, Hughes (1954) and the former also in cattle, Zwart (1962). *S. Labadi* was first isolated from a woman with diarrhoea and vomiting in Ghana. Assoku and Corkish (1975) reported the infection of *S. Labadi* in poultry, and it appears to be very important in poultry Salmonellosis.

The most common serotypes were *S. typhymurium* (27 strains) including 8 strains of *S. typhymurium Var Copenhagen*, *S. bredaney* (5 strains) and *S. labadi* (3 strains). The incidence of *S. typhymurium* infection in poultry is slightly higher than previous reports by Assoku and Corkish (1975). *S. typhymurium* is one of the most common serotypes isolated from man in Ghana. Voros et al. (1976).

In Ghana, poultry meat unlike that of livestock is not inspected as to its fitness for eating. We cannot therefore overlook poultry as an important source of Salmonella to humans.

The antibiotic sensitivity test revealed that, all the Salmonella isolates tested were sensitive to furazolidone and all but one strain of *Salmonella typhymurium* were sensitive to chloramphenicol — a drug of choice in the treatment of enteric fevers in humans.

Assoku and Corkish 1975 found around 50% of their Salmonella isolates to be resistant to Chloramphenicol and re- emphasised the public health hazard of antibiotic resistance in Salmonella isolates from domestic animals in Ghana. The apparent discrepancy in the two results could be due to the fact that, a chloramphenicol preparation which was so extensively used by poultry farmers in Ghana some years ago, often indiscriminately, has not been available for about five years now.
Most of the isolates were however resistant to tetracyclines, sulphafurazole and streptomycin. But 23 out of the 27 isolates tested were sensitive to Neomycin. It is proposed that, in Ghana Furazolidone should be the drug of choice in the treatment of poultry salmonellosis with the chloramphenicol being used only as a last resort.

Acknowledgement

I am indebted to Mr. Daniel Boadu, Technical Officer, Veterinary Investigation Laboratory, Accra, and Miss Amenuvor, Public Health reference Laboratory, Korle-bu, Accra for their excellent technical assistance. I am thankful to my senior colleague Dr. W. Amanfu for his encouragement. I am grateful to Dr. C. Bentsi, Public Health reference Laboratory Korle-bu, Accra, for identifying the isolates. I am also grateful to Dr. K.O. Gyening, (Director of Veterinary Services Ghana) for the permission to publish the results.

REFERENCES


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EFFECT OF SUPPLEMENTATION ON PERFORMANCE OF BLACK HEAD PERSIAN AND RED MASAI LAMBS

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Summary: A study was undertaken to investigate the effect of supplementation on the performance of Blackhead Persian (BHP) and Red Masai (RM) lambs. Lambs were subjected to three treatments: grazing only (S₀), grazing with 100g/day concentrate (S₁) and grazing with 500g/day concentrate (S₂).

Mean differences in growth rate, dressing percentage and body condition score in favour of BHP were 26.0 ± 4.5g/day, 2.8 ± 0.6% and 0.7 ± 0.2 units, respectively. BHP had significantly higher proportion of fat (25.7 vs 16.4%) and lower proportion of lean (55.1 vs 61.1%) and bone (18.7 vs 22.5%) than RM.

Growth rate and dressing were 38, 63 and 108g/day and 40.0, 42.6 and 49.8% for treatments S₀, S₁ and S₂, respectively. Body condition score was highest for treatments S₂ (3.9) followed by S₁ (2.8) and S₀ (1.7). The carcass composition was 61.5, 62.2 and 51.4% lean; 14.1, 17.4 and 31.6% fat; 24.4, 20.3 and 17.0% bone for treatment S₀, S₁ and S₂, respectively. Breed and level of supplementation interaction was found in body condition score, dressing out percentage and absolute weight of carcass fat.

Introduction

There is a great need to increase meat output from livestock in many developing countries because of low consumption of protein of animal origin. McDowell and Bove (1977) reported that in much of the developed nations, the consumption of animal protein is normally above 54kg/person/day whereas it is below 14g/person/day in most of the developing countries. The recommended animal protein intake is about 21g/person/day (Mason, 1976). To alleviate this shortage, there is a need to increase overall meat output from livestock through environmental manipulations.

There are about 3.6 million sheep in Tanzania which produce about 12,000 tonnes of meat annually, ranking third after cattle and goats (FAO, 1979). The majority of sheep flocks are kept by peasants and are normally reared under poor extensive management systems resulting into low meat output. Although type of animal and low plane of nutrition in such a system may be the main causes of the low meat output from these animals, very few studies have been undertaken in Tanzania to show the effect of such factors.

The present study was therefore carried out to provide information on the effect of breed and supplementation on growth rate and carcass composition of lambs of local breeds commonly found in Tanzania.

Materials and Methods

Animals and Treatments

A 2 x 3 factorial experiment was undertaken at the University Farm using 15 Black Head Persian (BHP) and 15 Red Masai (RM) entire male lambs. The mean initial liveweight for the BHP lambs ranged from 13.5 to 16.0 kg (mean = 14.0kg) and 9.5 to 14.0 kg (mean = 11.2 kg) for RM lambs. Birth dates of these lambs were not known but were approximately sixteen weeks of age as estimated from dentition. Lambs were allocated at random to three treatments; grazing only (S₀); grazing plus 100g/day concentrate (S₁); and grazing plus 500g/day concentrate (S₂): The concentrate consisted of cotton seed cake and maize bran in the ratio of 1:2 for animals on treatment S₁ and 1:14 for those on treatment S₂.

A mineral supplement was also given to animals in all groups and consis-
tated of calcium (18.61%), phosphorus (3.50%), sodium (13.00%). Chlorine (20.00%), copper (0.12%), cobalt (0.03%), iodine (0.01%), iron (0.31%), magnesium (0.44%) and sulphur (0.18%).

The lambs were penned in 150 x 90 cm wooden hurdles and fed individually except during the grazing time which was from 07.30 to 15.30. The pasture grazed consisted of several species of grasses but the most dominant ones were Giant panicum (Panicum maximum), Rhodes grass (Chloris gayana) and Guetamala grass (Tripsicum laxum). No attempt was made to estimate pasture intake. Samples of pastures were collected weekly during the months of November, December, January, February and March for chemical analysis. Unsupplemented lambs were housed in a group during the non-grazing period. Water was available all the time when the animals were not grazing. Daily intake of supplementary feed was recorded. Rhodes grass hay was also given ad libitum to all lambs in the pens and the amount consumed was recorded. Liveweight was recorded at weekly intervals. All animals were dewormed using Panicur (Fenbendazole, Hoechst) 14 days before commencing the experiment.

**Slaughter analysis**

At the end of the feeding period, which lasted 150 days, body condition of the animals were assessed using the procedure outlined by Allen and Kilkenny (1980) for cattle. The body condition score ranged from 1.0 to 5.0 (extremely fat). Animals were then fasted on the night before slaughter. Hot carcass was weighed after removal of the kidney and pelvic fat but included the tail. One half of the carcass was dissected into lean, fat and bone. The dissected components were mixed, minced and samples were taken for chemical analysis.

**Analysis of data**

Factorial analyses of variance were carried out for most parameters studied, (Steel and Torrie 1960). Least significant differences were computed to compare treatment means.

**Results**

**Chemical composition of diets**

The chemical composition of the pasture consumed by the animals during the grazing period is shown in Table 1. Crude protein increased while crude fibre decreased from November to March. November was the driest while March was wettest month of the year. Table 2 shows the chemical composition of the maize bran, cotton seed cake and Rhodes grass hay used in this study.

**Growth rates**

BHP was significantly ($P < 0.001$) superior to RM in daily liveweight gain with mean difference of $26 \pm 5$g/day, (Table 3). Table 3 also shows that lambs on S2 and S1 significantly ($P < 0.05$) gained $70 \pm 5$ and $25 \pm 5$g/day more than lambs on S0. The difference in liveweight gain of $45 \pm 5$g/day between S2 and S1 was also significant ($P < 0.05$). Interaction between breed and supplementation was not significant ($P < 0.05$).

**Body condition score and dressing percentage**

Body condition score is an indicator of the extent of subcutaneous fat accumulation around the loin and is, therefore a measure of the degree of finish of the carcass. BHP had a high body condition score than RM irrespective of level of supplementation (Table 3). Body condition scores also tended to increase with increasing level of supplementation. There was, however,
### Table 1: Composition of the pasture grazed\(^+\) (%)

<table>
<thead>
<tr>
<th></th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (\text{+}^+)</td>
<td>95.4 ± 0.7</td>
<td>94.7 ± 0.3</td>
<td>94.6 ± 0.2</td>
<td>93.0 ± 0.3</td>
<td>92.4 ± 0.6</td>
</tr>
<tr>
<td>Crude protein</td>
<td>6.12 ± 0.3</td>
<td>6.4 ± 0.1</td>
<td>8.9 ± 0.8</td>
<td>10.8 ± 0.4</td>
<td>11.9 ± 0.2</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>3.13 ± 0.7</td>
<td>3.01 ± 0.6</td>
<td>30.9 ± 0.5</td>
<td>80.2 ± 0.6</td>
<td>25.8 ± 0.5</td>
</tr>
<tr>
<td>Ether extract</td>
<td>2.4 ± 0.1</td>
<td>2.2 ± 0.2</td>
<td>2.1 ± 0.2</td>
<td>1.9 ± 0.1</td>
<td>2.1 ± 0.2</td>
</tr>
<tr>
<td>Nitrogen Free Extract</td>
<td>44.7 ± 0.4</td>
<td>45.2 ± 0.3</td>
<td>42.2 ± 0.2</td>
<td>40.4 ± 0.3</td>
<td>38.8 ± 0.4</td>
</tr>
<tr>
<td>Ash</td>
<td>10.5 ± 0.3</td>
<td>10.8 ± 0.4</td>
<td>10.6 ± 0.1</td>
<td>11.7 ± 0.6</td>
<td>14.0 ± 0.4</td>
</tr>
</tbody>
</table>

\(\text{+}\) Mean values and standard deviation for analyses of 12 samples  
\(\text{++}\) Values based on air dried samples.

### Table 2: Composition (%) of the maize bran, cotton seed cake and Rhodes grass hay.\(^+\)

<table>
<thead>
<tr>
<th></th>
<th>Maize bran</th>
<th>Cotton seed cake</th>
<th>Rhodes</th>
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</thead>
<tbody>
<tr>
<td>Dry matter (\text{+}^+)</td>
<td>89.0 ± 0.4</td>
<td>91.6 ± 0.3</td>
<td>91.8 ± 0.2</td>
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<tr>
<td>Crude protein</td>
<td>10.6 ± 0.2</td>
<td>30.5 ± 0.3</td>
<td>8.4 b 0.1</td>
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<tr>
<td>Crude fibre</td>
<td>10.0 ± 0.3</td>
<td>22.0 ± 0.3</td>
<td>26.0 ± 0.4</td>
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<tr>
<td>Ether extract</td>
<td>9.6 ± 0.7</td>
<td>8.0 ± 0.8</td>
<td>2.6 ± 0.4</td>
</tr>
<tr>
<td>Nitrogen Free Extract</td>
<td>10.0 ± 0.5</td>
<td>22.9 ± 0.3</td>
<td>38.4 ± 0.7</td>
</tr>
<tr>
<td>Ash</td>
<td>5.0 ± 0.3</td>
<td>8.2 ± 0.2</td>
<td>12.8 ± 0.6</td>
</tr>
</tbody>
</table>

\(\text{+}\) Mean values and standard deviation for analyses of 8 samples.  
\(\text{++}\) Values based on air dried samples.

### Table 3: Liveweight gain, body condition scores and dressing percentage as affected by breed and supplementation.\(^1\)

<table>
<thead>
<tr>
<th>BREED EFFECT</th>
<th>SED and significance</th>
<th>SUPPLEMENTATION EFFECT</th>
<th>SED and significance</th>
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</thead>
<tbody>
<tr>
<td>BHP</td>
<td>RM</td>
<td>S(_0)</td>
<td>S(_1)</td>
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<tr>
<td>No. of animals</td>
<td>15</td>
<td>15</td>
<td>0.4**</td>
</tr>
<tr>
<td>Initial weight (kg)</td>
<td>14.9</td>
<td>11.1</td>
<td>18.5**</td>
</tr>
<tr>
<td>Final weight (kg)</td>
<td>27.1</td>
<td>19.4</td>
<td>5.6**</td>
</tr>
<tr>
<td>Total gain for 148 days (kg)</td>
<td>12.2</td>
<td>8.3</td>
<td>38a</td>
</tr>
<tr>
<td>Daily gain (g)</td>
<td>82</td>
<td>56</td>
<td>4.5**</td>
</tr>
<tr>
<td>Total concentrates intake (kg)</td>
<td>85.7</td>
<td>73.6</td>
<td>7.1a</td>
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<tr>
<td>Body condition score</td>
<td>3.1</td>
<td>2.4</td>
<td>0.2**</td>
</tr>
<tr>
<td>Hot carcass weight (kg)</td>
<td>12.5</td>
<td>8.4</td>
<td>0.4**</td>
</tr>
<tr>
<td>Dressing percentage</td>
<td>46.1</td>
<td>43.3</td>
<td>0.6**</td>
</tr>
</tbody>
</table>

\(^1\) In this and subsequent tables, Means within the same row in \(S_0\), \(S_1\) and \(S_2\) treatments bearing different superscripts are different at \(P < 0.05\).  
\(* * *\) Significant at \(P < 0.05\).  
\(\ast\) Significant at \(P < 0.01\) and \(P < 0.001\).  
NS = non-significant at \(P < 0.05\).  
\(^2\) The interaction between breed and level of supplementation was only significant with respect to body condition score \(P < 0.01\) and dressing percentage \(P < 0.05\).
Table 4: Physical and chemical composition of carcass as affected by breed and level of supplementation.

<table>
<thead>
<tr>
<th>Breed Effect</th>
<th>SED and significance</th>
<th>Supplementation</th>
<th>SED and significance</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>BHP</td>
<td>RM</td>
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</tr>
<tr>
<td>No. of animals</td>
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<tr>
<td>Tissue weight (g)</td>
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<tr>
<td>Lean</td>
<td>1347</td>
<td>1482</td>
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<tr>
<td>Fat\textsuperscript{1}</td>
<td>1751</td>
<td>798</td>
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<tr>
<td>Bone</td>
<td>1134</td>
<td>893</td>
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<tr>
<td>Tissue weight (% dissected carcass weight)</td>
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<tr>
<td>Lean</td>
<td>56.6</td>
<td>61.1</td>
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<tr>
<td>Fat</td>
<td>25.7</td>
<td>16.4</td>
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<tr>
<td>Bone</td>
<td>18.7</td>
<td>22.5</td>
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<tr>
<td>Tissue ratios</td>
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<tr>
<td>Lean:bone</td>
<td>2.97</td>
<td>2.72</td>
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<tr>
<td>Lean:fat</td>
<td>2.16</td>
<td>3.73</td>
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<tr>
<td>Chemical composition (% dry matter basis)</td>
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<tr>
<td>Dry matter (% of fresh)</td>
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<tr>
<td>Crude Protein</td>
<td>42.9</td>
<td>40.4</td>
<td></td>
</tr>
<tr>
<td>Ether Extract</td>
<td>18.7</td>
<td>19.7</td>
<td></td>
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<tr>
<td>Ash</td>
<td>70.8</td>
<td>67.8</td>
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<tr>
<td>10.3</td>
<td>11.9</td>
<td></td>
<td>0.9NS</td>
</tr>
</tbody>
</table>

\textsuperscript{1} The interaction between breed and level of Supplementation was only significant with respect to fat content (P < 0.001).

significant (P < 0.01) interaction between breed type and level of supplementation. The body condition scores for lambs in treatments S\textsubscript{0}, S\textsubscript{1} and S\textsubscript{2} were 2.0, 2.9 and 4.4 for BHP and 1.4, 2.6 and 3.0 for RM.

The difference in dressing-out percentage of 2.8 ± 0.6 in favour of BHP was significant (P < 0.001). Lambs without supplement (S\textsubscript{0}) had the lowest dressing percentage. Lambs fed S\textsubscript{1} had 2.6 ± 0.7 units higher in dressing percentage than lambs in S\textsubscript{0} while lambs fed S\textsubscript{2} diet had 9.8 ± 0.7 and 7.2 ± 0.7 units higher than those on S\textsubscript{0} and S\textsubscript{1}, respectively and the differences were significant (P < 0.05) and was 41.2, 43.2 and 52.0 for BHP lambs and 37.0, 41.5 and 47.0% for RM lambs on treatments S\textsubscript{0}, S\textsubscript{1} and S\textsubscript{2} respectively.

Carcass composition

Breed and supplementation had significant effects on absolute weights of major carcass tissues (Table 4) and reflected differences which occurred in growth rates of these animals. There was significant (P < 0.001) breed and level of supplementation interaction effect on absolute weight of fat. The weight of carcass fat was 244, 133 and 95% more in BHP than in RM lambs for treatment S\textsubscript{0}, S\textsubscript{1} and S\textsubscript{2}, respectively.

When these tissues were expressed as % of carcass side weight BHP had higher (P < 0.001) proportion of fat and lower (P < 0.001) proportion of lean and bone. The percentage bone and lean generally decreased with increasing level of supplementation while that of fat...
increased from 14% in lambs under grazing (S₀) to 32% in lambs under the highest level of supplementation (S₂).

Differences in lean: bone ratio between BHP and RM lambs were small and insignificant but the difference in lean: fat ratio of 1.57 ± 0.540 in favour of RM was, however, significant (P < 0.01) (Table 4). The Lean: fat ratio was highest in unsupplemented lambs and least for lambs on the highest level of supplementation (S₂).

Dietary effects on carcass chemical composition were generally small (Table 4). The dry matter and ether extract content were higher in BHP than RM carcases, with mean differences of 2.5 ± 1.1 and 3.0 ± 2.2, respectively. The percentage of crude protein was lower in RM and tended to decrease with increasing level of supplementation.

Discussion

The average daily gains obtained for RM lambs in the present study, which were approximately 9 months of age, is very similar to that reported by French (1938) for RM at about 18 months of age under grazing conditions. Observation by French (1938) that pure short-tailed RM is superior in growth rate to grade BHP seem to contradict the present findings. Mtenga, et al. (1981) reported that BHP is superior in performance compared to RM, a trend supported by the present study. The high growth rate observed for BHP must have been a reflection of their heavier mature weight than RM (Mason and Maule, 1960).

Supplementation improved the performance of lambs, a finding similar to that reported by Wilson (1958) with goats and El Hag and Mukhatar (1978) with sheep. The improved performance of supplemented lambs could be partially attributed to increased nutrient intake. Irrespective of level of supplementation, BHP lambs had a tendency to put on more subcutaneous fat, and especially around the tail, rump and loin. This could account for the higher body condition scores obtained for this breed in the present study. The supplemented lambs (S₁ and S₂) had more carcass fat than the unsupplemented ones (S₀).

Breed difference in dressing percentage in favour of BHP in the present study conforms to the literature reviewed by Nyaky (1981). Furthermore, dressing percentage tends to increase with increase in carcass fatness (Berg and Butterfield, 1976) and lower dressing percentage observed for RM was, therefore, expected because RM had relatively little carcass fat. The dressing percentage also tended to increase with improved nutrition, a finding similar to that reported by Palsson and Verges (1952) in sheep and Devendra (1966) in goats. Weight at slaughter, degree of fatness and gut fill, acting singly or in combination, might have contributed to differences in dressing percentage. The gut fill was highest in S₀ lambs (16.7% live weight) followed by S₁ (10.6%) and S₂ (8.7%). This implies that the over-night fasting was not adequate to eliminate variation in gut fill between treatments.

Muscle (lean) is the most important carcass tissue as it is the tissue which consumers prefer and the muscle combined with an acceptable proportion of fat makes up the consumable meat. The proportion of bone, which is inedible is also important because in many countries saleable joints in lamb carcases include bone. The results indicate that the supplemented lambs were growing rapidly and were slaughtered at heavier weights than the unsupplemented lambs. The Blackhead Persian lambs were also growing faster relative to Red Masai lambs. This accounted for the more lean and fat in absolute weights obtained for the Blackhead Persian and supplemented lambs obtained in the present study, a finding similar
to that of Gailli (1975).

Supplementation increased the proportion of carcass fat with a concomitant reduction in lean proportion. Market requirement for carcass fat in Tanzania and many other developing countries has not been quantified and a practical conclusion from this study becomes difficult. Our experience shows that there is a high demand for animal fat in Tanzania due to shortage of cooking vegetable oil. Animal fat generally fetches higher price than lean if it is properly trimmed. It is likely, however, that the lean: fat ratio of 1.30 and 6.88 obtained for Blackhead Persian lambs supplemented with 500g concentrate and unsupplemented Red Masai lambs, respectively, may not satisfy market requirement in Tanzania. This is because there was a consistent preference for carcasses from unsupplemented Blackhead Persian lambs and those receiving 100g/day concentrate while carcasses from Blackhead Persian lambs receiving 500g/day were regarded too fatty. In case of Red Masai breed, carcasses from lambs receiving 100 and 500g/day concentrate were more preferred than those from unsupplemented lambs, the latter being regarded as having too little fat cover. This is reflected in the breed and supplementation interaction in carcass fat observed in the present study and is in agreement with the finding of Gailli (1975).

The present study implies that feeding regime for the two breeds should be different in order to produce a carcass of given level of fatness when animals are slaughtered at similar chronological age. However, animals involved in this study are few and limited to only male animals. More information is required especially on the possibilities of interaction between level of supplementation, sex and the various breeds of sheep found in Tanzania.

A small proportion of sheep producers in Tanzania supplement their sheep to take advantage of the higher growth rates and better carcasses obtained from such a practice (Nyaky, 1981). Such lambs generally fetch higher prices per unit weight than animals of the same weight and sex under normal grazing conditions. However, in any animal production system, the efficiency of meat production is usually determined by the cost involved animal and management practice found in a farm. Nyaky (1981) showed that there was more overall monetary gain by keeping Blackhead Persian than Red Masai lambs for fattening. He further found that the monetary gain using either Blackhead Persian or Red Masai lambs increased with increasing level of supplementation. It is likely that the optimum level of supplementation in terms of monetary returns lies between 100 and 500g/day concentrate. It is suggested that studies be carried out involving concentrate to be given to growing — fattening Blackhead Persian and Red Masai lambs.

Acknowledgements

We are grateful to Mr. A.S. Yagunga, Mr. P. Mihalu and Mr. J. Chugga for their valuable assistance throughout this experiment. F.P. Nyaky acknowledges the receipt of a post-graduate scholarship from Norwegian Agency for International Development (NORAD) which funded this study.

REFERENCES

Effect of supplementation on performance of Black Head Persian and Red Massai Lambs


Received for publication on 11th. July, 1983

Materials and Methods

Two hundred and twelve (12) adult birds were caught at the Kazinga Lake National Park using nets and by shooting the hunter (adult one) around using double-barrel short-guns model the Park. Bone was collected from the wing tip of each and was taken to the laboratory. Two thin blood samples were made from each bird stated with glass. The slides were always examined for blood parasites. Blood were examined on each of the highest scale made from the blood of adult bird.
A study on the effect of dietary supplements on the growth of children in Guatemala. The study found that children who received supplements had a higher rate of growth compared to those who did not. This suggests that supplements can be a valuable tool in promoting healthy growth in children.

The study was conducted in Guatemala, where malnutrition is a significant problem. The results have important implications for public health policies and the development of effective interventions to combat malnutrition.

Acknowledgments

We are grateful to Mr. A.B. Vogt, Mrs. P. Minaya, and Mr. J. Ocampo for their valuable assistance throughout this project. Mr. P. Rybak, director of the Nutrition Program, provides valuable nutritional information to enhance the growth of children in Guatemala.

The study was funded by the World Bank and the United Nations Children's Fund (UNICEF). The data was collected in a rural area of Guatemala, and the results were analyzed using statistical software.

References


[Further references provided as needed]
SOME BLOOD PARASITES IN WILD BIRDS FOUND AROUND KAINJI LAKE NATIONAL PARK OF NIGERIA

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Department of Veterinary Parasitology. University of Ibadan, Ibadan, Nigeria.

Abstract: A survey of blood parasite infections of different wild birds caught in the Borgu National Park was undertaken. One hundred and twenty-two (58.1%) out of the two hundred and ten birds examined were found with parasites. *Plasmodium* and *Leucocytozoon* species were the most common parasites encountered. Other parasites found were *Haemoproteus*, *Trypanosoma*, *Microfilaria* and *Aegyptianella* species. Some birds had mixed infections.

Introduction

Akande and Diepolu (1977) suggested coccidiosis might be a major disease of wild bush fowls (*Francolinus*) and that this species might contaminate free range areas of other scavenging domestic fowls with *Eimeria* species. Recently, Ayeni, Diepolu and Okaeme (1983) found *Leucocytozoon*, *Plasmodium* and *Aegyptianella* species as common blood parasites of the wild grey breasted helmet guinea fowl (*Numida meleagris galeata*) caught at the Borgu section of the Kainji Lake National Park. The present study was designed to determine the incidence of the blood parasites of wild birds in the Kainji Lake National Park area of Nigeria with a view to providing basis for detailed investigation on those parasites which are pathogenic to domestic species of poultry.

Materials and Methods

Two hundred and ten (210) wild birds were caught at the Kainji Lake National Park using nets and by shooting the bigger (adult size) species using double barrel short-gun around the Park. Blood was collected from the wing vein of each bird caught alive and from the jugular vein of each bird. Two thin blood smears were made from each bird stained with Giemsa. The slides were subsequently examined for blood parasites. 200 fields were examined on each of the two slides made from the blood of each bird.

Results

Table 1 shows various species of blood parasites found in different wild bird species examined. 122 (58.1%) out of the 210 birds examined had blood parasitic infections. The main parasites found were *Plasmodium*, *Haemoproteus*; *Leucocytozoon*; *Aegyptianella*, *Microfilaria* and *Trypanosoma* species. *Leucoctozone* and *Plasmodium* species were the most common. *Trypanosoma* was differentiated from *Microfilaria* by using its shape, presence of flagellum and kinetoplast. The remaining blood parasites were distinguished from one another through the presence and position of Schizogyony either in the erythrocytes or, leucocytes or in tissues and the presence or absence and location of granules and pigment granules in the blood cells.

Of the seven groups of birds examined, the weavers (*Ploceus cucullatus*) had the highest proportion of infected ones, followed by the Purple Glossy Starling (*Lamprotornis purpureus*) and the White-faced Tree Duck (*Dendrocyna viduata*) while Cattle Egrets (*Ardea ibis*) had the lowest proportion of infected ones.

Discussion

The results evidently show that a number of wild birds around the Park harbours varied species of blood parasites, especially *Plasmodium* and *Leucocytozoon* species. These parasites were
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<th>77</th>
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**Table 1:** Blood parasites found in wild birds at the Bororo Game Park.
also found in the blood of domestic fowls (Adene and Dipeolu 1975) and turkeys (Akinboade and Dipeolu 1981) showing that these parasites are very common and probably specific for all birds. Since poultry farms are scattered along the periphery of the Park, it becomes necessary to investigate further the species of these parasites and also find out whether the wild birds are reservoirs of these parasitic infections which are known to be pathogenic to poultry. Garnham (1950) emphasised the need for such extensive study on blood parasites of wild birds after finding *Leucocytozoon* species in the blood of some wild birds. Since, then, several workers (Cowan 1955; Oosthuizen and Markus 1967a; 1967b; 1969a; 1969b; Peirce 1969; Peirce and Backhurst 1970; Herman, Kinsley and Knipling (1971) have recorded a wide range of haematozoan parasites in different wild birds in North America and East Africa.

Only one wild bird, a weaver, had microfilaria in its blood. Peirce (1970) recorded microfilaria in East Africa wild birds including the weavers. This is the first time this parasite is being reported in wild weaver birds in Nigeria. Within the Kainji Lake Basin area weavers were found inhabiting human dwellings as well.

The only case of *Trypanosoma* infection recorded in this study is in a cattle egret. In Nigeria, these bird species are also commonly found accompanying nomadic cattle and they feed on ticks and other ectoparasites of cattle. Although *Trypanosoma avium* infection had been reported in birds in East Africa (Peirce *et al.* 1977), it is not known whether the single incidence in this investigation is a chance occurrence or whether the infection is more widespread than reflected in these results. This also needs further investigation. In view of the association of cattle egrets and weavers with human dwellings and livestock, and the fact that both man and livestock, and the fact that both man and livestock may be infected with *Trypanosoma* and *Microfilaria* parasites, the zoonotic potential of these parasites may be indicated.

**Acknowledgement**

The continuing collaboration between the scientists of the Department of Veterinary Parasitology University of Ibadan and the Wildlife Division, Kainji Lake Research Institute, has resulted in this precursory report. The heads of the two departments are acknowledged for their generous financial support.

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INCIDENCES OF ABNORMAL WILD ANIMAL MORTALITY IN NORTHERN TANZANIA 1979 - 82

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Tanzania Livestock Research Organization, Veterinary Investigation Centre, P.O. Box 1068, Arusha, Tanzania.

Prior to the March 1982 rinderpest outbreak in buffaloes around Lobo in the Serengeti National Park, several incidences of abnormal mortality in wild animals in Arusha and Kilimanjaro regions of northern Tanzania were reported to the Veterinary Investigation Centre (V.I.C.) Arusha for investigation in the period between August 1979 and January 1982. A record of the outbreaks is summarized in Table 1 and the areas involved mapped in Fig. 1.

It was unfortunate that during the investigations sick wild animals and fresh carcasses could not be traced for sampling for serological microbial examinations. In most cases reports reached the V.I.C. Arusha long after the mortalities were over and the lack of facilities for rinderpest and rinderpest-like diseases diagnosis in the country during that time discouraged further investigations into the causes of the outbreaks.

In areas where cattle were routinely vaccinated annually against rinderpest, no alarming deaths in cattle suggestive of rinderpest were observed in or around the foci of the abnormal wild animal mortality. On the other hand in the non-rinderpest vaccinated areas abnormal cattle deaths were reported in some places following the game animal mortalities. In most cases the mortality in cattle coincided with breakdown in dipping for the control of ticks and their consequent tick-borne diseases and shortage of trypanocides for the control of trypanosomiasis. The fact that rinderpest in cattle in Tanzania had been controlled for over the last 14 years, the last outbreak having occurred during early 1966 in the Sonjo valley to the west of L.

Natron (Atang and Plowright 1969), the possibility of an outbreak of the disease was out of the minds of most veterinary field staff. Tick-borne diseases and trypanosomiasis were often the most obvious diagnosis. The causes of wildlife mortalities prior to March 1982 could not be ascertained. However, the confirmation of rinderpest seroconversion in convalescent buffaloes from Lobo Game Reserve, Northern Serengeti National Park and the finding of high rinderpest antibody titres in the sera of few sick, convalescing and recovered cattle in Mwanga (Kwakoa, Toloha, Mgagau and Pangaro villages) and Same (Njoro and Bendera villages) district in Kilimanjaro region which had never been vaccinated against rinderpest suggest strongly that most of the game animal mortality in those areas was likely to have been caused by rinderpest.

Rinderpest is known to affect both domestic and wild ruminants and swine. Game animals with little doubt help to maintain the disease (Plowright 1963). Despite the fact that there has been no evidence of significant rinderpest infection in any wild animal species in Tanzania including buffalo, eland and wildebeest since early 1963 (Plowright and McCulloch 1967, Taylor and Watson 1967), the abnormal mortality in buffaloes and the other rinderpest susceptible species of wild animals reported in this paper though not confirmed might have been foci of rinderpest outbreaks.

If rinderpest in cattle is to be controlled more effectively in future, a close follow up of its trend in game animals should be maintained by constant monitoring and surveillance.

*Present address: Veterinary Investigation Centre, P.O. Box 186, Mtiara, Tanzania.
<table>
<thead>
<tr>
<th>Date</th>
<th>Area</th>
<th>Reported history</th>
<th>Observations made</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 1979</td>
<td>In Sale Plains near Malambo to the east of Serengeti N. Park and north of Ngorongoro Conservation Area</td>
<td>Abnormal mortality in wildebeest (Connochaetes taurinus), zebras (Equus spp) and vultures (family Avypodi).</td>
<td>Only one decomposed wildebeest carcass was found.</td>
</tr>
<tr>
<td>July &amp; August 1980</td>
<td>Around Migaui, Pangaro, Kwakoa, Toloha, and Ndea villages in Mwanga district, Nyoro village in Same district (all villages east of river Pangani towards the Tanzania-Kenya border) and in Mikomazi Game Reserve contiguous with Tavao N. Park of Kenya.</td>
<td>Abnormal mortality in gazelles (Gazella spp), giraffes (Giraffa camelopardalis) and elands (Taurotragus oryx) preceded by sign of blindness and bloody diarrhoeas.</td>
<td>No sick or dead wild animals could be traced. Cattle mortality was observed which coincided with breakdown in digging. The clinical, post mortem and laboratory findings suggested tick-borne diseases. Serological and virological tests were not done due to lack of facilities but Bovine Viral Diarrhoea and Maasai Disease were included in differential diagnosis. 5 decomposed carcasses were autopsed which revealed no significant pathological changes. No sick buffaloes could be traced.</td>
</tr>
<tr>
<td>October 1980</td>
<td>In Arusha National Park to the east of Mt. Meru.</td>
<td>Death of over 20 buffaloes (Syncerus caffer) within 2 weeks after short illness.</td>
<td>No sick or dead kudus could be traced.</td>
</tr>
<tr>
<td>January and February 1981</td>
<td>Around Tolaha, Kwakoa, Kigamongoji and Migaui villages in Mwanga district.</td>
<td>Abnormal mortality in lesser kudus (Tragelaphus imberbis) preceded by signs of blindness and bloody diarrhoeas.</td>
<td>No sick wild animals could be traced. Only one skeleton was found probably of an eland.</td>
</tr>
<tr>
<td>May 1981</td>
<td>Around Olmolog to the west of Mt. Kilimanjaro near the Tanzania-Kenya border in the area contiguous with Amboseli N. Park of Kenya.</td>
<td>Abnormal mortality in buffaloes, elands and kudus.</td>
<td>Neithr sick nor dead wild animals could be traced during the investigations.</td>
</tr>
<tr>
<td>June 1981</td>
<td>In Longido game controlled area near the Tanzania-Kenya border to the south east of L. Natron.</td>
<td>Abnormal mortality in gazelles and giraffes.</td>
<td>Only one old buffalo carcass was found and the cause of death was suggested to be due to old age or exhaustion after a long search for water and pastures.</td>
</tr>
<tr>
<td>January 1982</td>
<td>In Simanjiro area near Tarangire N. Park to the south of Arusha town.</td>
<td>Abnormal mortality in buffaloes and elands.</td>
<td>One sick buffalo with diarrhoea was shot and autopsied. Haemorrhagic gastro-enteritis was the most significant pathological finding. The animal was confirmed to be rinderpest infected by the agar gel precipitation test.</td>
</tr>
<tr>
<td>April 1982</td>
<td>At Lobo in the Serengeti N. Park near the Tanzania-Kenya border.</td>
<td>Abnormal mortality in buffalo herds. over 200 animals died within two months.</td>
<td>One sick buffalo with diarrhoea was shot and autopsied. Haemorrhagic gastro-enteritis was the most significant pathological finding.</td>
</tr>
<tr>
<td>June 1982</td>
<td>At Ngorongoro Crater.</td>
<td>Abnormal mortality in buffaloes, elands and warthogs. over 1000 buffaloes died within 2 months.</td>
<td>Major clinical signs in cattle included paleness and icterus of cutaneous mucous membranes, muroid ocular and nasal discharge, erosive and ulcerative lesions of oral and nasal mucosae, swollen superficial lymph nodes and diarrhoea. Post mortem examination revealed in addition to the clinical signs moderate to severe haemorrhagic gastro-enteritis. Rinderpest was confirmed serologically.</td>
</tr>
<tr>
<td>September and October</td>
<td>Around Toloha, Kwakoa, Migaui district and Nyoro and Bedera in Same district.</td>
<td>Abnormal mortality in cattle, sheep and goats preceded by signs of mucopurulent nasal and ocular discharge and bloody diarrhoea.</td>
<td>Only one decomposed wildebeest carcass was found.</td>
</tr>
</tbody>
</table>
Acknowledgement

The authors wish to thank Dr. G.R. Scott of the Centre for Tropical Veterinary Medicine, Edinburgh for his encouragement to publish this paper, Dr. P.B. Rossiter of Kenya Agricultural Research Institute, Muguga, and Dr. W.P. Taylor of the Animal Virus Research Institute, Pirbright, for testing buffalo tissues in gel diffusion and serological examination of the cattle sera from Mwanga and Same districts, the Park warden of Serengeti National Park and the Conservator of Ngorongoro Conservation Area Authority for the information on estimates of buffalo deaths in the respective areas, Dr. C. Mollel of the Serengeti Wildlife Research Institute, staff of the game and livestock departments of Arusha and Kilimanjaro regions and last but not least Dr. M.M. Rweyemamu FAO† rinderpest consultant, for criticisms and advice.

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INVESTIGATIONS ON AN OUTBREAK OF POX IN SHEEP AND GOATS IN MBUGUNI-SHAMBARAI AREA OF ARUSHA REGION TANZANIA

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Summary: In January 1980, the Veterinary Investigation Centre (V.I.C.) Arusha was called to investigate an outbreak of an unknown skin disease in sheep and goats in Mboguni division (Arumeru district) and the contiguous Shambarai ward (Kiteto district) of Arusha region. In a 3 weeks survey 502 goats and 394 sheep in 12 flocks from 4 different villages of Mboguni – Shambarai area were investigated and sheep pox was found to be the cause of the outbreak.

Introduction

Sheep pox is an acute, highly contagious and frequently fatal disease of sheep and goats characterized by generalized papules on the skin and plaques on mucous membranes. The disease is caused by a pox virus closely related antigenically to the goat pox and lumpy skin disease viruses. Geographically, sheep pox is widespread in Morocco, Algeria, Libya, Ethiopia, Turkey, Syria, Lebanon, Iraq, Iran, India and Afghanistan and less common but still notorious in Portugal, Russia, Israel, Jordan, Saudi Arabia, Pakistan, Sudan, Kenya and Tanzania. (Jensen 1974). In Tanzania, the disease had disappeared for many years until recently when it was reported again in northern Tanzania by Shaka (1979). In his field study of 12 farms in north western Arumeru district and the adjacent area in Monduli district, 1946 sheep and 138 goats were examined. Morbidity rates in these farms ranged from 75-100% and mortality rates from 8-60%. The highest mortality was recorded in goats. Shaka concluded that the disease was re-introduced into northern Tanzania by the migrating livestock of the Maasai from southern Kenya where the disease has been enzootic for many years. The movement was triggered by the severe drought of 1976 and was in search of water and pastures. From Monduli district (border district) the disease diffused into the other districts of Arusha region.

This paper deals with investigations on an outbreak of pox in sheep and goats of Mboguni – Shambarai area of Arusha region Tanzania.

Materials and Methods

A total of 502 goats and 394 sheep from 12 flocks of 4 different villages in Mboguni Shambarai area were clinically examined for skin lesions.

Two sheep and two goats were sacrificed and autopsied in the field. Pieces of affected skin and subpleural lung nodules from both sheep and goats were preserved in 10% buffered formalin and 50% glycerine for histopathological and virological examinations respectively.

Blood serum samples were collected from 17 clinically affected and convalescing goats and 9 non-clinically affected goats for serological examination. No sera was collected from sheep.

All samples were submitted to the Central Veterinary Laboratory (C.V.L.) Dar-es-Salaam for histopathological, virological and serological examinations.

Results

Clinically, sheep and goats with cutaneous eruptions appeared to be physically depressed and weak. Appetite was markedly reduced and rectal temperatures were elevated to 40-41°C. Breathing was laboured and noisy due to swelling of nostrils and nasal mucosa.
The cutaneous lesions ranged from circumscribed hyperemic papules to crater-like scabs in areas devoid of wool such as cheeks, lips, nostrils, udder, vulva, scrotum under the tail in sheep and on the oral, tongue nasal and ocular mucosae. In goats and in severe cases in sheep the skin lesions tended to be more widespread involving the neck, thoracic and abdominal regions and could be felt as hard intracutaneous nodules.

Postmortem findings of the four carcasses opened in addition to the skin eruptions showed as a constant feature marked solitary greyish subpleural nodules on lungs measuring about 1 cm. in diameter. The superficial and body lymph nodes were swollen and oedematous and pimply gut (Oesophagostomum spp.) nodules on the wall of the intestinal tract and Haemonchus spp. in the abomasum were a common finding.

Results from C.V.L. Dar-es-Salaam confirmed pox lesions histopathologically and initial virus isolations suggested a pox virus. Characterization of the virus has not yet been completed to date.

Epizootiological observations showed that:

(i) The disease was observed for the first time in the area in late October 1979 and is believed to have been introduced from the neighbouring Moduli district where outbreaks of sheep pox were reported and confirmed in previous years.

(ii) Morbidity rates in both sheep and goats were variable but more goats appeared to have been affected compared to sheep. Morbidity rates of up to 83% in goats and 75% in sheep were recorded.

(iii) No significant age incidence was observed although in sheep, lambs appeared to suffer more severe lesions and fatalities than adults.

(iv) Mortality rates among the affected animals were also variable though high in some flocks recording up to 100%.

(v) Few recoveries were recorded which were variable and in the absence of any chemotherapy took on average 1-2 months to complete.

Data of number of animals affected, dead and those that recovered collected from the observations made and from the stock owners is summarized in Table 1.

<table>
<thead>
<tr>
<th>Village</th>
<th>Goats</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total No. of animals</td>
<td>No. affected</td>
</tr>
<tr>
<td>(a) Migungani</td>
<td>340</td>
<td>87</td>
</tr>
<tr>
<td>(b) Kambi ya Tanga</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>(c) Mbuguni</td>
<td>98</td>
<td>16</td>
</tr>
<tr>
<td>(d) Shambarai Burka</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>502</td>
<td>108</td>
</tr>
</tbody>
</table>

* none were observed or reported at the time of the study.
Discussion

The clinical, postmortem, histopathological and initial virological findings together with the epizootiological information are highly suggestive of sheep pox as the probable diagnosis of the skin disease in both sheep and goats of the area under discussion. The fact that more goats were affected than sheep could be due to the fact that most farmers kept more goats than sheep and that skin lesions were easier to see in goats due to their relatively shorter hairs compared to sheep which needed to be examined more closely particularly under the tail. The high mortality rates and the long convalescence period experienced in some flocks were probably due to factors such as helminthiasis, secondary bacterial invasion, heat stress and poor pastures during the time of the outbreak. The disease is likely to have been spread from Monduli district to the Mbuguni – Shambarai area. Factors which appear to have contributed to the spread of the disease in the area include:

Firstly the Shambarai livestock market situated at the Arumeru-Kiteto district border just adjacent to Mbuguni village operated under to proper veterinary supervision. This was due to its peripheral location far from its administrative district headquarters at Kibaya about 200 miles away. The market attracted many livestock traders and infected animals are likely to have been sold at the market contaminating the area.

Secondly animals caught in stock thefts which might have been carrying the infection have quite often been detained by the village authorities pending release to their rightful owners. Thirdly the communal dipping and grazing facilities of the villages concerned have probably facilitated close contact of infected and uninfected animals from different flocks ideal for contact and aerosol transmission of the disease. Finally the dry, dusty and windy nature of the area during the long dry season and the ability of the virus to survive under such conditions have probably contributed considerably to the spread of the disease within the area.

Acknowledgement

The authors wish to thank Dr. A.D. Maeda of the Department of Microbiology and Parasitology, University of Dar-es-Salaam, Morogoro, for her encouragement to publish this paper, the C.V.L. Dar-es-Salaam for the histopathological and viral examinations of the samples, and last but not least staff of the livestock department and village authorities of Mbuguni division for their cooperation in providing information and animals for examination.

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The expectations and body weight also were recorded at each visit. The body weight was determined by the use of a balance scale, and the body length was measured with a flexible tape measure. The weight and length measurements were taken at the beginning and end of the experiment to determine the growth of the fish. The food was provided to the fish in a balanced diet, and the water temperature was maintained at a constant level throughout the experiment.
THE EFFECTS OF PANACUR (FENBENDAZOLE) ON NEMATODE PARASITES
OF CAMELS UNDER NOMADIC CONDITIONS IN NORTHERN KENYA

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Summary: Fenbendazole 10%; Panacur (Hoechst, F.R.G.) given as a drench was used to treat a
group of camels which had a natural infection of nematodes. The drug was given a drench at
approximately 4-8 weeks intervals and at a dose rate of 7.5 mg/kg body weight.
There was a significant difference (P < 0.01) between strongyle egg counts of the treated
and untreated groups from the beginning of the investigations up to the end. The drug, however,
did not completely eliminate Trichuris eggs from the treated group. From a few animals that died
in the treated group, the drug was 100% effective in clearing all the nematode worms from
their guts. It was concluded that Fenbendazole is a promising anthelmintic for the common
camel nematodes.

Introduction
Fenbendazole (Pancur — Hoechst, F.R.G.) is a recently synthesized anthelmintic (Ross,
1975). Its active principle is Methyl-5 (Phenylthio)-2 benzimidazole Carbamate. It is related to other
benzimidazole anthelmintics currently being marketed. Different formulations in form of powders, suspensions, granules,
boluses and pellets are available for use in different animals according to the manufacturer’s instructions. Recent
work in Kenya (Wilson et al., 1981, Rutagwendena, 1982) has shown that nematode worms of the genera
Haemonchus, Trichostrongylus and Oesophagostomum are present in Kenyan camels. The same workers also
detected eggs of Strongyloides, Trichuris and Ascaris at relatively lower incidences.

Fenbendazole has broad spectrum of activity against nematode infections of cattle, (Duwel, 1974, Tiefenbach, 1974
and Todd et al. 1976); of sheep (Duwel, 1974, Kirsch, 1974) and of horses (Enigk et al., 1974, and Drudge and
others 1975, Foster and Halsberger, 1975). High efficacy of the drug was also reported against larval and immature
stages of Dictyocaulus viviparus in cattle (Duwel, 1974) and horses Duncan et al. (1980). The efficacy of this drug
has more recently been evaluated in poultry with promising results (Ssenyonga 1982).

It was felt necessary to test its efficacy against camel nematodes in an arid environment in Northern Kenya. This
study was conducted during the course of an investigation into the effects of a drug package on camel diseases and evaluation
of the package on camel production in Ngurunit, Marsabit District, Northern Kenya.

Materials and Methods
The investigations were carried out at Ngurunit in Marsabit District Northern Kenya. Ngurunit (1° 50 N) and
37° 13’ E) receives an annual rainfall of 400-600 mm and stands at an altitude of
740 mm above sea level. The vegetation of this area is mainly woodland and dwarf shrubland with Duosperma
eremophilum being the most common plant species.

A total of 120 camels of mixed age and sex groups were used in this study. They were divided into 2 groups of 60
camels each. The first group (Group A) was owned by 3 nomadic pastoralists and consisted of 14 calves aged between
one month and one year, 13 immatures aged between one and four years and 33 adults aged above 4 years. This group
was on a contract for the experiment
and remained the property of the owners. The second group (Group B) was locally purchased a month later from the area with an assumption that both groups had been under the same management. This group consisted of 2 calves, 19 immatures and 39 adults. As it was very difficult to purchase camels with their calves, an attempt was made to have more immatures in the group so that both groups (A and B) were in numerical balance.

The two groups of camels were herded separately but were kept in adjacent enclosures (Bomas) for security against predators. The herds drank at separate wells and were managed traditionally. Group A received panacur drench 10% once every 4-8 weeks and group B was left as untreated controls. Faecal samples were collected from each camel on the first day of the investigation and this was continued routinely once every month up to the end of the investigations. The faeces were subjected to a modified McMaster’s technique for egg counting and identification (Anon, 1979). In addition, postmortem worm counts were carried out on most animals which died during the study. This was done according to the method described by Eysker, (1978). Rainfall data of the area was read from a standard rainfall gauge. Larval cultures were also performed on a few samples using standard procedures (Anon, 1979). No pre-treatment faecal sampling was carried out because it was assumed that the control group (B) would give this value.

The faecal sampling and drug administration to group A were carried out on the first day of the experiment and was continued once every 4-8 weeks and was always done at least 7 days after the previous monthly faecal sampling. The drug was administered as a drench at a dose rate of 7.5 mg/kg body weight, which is the dose that is recommended for cattle. Camel body weights were estimated once every month using the method described by Field (1979) and for purposes of drug administration, body weights were always extrapolated from those of the previous month.

Results and Discussion

Table 1 shows the mean monthly strongyle egg counts of the two groups of camels and the total rainfall of the area during the study period. The results show that strongyle eggs disappeared from the treated herd after 4 months of the trial. The eggs never appeared again except in February and May when the strongyle egg levels at this time were very low. The mean egg counts were significantly different (P < 0.01) for the two herds from the time the trial started up to the end. The results further indicate that the strongyle eggs of the treated herd dropped from an initial level of 156 eggs per gram in February 1981 to 75 eggs per gram in June 1981. From July 1981, no strongyle eggs were detected from this herd except on two occasions in February and May 1982. The untreated group mean egg counts rose up to 509 eggs per gram of faeces in June 1981 and after this period the egg counts began to fall. This corresponded to one month after the heavy rains in the area. The eggs remained between 200 and 400 eggs per gram of faeces during the dry season until the next heavy rains of 1982. The egg counts of this herd did not reach the peak observed in 1981 although they showed a similar trend of rise. The short rains of November to December 1981 did not seem to affect the levels of strongyle egg counts of this herd.

The egg production peaks observed in this study after the heavy rains July 1981 and April 1982 have been reported in cattle by Levine (1963) and Yazwinski and Gibbs (1975). Hart (1964) reported a rise in Haemonchus egg counts at the end of a dry season in
Table 1: Mean Monthly Strongyle Egg Counts of the two herds of camels.

<table>
<thead>
<tr>
<th>Date</th>
<th>Mean Strongyle egg counts for Group A (Treated)</th>
<th>Mean Strongyle egg counts for Group B (Control)</th>
<th>Degrees of Freedom df.</th>
<th>t-cal</th>
<th>t-crit.</th>
<th>Total rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. 1981</td>
<td>156</td>
<td>126</td>
<td>Not yet purchased</td>
<td></td>
<td></td>
<td>122.5</td>
</tr>
<tr>
<td>March</td>
<td>15</td>
<td>127</td>
<td>101</td>
<td>3.67*</td>
<td></td>
<td>220.4</td>
</tr>
<tr>
<td>April</td>
<td>4</td>
<td>265</td>
<td>97</td>
<td>3.76*</td>
<td></td>
<td>56.8</td>
</tr>
<tr>
<td>May</td>
<td>97</td>
<td>509</td>
<td>104</td>
<td>4.04*</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>June</td>
<td>25</td>
<td>493</td>
<td>112</td>
<td>5.88*</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>July</td>
<td>0</td>
<td>277</td>
<td>113</td>
<td>6.23*</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Aug.</td>
<td>0</td>
<td>342</td>
<td>116</td>
<td>4.85*</td>
<td></td>
<td>2.62</td>
</tr>
<tr>
<td>Sept.</td>
<td>0</td>
<td>275</td>
<td>114</td>
<td>4.33*</td>
<td></td>
<td>5.5</td>
</tr>
<tr>
<td>Oct.</td>
<td>0</td>
<td>275</td>
<td>114</td>
<td>5.11*</td>
<td></td>
<td>9.8</td>
</tr>
<tr>
<td>Nov.</td>
<td>0</td>
<td>389</td>
<td>113</td>
<td>3.50*</td>
<td></td>
<td>46.6</td>
</tr>
<tr>
<td>Dec.</td>
<td>0</td>
<td>238</td>
<td>113</td>
<td>3.50*</td>
<td></td>
<td>Trace</td>
</tr>
<tr>
<td>Jan. 1982</td>
<td>0</td>
<td>236</td>
<td>111</td>
<td>7.48*</td>
<td></td>
<td>&quot;</td>
</tr>
<tr>
<td>Feb.</td>
<td>1.5</td>
<td>211</td>
<td>109</td>
<td>4.99*</td>
<td></td>
<td>&quot;</td>
</tr>
<tr>
<td>March</td>
<td>0</td>
<td>320</td>
<td>107</td>
<td>5.91*</td>
<td></td>
<td>&quot;</td>
</tr>
<tr>
<td>April</td>
<td>0</td>
<td>470</td>
<td>106</td>
<td>5.12*</td>
<td></td>
<td>&quot;</td>
</tr>
<tr>
<td>May</td>
<td>1.5</td>
<td>465</td>
<td>119</td>
<td>8.86*</td>
<td></td>
<td>156.1</td>
</tr>
</tbody>
</table>

* Significant (P < 0.01)

Nigerian cattle. This rise was attributed to inhibited immature stages of the worm resuming development as a result of a decline in immune status of the host and this probably occurs also in camels.

**Internal Parasite Point Prevalence Percentage**

Table 2 gives the percentage of animals affected with internal parasites at each monthly sampling date. The results indicate a high point prevalence percentage of animals having strongyle eggs in the untreated group throughout the investigation period. The highest percentage of animals affected (88.7%) was recorded in April 1982. The results further indicate that large proportions of animals became infected during and immediately after the heavy rains. During the dry months, infection remained between 55.7% and 69.9%. Strongyloides eggs were also present in both groups at a relatively low prevalence rate and tended to disappear towards the end of the investigation period. Trichuris eggs were detected throughout the study period and were missed only twice in the treated group (in February and October 1981) The percentage of treated animals having trichuris eggs was higher than for any other eggs of internal parasites. The low efficacy of the drug on Trichuris worms has been reported (Furmaga and Gundlach 1977) and these results do agree with their work.

Ascaris eggs were present in both herds at very low percentage during the study period; 2% of the treated group were infected in April 1981. After that period, ascaris eggs were not detected again up to the end of the investigations.
Table 2: Internal Parasites Point Prevalence Percentage

<table>
<thead>
<tr>
<th>Date</th>
<th>Strongyle</th>
<th>Strongyloides</th>
<th>Trichuris</th>
<th>Ascaris</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T</td>
<td>U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb. 1981</td>
<td>25.4</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>3.3</td>
<td>44.2</td>
<td>18.3</td>
<td>15</td>
</tr>
<tr>
<td>April</td>
<td>1.9</td>
<td>40.7</td>
<td>17.7</td>
<td>13.7</td>
</tr>
<tr>
<td>May</td>
<td>53.3</td>
<td>80.4</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>June</td>
<td>20.3</td>
<td>87.7</td>
<td>22</td>
<td>6.8</td>
</tr>
<tr>
<td>July</td>
<td>0</td>
<td>7.7</td>
<td>12</td>
<td>3.5</td>
</tr>
<tr>
<td>Aug.</td>
<td>0</td>
<td>55.7</td>
<td>0</td>
<td>5.5</td>
</tr>
<tr>
<td>Sept.</td>
<td>0</td>
<td>69.4</td>
<td>6</td>
<td>5.4</td>
</tr>
<tr>
<td>Oct.</td>
<td>0</td>
<td>69.4</td>
<td>1.8</td>
<td>21.3</td>
</tr>
<tr>
<td>Nov.</td>
<td>0</td>
<td>69.9</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Dec.</td>
<td>0</td>
<td>57.4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Jan. 1982</td>
<td>0</td>
<td>57.4</td>
<td>0</td>
<td>1.8</td>
</tr>
<tr>
<td>Feb.</td>
<td>0.5</td>
<td>63</td>
<td>0</td>
<td>5.3</td>
</tr>
<tr>
<td>March</td>
<td>6</td>
<td>77.4</td>
<td>0</td>
<td>9.6</td>
</tr>
<tr>
<td>April</td>
<td>0</td>
<td>88.7</td>
<td>0</td>
<td>3.6</td>
</tr>
<tr>
<td>May</td>
<td>1.5</td>
<td>83</td>
<td>0</td>
<td>26.9</td>
</tr>
</tbody>
</table>

T = Treated  U = Untreated

Pancur 10% solution as observed in this study is effective against common nematodes of camels at the dose recommended for cattle. There was a significant difference (P < 0.01) between strongyle egg counts of group A and B indicating that the drug had a tremendous effect on egg production of the worms of the treated group. Although faecal egg counts have been criticised for not being accurate in estimating the worm burdens of livestock, they are used to estimate levels of egg production and if used for a long time can give a rough indication of the status of helminthiasis in livestock. In this study, faecal
 egg counts, larval cultures and postmortem worm counts were used to study camel helminthiasis. Results from faeces cultured from the untreated animals showed that *Haemonchus contortus* was the most common nematode present (80% of harvested larvae) Trichostrongylus and Oesophagostomum were also present at low levels. (8% & 2% respectively). Postmortem worm counts identified Haemonchus as the most common camel nematode present. This confirmed reports in other areas, (Richard, 1979, Mukasa (1981) where camels are kept.

Kirsch and Duwel, (1975) reported an efficacy of upto 99–100% of the drug. In this study we could not possibly kill all the animals that were under investigation as one group was privately owned and the prices of camels in Northern Kenya are too prohibitive to justify the needs of the experiment. However, in a few animals that died (due to other causes) in the treatment group, panacur was found to be 100% effective in removing the common nematodes of the camels.

Workers who have dealt with camel diseases, Richard (1979) Mukasa (1981) Rutagwenda (1982) have tended to stress the importance of protozoal, viral and bacterial diseases possibly because of the direct losses observed in death of these animals. Losses caused by helminths, however, like disturbance of nutrition, general weakness and thinness are always difficult to quantify. Nevertheless, helminthiasis remains one of the most important camel disease conditions in Kenya, Wilson *et al.* (1981), Rutagwenda (1982), and so it is important to have an effective drug to be able to control these important parasites.

**REFERENCES**


Received for publication on 23rd. February, 1983
This study is effective against experimental  
cancer in mice. There was a significant  
difference (p < 0.01) between the  
control group and the treated group,  
indicating that the drug had a  
significant effect and was effective in the  
prevention of cancer.

However, the drug has not been  
average in clinical trials on human  
cancer patients. Further research is  
needed to determine its effectiveness  
in humans.

The drug has been approved for  
clinical trials by the regulatory  
bodies in several countries. It is  
expected to be available on the  
market in the near future.
THE PATHOLOGY OF TRYPANOSOMA BRUCEI BRUCEI IN THE DOG

E. KAGWA,* W.K. MUNYUA and G.M. MUGERA,
Department of Veterinary Pathology and Microbiology, P.O. Box 29053, Kabete, Kenya.

Summary: Post mortem findings and some histological lesions are reported in dogs experimentally infected with T.b. brucei. Using the direct fluorescent antibody test, the distribution of immunoglobulins was found to be proportional to that of trypanosome antigens in most tissues. The exception was the renal glomeruli which tended to have higher Ig than the Ag content. Renal failure due to trypanosomiasis did not occur. In general terms the extent of tissue damage was correlated with the immunoglobulin content in the tissues examined. These results suggested the involvement of immune complexes in the development of the tissue lesions in the dog.

Introduction

In all animal species, the pathology and pathogenesis of trypanosomiasis is still obscure in a number of respects. A recent consideration with regard to pathogenesis is the influence by the host immune response, with particular reference to formation of immune complexes. The latter have been detected in experimental infections, in mice (Lambert and Houba, 1974). Galvo-Castro et al. (1978) demonstrated that, in infected mice, lesions in striated muscles depend on the immune response of the host against the parasite antigens. They found that IgG and IgM deposition was associated with presence of trypanosomal antigens. The histology results obtained by Morrison et al. (1981a) suggested that the severity of the tissue changes in infected dogs was in general related to the number of organisms found within the tissues. The present study was undertaken to investigate the formation of immune complexes and correlate their location with pathological changes and presence of trypanosomal antigens in selected organs and tissues which are known to be affected by trypanosomiasis in the dog.

Materials and Methods

Animals

Albino mice were used for maintaining the trypanosomes. Albino rabbits were used for production of antisera against canine immunoglobulins (Ig); immunoglobulin G (IgG) and immunoglobulin M (IgM). Adult local cross bred dogs were used in the major experiment.

Trypanosomes

Trypanosoma brucei brucei EATRO 1207, isolated by inoculation into mice of blood from a naturally infected dog in Mweya, Queen Elizabeth National Park, Uganda, in 1969, was used. A second strain, T.B. brucei ILRAD 273, was also used. This strain was isolated from a Kongoni in Serengeti National Park, Tanzania, in 1971.

Infection of dogs

Trypanosomes were separated from mouse blood using the method described by Lanham (1968) as modified by Staak et al. (1976). Each of 19 dogs was intravenously inoculated with 10^4 trypanosomes while five dogs were left as controls. Ten of the dogs received T. b. brucei EATRO 1207, while 9 received T.b. brucei ILRAD 273.

Sampling of animals

Animals were checked for parasita-
emia using the haematocrit centrifuge technique (Woo, 1971). Rectal temperatures were taken daily and serum samples were taken every other day and stored at -20°C until used.

Dogs were sacrificed in extremis. At post mortem, urine was collected for analysis. Part of the urine was examined visually for colour, under a microscope for cell content and using a hand refractometer (Atage SPR - T2 Japan) set against distilled water for specific gravity. The Combar® Test strips (Boeringer Mannheim GmbH, West Germany), were used to determine the pH and the presence of glucose, acetone, urobilinogen, bilirubin and blood. Turbidity was determined by Pandy’s method (Baker et al. 1962). Briefly, one drop of urine was added to 0.5 ml of Pandy’s fluid (saturated acqueous phenol solution) and the tube held against light to detect any turbidity produced. Turbidity was correlated with presence of globulin and expressed as +, ++ or ++++. Another portion of urine was cultured under anaerobic and aerobic conditions for bacteriological examination.

**Histopathology**

Pieces of selected tissues (heart, kidney, liver, spleen, brain and lymph nodes) were fixed in 10% formaldehyde processed and stained with haematoxylin and eosin for histological examination. Another set of tissues was immediately frozen on a carbon dioxide freezing microtome (Jug AG, Heidelberg, W. Germany), following the method described by Goldman (1968). They were quickly transferred to a cryostat machine (Slee, London, Type H.S. South London Electrical Equipment Co. Ltd. London) where 5-6 μm thick sections were cut at -20°C. After air drying, they were fixed in cold acetone, wrapped in aluminium foil and then stored at -80°C. Determination of blood urea nitrogen: Blood urea nitrogen (BUN) was determined from the stored serum samples using the uraстрat urea nitrogen test strips (General Diagnostics, Werner and Lambert Company, Morris Plains, New Jersey, 07950, U.S.A.).

**Isolation of canine immunoglobulins**

Canine immunoglobulins were extracted by precipitation with ammonium hydroxide following Kendall’s method as adopted by Goldman (1968). Much of the Ig was kept while another fraction was used for preparation of canine IgG, following the method described by Fahey and Terry (1978). The 1st peak containing IgG was collected and concentrated.

IgM was extracted from canine while sera following the method of Fey et al. (1976). The 1st fraction containing IgM was purified on Pevikon block electrophoresis (Calbiochem Labs. a San Diogo). The protein content of the prepared Ig, IgG and IgM was determined using the copper-Polin test first described by Lowry et al. (1951) and modified by Rieder (1974). The fractions were tested by immunoelectrophoresis following the method described by Scheidegger (1955) and by double immuno diffusion after Ouchterlonhy (1958).

**Antisera production**

The purified fractions of Ig, IgG and IgM were separately inoculated intramuscularly into rabbits, 2 for each fraction. Two other rabbits were similarly inoculated with a soluble crude trypansome extract. The extract was obtained by hypotonically treating trypansomes and thensonicating them for 30 sec. in a BP-1 sonic oscillator (Bronwill). Rabbits were bled after 2 weeks to obtain respective antisera whose reactivity was tested against the original preparations using the immunodiffusion test.

**Immunofluorescence**

IgG was extracted from the respective antisera as described above. It was then conjugated with fluoresceine isothiocy-
Fig. 1: Blood urea nitrogen (BUN) in infected and control dogs.

Fig. 2: Liver from a dog infected with *T. b. brucei* Haemorrhages and necrosis in the centrilobular area (x 250 magnification).
nate dye (FITC) following the method described by Brandtzaeg (1973). The quality of the conjugates was checked by calculation of the fluorescein to protein ratios (F/P ratio), testing the staining specificity in the direct and indirect antibody tests (Goldman, 1968). These conjugates were used for the direct fluorescent antibody test (Goldman, 1968) on tissue sections, obtained from experimental dogs.

Results

Gross Pathology

Dogs were extremely emaciated, with no signs of oedema. The external mucous membranes were pale and had some haemorrhages. Partial or complete corneal opacity which was unilateral or bilateral, with moderate lacrimal discharge were common features in the eyes.

The carcasses exhibited muscle wasting and gelatinous appearance of cutaneous fat. Some cases (three) and straw-coloured fluid in the peritoneal cavity. The internal mucous membranes showed variable degrees of haemorrhage. All lymph nodes were only slightly enlarged, but were oedematous on cut surface. The medulla was often yellowish brown in colour with scattered haemorrhages. The spleen was either small or still enlarged and slightly darker in colour. The liver was swollen and congested while the kidneys were pale and on cut surface, showed haemorrhages especially along the corticomedullary junction. Some cases (six) had hydrothorax while more cases (sixteen) and hydropericardium, in which the fluid was straw-coloured and contained fibrin flakes. Pericardial fat was galatious, the heart was globular in shape with pericardial and endocardial haemorrhages, especially in the atria. Lungs from some cases (five) were emphysematous while the trachea had some haemorrhages. In the brain, haemorrhages usually involved the meninges.

Blood urea nitrogen (BUN) values, expressed in mg/100ml of blood showed an elevation when compared with the control dogs (Fig. 1).

Urine showed no deviation from the normal light yellow colour and pH of 6.0. The specific gravity was only slightly elevated from the average value of 1.020 (as in the controls) to 1.038 (range 1.035-1.055). There were increased number of leucocytes in the urine. This could have contributed to the slight change of specific gravity and the increased turbidity that was observed. There was no urobilinogen, bilirubin, erythrocytes nor acetone in the urine of infected dogs.

Histologically, there were widespread inflammatory reactions in the organs examined (Figures 1, 2 and 3). The relative severity of changes in these tissues is outlined in Table 1.

<table>
<thead>
<tr>
<th>Tissues examined</th>
<th>Relative Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>+++</td>
</tr>
<tr>
<td>Spleen</td>
<td>++++</td>
</tr>
<tr>
<td>Lymph node</td>
<td>+++</td>
</tr>
<tr>
<td>Liver</td>
<td>++</td>
</tr>
<tr>
<td>Heart (auricle)</td>
<td>+++</td>
</tr>
<tr>
<td>Heart (ventrical)</td>
<td>+</td>
</tr>
<tr>
<td>Brain</td>
<td>+</td>
</tr>
</tbody>
</table>

N.B. + indicates degrees of severity of tissue lesions which included haemorrhages, necrosis in some cases, and infiltration of tissues with inflammatory cells: polymorphonuclear cells, lymphocytes, neutrophils and plasma cells.

Immunohistology

The relative staining of the selected tissues is summarised in Table 2.

The distribution of IgM staining was similar but less intense than that of the IgG in different tissues. The concentration of the trypanosomal antigens was proportional to the immunoglobulin content in the heart, lymph nodes, liver and the brain. In the kidney and spleen, relative quantity of antigens was less than that of the immunoglobulins.
The pathology of *trypanosoma brucei brucei* in the dog 73

Fig. 3: Auricle of the heart, from a dog infected with *T. b. brucei*. Note the presence of congestion, haemorrhages, degeneration and diffuse infiltration with variable numbers in inflammatory cells: polymorphonuclear cells, lymphocytes, neutrophils and plasma cells × 250 magnification.

Table 2: Degrees of fluorescence in dog’s tissues directly stained with either anti-trypanosome, anti canine IgG or anticanine IgM FITC conjugates.

<table>
<thead>
<tr>
<th>Detected</th>
<th>Non-infected (Controls)</th>
<th>Infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tryps Ag</td>
<td>IgG</td>
</tr>
<tr>
<td>Kidney</td>
<td>-</td>
<td>b</td>
</tr>
<tr>
<td>Kidney</td>
<td>-</td>
<td>b</td>
</tr>
<tr>
<td>Spleen</td>
<td>-</td>
<td>±</td>
</tr>
<tr>
<td>Lymph node</td>
<td>-</td>
<td>±c</td>
</tr>
<tr>
<td>Liver</td>
<td>-</td>
<td>±c</td>
</tr>
<tr>
<td>Heart (auricle)</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Heart (ventricle)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Brain</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

a Tryps. Ag = trypanosomal antigen.
b = indicates no fluorescence.
c ± indicates doubtful fluorescence.
d + indicates positive fluorescence, the more plus signs the more intense in the staining.
Discussion

The post mortem and histological lesions observed in the dogs infected with either of the *T.b. brucei* strains used here, did not markedly differ from those observed by Sayer *et al.* (1979) and Morrison *et al.* (1981a, 1981b) and were not affected by the difference in strains of trypanosomes used. Using immunofluorescence, trypanosomal antigens, IgG and IgM were demonstrated in the tissues examined. With the exception of the spleen and the kidney, trypanosome antigens were found to be proportional to the immunoglobulins in the organs examined. It is probable that the Ag and Ab detected were immune complexes which tend to form in excess of antigen as indeed is likely with the trypanosomes. Such complexes have also been detected in various tissues of other animals infected with trypanosomes (Boreham and Kimber, 1970). Immune complexes deposited in the glomeruli may cause nephritis (Nagle *et al.* 1974; Rouse and Lewis 1975), but the extent to which they contribute to the pathology in trypanosomiasis is debatable. Goodwin and Guy (1973) found renal insufficiency to be important in rabbit trypanosomiasis, while it appeared to Murray *et al.* (1975) that renal failure was an uncommon complication in animals and man. In these dogs, there were no signs of renal impairment though the kidneys were affected, as evidenced by histological and urine analysis results. The parenchymal and glomerular damage was found to be more proportional to the high Ig content rather than to trypanosomal antigen which was scanty. The low content of trypanosomal antigen compared to the immunoglobulin in the kidneys indicated that less immune complexes specifically attributable to trypanosomiasis were present. Even in un-infected dogs where there was no trypanosome Ag, occasional Ig staining was demonstrated in the same organs. It has been reported that there is a high incidence of spontaneous subclinical glomerulonephritis resulting in immune complex formation (Halliwel and Blackemore, 1972; Rouse and Lewis, 1975; Muller Peddinghaus and Trautwein, 1977), especially in the dog. These nephropathies, found mainly in adult dogs, were thought to be due to subclinical infection with certain viruses, especially the adenoviruses. These, might as well have contributed to the high Ig content in the kidneys of our dogs. In the spleen more immunoglobulins, both IgG and IgM were found. This was not surprising since the spleen is normally involved in immunoglobulin synthesis.

Generally, the IgG (IgM) concentration in tissues correlated with the severity of lesions seen histologically, except in the kidney, the spleen (for reasons given above) and the liver. The liver had more severe lesions than could be accounted for by the low immunoglobulin content. This may be due to the physiological functions of the organ, as a site for detoxification, where by toxins from any origin, encountered previously in the dogs' life could have led to more severe pathological lesions in this organ.

To conclude, in tissues where immunoglobulin were found to be proportional to the trypanosome antigen content, it was probable that they were present as immune complexes. The severity of tissue lesions correlated with the immunoglobulin content, and hence possibly to the concentration of immune complex in these organs. These results agree with those of Galvao-Castro *et al.* (1978) where they suggested a possible role for immune complexes in the development of inflammatory reactions in the striated muscles of infected mice.

Acknowledgement

The senior author is greatly indebted to DAAD, of the Federal Republic of
Germany, for financing this work which was in part fulfilment for PhD.

The co-operation of the Pathology Laboratory at the International Laboratory for Research on Animal Diseases (ILRAD) in providing facilities and some technical assistance for this work is greatly appreciated. Special thanks go to Dr. W.I. Morrison of ILRAD and Prof. K. Lindqvist of the University of Nairobi, for the guidance in the immunopathological work. Thanks are also due to Mr. C. Kahango, of University of Nairobi, for typing this manuscript.

REFERENCES

Received for publication on 5th. July, 1983
Discussion

In the study by Brown et al. (1998), it was observed that the kidney biopsy samples showed abnormalities in the glomerular basement membrane, which was not seen in control samples. These findings are consistent with the results of a study by Smith et al. (2000), who reported similar changes in the kidney biopsy samples of patients with diabetes.

The pathological examination of the kidney biopsy samples revealed significant changes in the glomerular basement membrane, which was thicker than in control samples. This was confirmed by immunohistochemical analysis, where specific markers for the basement membrane were detected.

Acknowledgement

The authors would like to express their gratitude to UHAD of the Federal Republic of...
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VI. MISCELLANEOUS


IBAR/1984 F.A. CLIFTON-HADLEY
1 Studies of Streptococcus suis type 2 Infection in pigs

AUTHOR’S SUMMARY: Investigations into the immunology, pathogenesis and epidemiology of Streptococcus suis type 2 infections were carried out in experimental pigs and in naturally-occurring field outbreaks of disease.

The capsular polysaccharide from Str. suis type 2 was shown to induce opsonic antibodies in pigs when injected with Freund’s incomplete adjuvant, but difficulties encountered in experimental production of the disease prevented a study of their protective effects.

Problems with the bacterial tests led to an investigation of other assays for antibodies against Str. suis type 2, namely, a phagocytic test with pig neutrophils, a mixed reverse passive antiglobulin haemagglutination test and an indirect haemagglutination test. There was evidence that with modifications both the latter tests would be useful.

Transmission studies in 39 conventionally-reared and 7 hysterectomy-derived, colostrum-deprived pigs yielded interesting results with regard to the distribution of the organism in relation to the disease process.

Tonsil carriage in clinically-healthy pigs was demonstrated after experimental and natural infection. Detectable carrier rates varied between 0 and 59%. The organism was shown to persist in the presence of circulating opsonic antibodies and in pigs on penicillin-medicated feed. Attempts to isolate the organism from the genital tract were unsuccessful.

Medicated early weaning and classical SPF techniques applied to infected herds appeared to be effective in producing pigs free from Str. suis type 2 infection.

IBAR/1984 G.E. WESSMAN, R.I.L.
2 WOOD and N.A. NORD
Identification of three new serotypes of group E Streptococci isolated from swine

AUTHOR’S SUMMARY: Evidence is presented for the recognition of 3 new serotypes of Group E Streptococci (GSE). Serological and biochemical characteristics of 3 porcine isolates of GSE, that could not be placed in any of the 3 established serotypes, were examined. On the basis of double-diffusion precipitin reactions, the isolates were found to be of 3 distinct, previously unreported serotypes. They were given serotype designations VI, VII and VIII.

IBAR/1985 A.W. HILL
3 Progressive pathology of severe Escherichia coli mastitis in dairy cows

AUTHOR’S SUMMARY: An investigation was made using light and electron microscopy of the progressive pathological changes in nine experimental and two natural cases of severe Escherichia coli mastitis in dairy cows. The duration of infection varied from 18 hours to 13 days. Epithelial lesions were not found in glands which had been infected for more than 24 hours. However, the epithelia of the sinuses and large ducts became hyperplastic after 60 hours of infection and by six days hyperplasia was extensive on the crests of folds. The leucocyte response in the lumina of the glands and subepithelial tissue showed a progressive change from an acute neutrophil reaction to a chronic mononuclear cell infiltration within the first 36 hours of infection. The only changes affecting the secretory tissue occurred after six days of infection and were typical of mammary gland involution which was probably a direct consequence of anorexia.

IBAR/1985 W. DONACHIE, J.
4 FRASER, M. QUIRIE, N.J.L. GILMOUR
Studies on strains of Pasteurella haemolytica not typeable by the indirect haemagglutination test
Res. vet. Sci., 1984 37 (2) 188.

AUTHOR’S SUMMARY: Thirty strains of Pasteurella haemolytica which were untypeable by the indirect haemagglutination (IHA) test were examined serologically by rapid plate agglutination (RPA), agar gel diffusion (AGD), crossed immunoelectrophoresis (CIE) and counter current immunoelectrophoresis (CCIE) tests. Nine serogroups were identified by CIE. Serogroup specificity, dependent on two antigens, was present in heated saline extracts of cells. Single representative strains from two serogroups were not pathogenic for specific pathogen-free lambs.

IBAR/1984 M. MOCHIZUKI, S. HIDAI
5 S. HSUAN AND H. SATO
Fecal Examinations for Diagnosis of Canine Parvovirus Infection

AUTHOR’S SUMMARY: Seventy canine fecal samples were examined by several laboratory methods for establishing a proper diagnostic test for canine parvovirus (CPV) infection. Immune electron microscopy (IEM) was a very reliable laboratory tool for diagnosis of canine viral enteritis, but in the CPV enteric infection, fecal hemagglutination and subsequent hemagglutination-inhibition tests with a reference immune
serum were comparable to IEM in respect of specificity, rapidity and expense. Picornavirus-like or astrovirus-like particles were also detected in some samples.

IBAR/1984 M.J. FRANCIS and L.

6 BLACK
Effect of the sow vaccination regimen on the decay rate of maternally derived foot-and-mouth disease antibodies in piglets.


AUTHOR’S SUMMARY: Three pairs of sows were vaccinated against foot-and-mouth disease (FMD) at various intervals before farrowing and samples of blood were collected from their piglets periodically for 70 days after birth. When the sows were vaccinated 12 to 13 days before farrowing the predominating FMD neutralising antibody at time of parturition was IgM and the observed half lives of the maternally derived antibodies in the piglets were short (four to eight days). However, when sows were last vaccinated 30 to 32 days before farrowing, the maternally derived FMD neutralising antibodies in the piglets were predominantly IgG and the observed half lives were seven to 21 days. These observed half lives for IgG were shown to be closely related to the period over which the maternally derived antibodies could be demonstrated and to the rate of increase of the piglet’s blood volume over the same period. If corrections were made for increase in blood volume the decay rate of IgM antibodies in piglets was seven to 18 days while the decay rate of IgG antibodies in piglets was seven to 18 days while the decay rate for IgG was greater than 408 days. This result suggested that there was little or no IgG catabolism or excretion during the first 70 days of the piglet’s life.

IBAR/1984 T. IZUCHI and T.

7 MIYAMOTO
Influence of Newcastle Disease and Infectious Bronchitis Live Virus Vaccines on Immune Response against Infectious Laryngotracheitis Live Virus Vaccine in Chickens


AUTHOR’S SUMMARY: Efficacy of infectious laryngotracheitis (ILT) live virus vaccine was determined in combination with Newcastle disease (ND) or infectious bronchitis (IB) live virus vaccine by ocular administration to chickens. As for the ILT and IB vaccines, the efficacy of each vaccine was not altered even if both vaccines were inoculated simultaneously. On the contrary, when ILT vaccine was administered simultaneously or contiguously with ND vaccine to young chickens, the marked suppression was observed in ILT immunization. Significant immunosuppression occurred when ILT vaccine was inoculated during the period between 3 days before and 5 days after vaccination with ND vaccine in chickens young than 5 weeks of age. It did not occur, however, in chickens older than 7 weeks of age or having antibody against ND virus enough to protect growth of the ND virus. These facts show that careful attention must be paid when ILT and ND live virus vaccines are administered to young chickens.

IBAR/1984 E.Z. MUSHI and J.S.

8 WAFULA
The shedding of a virulent Kabete 0 strain of Rinderpest virus by cattle


AUTHOR’S SUMMARY: A Muguga strain of the virulent Kabete 0 strain of rinderpest virus was demonstrated in the ocular, nasal, oral and rectal swabs collected from infected cattle. Ocular shedding was detected at the onset of viraemia and before the onset of clinical signs whilst virus shedding in nasal, oral and rectal discharges appeared at the same time as lesions. It is suggested that virus isolation from ocular and nasal swabs should be considered in the diagnosis of rinderpest in addition to the other methods currently employed, as virus was isolated from swabs collected from dead animals.

IBAR/1984 H.H. TANTAWI, N.

9 AMIN, Y.I. YOUSSEF, M.
FAWZIA, J.M. AL-
ABDULLA, A.
EL-BATRAWI, A.
EL-GHAWAS, A.A.
NASSER and I.M. REDA
Infectious tenosynovitis in broilers and Broiler breeders in Egypt


AUTHOR’S SUMMARY: Two infectious tenosynovitis-producing viruses were isolated from tendon sheaths and synovial fluids of 59 broilers and 15 broiler breeders obtained from different flocks in Egypt during June to October, 1983. The viruses grew well on the choriolallantoic membrane of developing chicken embryos, produced small localized white pox lesions with oedematous swellings at the inoculation sites and death of most of the embryos 72 to 96 hours post-inoculation. They also induced cytopathic effect in chicken embryo rough, Vero and MS cell lines. The viruses were neutralized by reovirus S1133 antiserum, both in tissue culture and on the
choriollantoic membrane. Inoculation of the viruses into 2-day-old broiler chicks via the foot pad, intramuscular and oral routes reproduced the disease with the development of characteristic clinical, pathological and serological responses. The infection was transmitted to in-contact control chicks. This is the first report of the disease and of the isolation and identification of the causative virus in Egypt.

IBAR/1984 A. ANGBA & F. PIERRE
10 Sheep pox in Ivory Coast. Epidemiology, diagnosis and prevention

AUTHOR'S SUMMARY: Two outbreaks of sheep pox occurred in Djallonke sheep in 1979 in the centre and the south of Ivory Coast. The first outbreak whose primary focus remained unknown, affected mildly only one herd. The second outbreak derived from the first one spread out very quickly to several herds and entailed several hundreds of deaths especially among young animals. The sheep which were already weakened by gastrointestinal and blood parasites were particularly affected. A differential diagnosis was established between sheep pox, contagious ecthyma and dermatophilosis. The efficiency and innocuousness of several types of commercial vaccines were tested: killed, attenuated and sensitized vaccines. Djallonke sheep of this part of Ivory Coast developed serious side effects of attenuate vaccines but withstand very well the sensitized vaccines which have been used successfully since then.

IBAR/1984 JOHN J. REDDINGTON, R. WES LEID and R.B. WESCOTT
11 A Review of the antigens of Fasciola hepatica

AUTHOR'S SUMMARY: The interaction between the antigens of Fasciola hepatica and the host immune response are reviewed. This paper evaluates not only more recent work, but the older literature as well. Antigens from each stage in the life cycle are considered with the idea of identifying those antigens with a potential for use in an effective vaccine. Antigens which cross-react with other parasite species are detailed as well as those that cross-react between different stages in the life cycle of F. hepatica. The objective of the review is to demonstrate for other investigators that vaccination against F. hepatica is a distinct possibility. We hope to encourage more investigators to initiate work on this aspect of an economically important cosmopolitan parasite.

IBAR/1984 I.H. ARZOUN, H.S. HUSSEIN and M.F. HUSSEIN
12 The pathogenesis of experimental Haemomonchus longistipes infection in camels

AUTHOR'S SUMMARY: The pathogenesis and clinical signs of Haemomonchus longistipes infection were studied in four experimentally infected camels two of which were adults and the other two were young. In the former animals, an acute infection developed, characterized by mucoid diarrhoea, anorexia, anaemia, loss of body weight, oedema of the lower parts of the limbs, general malaise and death at 8-10 weeks post-infection. In the two younger camels, a less dramatic disease was encountered with less severe symptoms and no oedema, but also terminating fatally at 19-20 weeks post-infection. Parasitological, haematological and biochemical parameters were determined during the course of the infection and were mostly comparable with those usually encountered in haemonchosis of other animals.

IBAR/1984 O.O. DIPELOU and O.A. AKINBOARDE
13 Studies on ticks of veterinary importance in Nigeria XI. Observations on the biology of ticks detached the red-flanked duiker (Cephamophipys rufulatus) and parasites encountered in their blood.

AUTHOR'S SUMMARY: Some aspects of the biology of Amblyomma variegatum and Boophilus decoloratus detached from red-flanked duikers were studied. Smears were also made from the blood of the duikers and examined for the presence of parasites. Anaplasma marginale was the only blood parasite found in the blood smears. Compared with ticks detached from cattle, duiker ticks produced a greater number of eggs. The lengths and breadths of eggs produced by duiker ticks were greater than those of cattle ticks and unlike A. variegatum detached from cattle, the lengths and breadths of eggs of earlier and later ovipositions of this species detached from duiker were similar. Whereas deformed eggs characterised by circular shape and small size constituted a small percentage of eggs of cattle ticks, none was found among eggs of duiker ticks. The preoviposition, oviposition and eclosion periods microscopic egg structure, embryonic development, hatching patterns and mortality rates of the eggs of ticks from both hosts were similar.
IBAR/1984 I.S. KALRA, K.B. SINGH, B.P. SINGH, R.P. SINGH, D.C. NAURYAL and A.P. GALHOTRA

Trypanosoma theileri infection in cows


AUTHOR’S SUMMARY: Two cases of T. theileri infection in cows have been reported. One cow had intestinal obstruction and underwent laparotomy, while the other cow had progressive weakness and debility. In one case, Gilpol was ineffective. The response of the other cow to Benenil could not be ascertained. One of the cows was hypoglycaemic and its serum protein registered a rise.

IBAR/1984 S.N. CHIEJIKIA, B.B. FAKAE

Development and survival of infective larvae of gastrointestinal nematode parasites of cattle on pasture in eastern Nigeria

Res vet. Sci., 1984 (2) 148

AUTHOR’S SUMMARY: A study of the development and survival of the infective larvae on the common strongylate nematodes of cattle at Nsukka, eastern Nigeria, from September 1981 to March 1982, showed that the dry season (November to Match) was generally unfavourable for preparasitic development and survival of Cooperia, Haemonchus and Trichostrongylus species. However significant development may occur during the last two months of the season as a result of the small amounts of rain that usually fall at that time of the year. It was shown, using tracer goat kids, that only paddocks contaminated late in the dry season were infective at the start of the rainy season and that March contamination, in particular, is an important source of the ‘early rains’ (April/May) rise in herbage infestation commonly observed.

IBAR/1984 M.G. BINTA and M.P. CUNNINGHAM

Cutaneous responses of cattle to extracts from Rhipicephalus appendiculatus larvae.


AUTHOR’S SUMMARY: A component of an extract from Rhipicephalus appendiculatus larval ticks induced an immediate inoculation. Generally, the magnitude of the cutaneous reaction depended upon the duration of exposure of the cattle to tick infestation. The skin reaction was absent in steers not previously fed on by ticks.

Field trials, using the extract in the Narok District of Kenya (Masailand), showed that the skin swelling thus induced was biggest in adult cattle and those over 9 months, moderate in the 6-month age-group and barely palpable in the less-than-1-month age-group.

IBAR/1984 E.R. MUTIGA, and A.A. BAKER

Detection of Oestrus and Mating Behaviour of Entire Rams, Vasectomised Rams and Testosterone Treated Ewes and Wethers

The Kenya Vet., 1984, 8 (1) 15

AUTHOR’S SUMMARY: The ability to detect oestrus and mating behaviour of two entire rams, two vasectomised rams, two testosterone treated ewes and two testosterone treated wethers was studied. No significant differences were observed between them.

In a ten minute observation period the testosterone treated wethers approached the ewes in oestrus more aggressively than the others. The testosterone treated ewes stayed longer with and mounted the ewes in oestrus more frequently (p < .001) than the other teasers. These testosterone treated ewes not only mounted the ewes in oestrus but they also stood to be mounted.

IBAR/1984 B.D. PERRY, B. MWANAUMO, H.F. SCHELS, E. EICHER and M.R. ZAMAN

A study of health and productivity of traditionally managed cattle in Zambia


AUTHOR’S SUMMARY: A three-tiered survey was devised comprising a detailed questionnaire, a serological survey and a sentinel herd scheme for disease surveillance. The survey was carried out in the traditional farming sector in 7 districts of Zambia to obtain background information on cattle management and productivity, data on the prevalence of tick-borne and other disease problems in these areas and to monitor changes in individual herds.

In the questionnaire survey, 288 farmers were interviewed. They owned a total of 15,360 head of cattle, representing approximately one percent of the national herd. Mean herd sizes ranged from 31 to 114 for each district. Mean calving percentages were 44–80%. Average national off-take from these herds was 10%. Calf mortality rates ranged from 4 to 32%, while adult yearly mortality rates changed from 4 to 16%. Factors affecting the regional variation of these figures are discussed.
Comparative Digestion, Rumen Fermentation and Kinetics of Forage Diets by Steers and Wethers


AUTHOR’S SUMMARY: Four rumen fistulated wethers and beef steers were used to evaluate differences in dry matter digestibility (DMD) between cattle and sheep. They were fed either perennial ryegrass or switchgrass hay at an ad libitum or restricted level for four experimental periods. Significant ruminant species x forage and ruminant species x level of intake (P < .05) interactions were observed for digestible dry matter. The steers digested the switchgrass 7 percentage units greater than the wethers while ryegrass was digested equally. Digestibility differences between the steers and wethers were 6 percentage units at the ad libitum level of intake and 1 unit at the restricted level of intake. Crude protein digestibility tended to be greater (P > .10) for sheep with a 7 unit difference for switchgrass and a 3 unit difference for ryegrass. The mean ruminal solids retention time of the digesta was approximately (P < .01) 50% greater (26.0 vs. 17.4 h) in cattle, with no difference in ruminal liquid dilution rate (LD) between animal species. Total ruminal volatile fatty acid concentration differed (P < .10) with level of intake; however, no influence due to intake on the molar proportion of acetate (P > .10) or propionate (P > .10) was evident in spite of a difference (P < .01) in LD. Rumen pH (P < .05) and osmolality (P < .01) were affected by both level of intake and forage, with ryegrass and high level of intake decreasing pH and increasing osmolality. No animal species differences were observed for in situ dry matter disappearance over time as measured using Dacron bags suspended in the rumen, suggesting that differences in DMD between ruminant species was related to solids retention time of digesta rather than differing rates of digestion.

IBAR/1984 I.M. YOUNG, D.B.
ANDERSON AND R.W.J. PLENDERLEITH
Increased conception rate in dairy cows after early post partum administration of prostaglandin F2 THAM


AUTHOR’S SUMMARY: Commercial dairy cows were given a routine injection of dinoprost tromethamine (prostaglandin F2 x THAM) in the early post partum period. The first service conception rate of 64 cows given a single 25 mg injection of dinoprost during the period 14 to 28 days after calving was 68 per cent, that of 64 untreated controls was 43 per cent. The difference was highly significant at the level P = 0.007. In cows with no blood progesterone and with basal progesterone concentrations at the time of treatment, indicating absence of an active corpus luteum, the mean conception rates for 30 treated and 38 control cows were 70 and 44 per cent, respectively, demonstrating that this is not a luteolytic effect. Although that implies a positive myometrial effect, the interval from calving to first service was not shortened in treated cows.

IBAR/1984 C.L. JOHNSON
Strategic feeding of high yielding dairy cows


AUTHOR’S SUMMARY: Computerised management schemes are widely used in British dairy herds yet the standardised lactation curves might not be the most appropriate in particular herds. The shape of these curves is more a reflection of feeding than lactational physiology. Experimental evidence support the approach of prediction of yield potential for each cow in early lactation, the mean rate of fall for the herd and appropriately tailored feeding. Daily pattern of supplementary feeding interacts with body energy balance and might have implications in the incidence of metabolic diseases and infertility. Compositional quality and total yields of milk constituents are influenced by quality and the level of nutrition used at the onset of each lactation.

IBAR/1984 H.D. CHAPMAN
Drug resistance in avian coccidia (A Review)


AUTHOR’S SUMMARY: Drug resistance is now recognized as a major cause of the failure of drugs to control coccidiosis in the fowl. In this article, biological, biochemical and genetic aspects of resistance in Eimeria are reviewed and some of the problems that may limit progress in understanding the nature of resistance in coccidia are discussed.

IBAR/1984 D.K. SARMA, B.R. BORO and S. RAHMAN
Serotype and drug susceptibility of Escherichia coli from calves and their Environment


AUTHOR’S SUMMARY: One hundred and four E. coli strains were isolated from 64 swab samples of healthy calves and their shed environment. 036, 055, 060, 05 and 035 were predominant 'O' groups from calves and 040 and 055 from their environment. Majority of strains from calves and their environment
were sensitive to nalidixic acid, kanamycin, polymyxin B and neomycin. A high proportion of strains was resistant to oxytetracycline, sulfathiazole and erythromycin.

IBAR/1984 ABDULLAH, A.S., 24 SHEIKH-OMAR, A.R., BAGGOT, J.D. and ZAMRI, M.
Adverse effects of imidocarb dipropionate (Imizol (R)) in a dog.


AUTHOR'S SUMMARY: One of 13 healthy dogs used in a pharmacokinetic study of imidocarb dipropionate died due to difficulty in breathing, tachycardia, weakness and profuse diarrhoea. Autopsy findings showed marked pulmonary congestion and oedema. Kidneys were grossly enlarged and markedly congested with extensive haemorrhage in the cortex and medulla. Marked tubulonephrosis was also exhibited microscopically. Liver and spleen were moderately enlarged and congested. The adverse effects of imidocarb may be due to excessive acetylcholine action.

IBAR/1984 A.J. NGOMUO, S.E., 25 MARRINER and J.A. BOGAN
The pharmacokinetics of fenbendazole and oxfendazole in cattle


AUTHOR'S SUMMARY: The pharmacokinetics of fenbendazole and oxfendazole in cattle are described. The pharmacokinetics of oxfendazole were not significantly different when administered orally and by intra-ruminal injection. At a dose rate of 4.5 mg/kg, administered orally, fenbendazole gave rise to mean peak concentrations in plasma of fenbendazole and oxfendazole of 0.11 and 0.13 ug/ml respectively. Oral administration of oxfendazole at 4.5 mg/kg body weight, gave rise to plasma peak concentrations of fenbendazole and oxfendazole of 0.10 and 0.20 ug/ml respectively. Following intra-ruminal administration of oxfendazole, the peak concentrations were 0.11 and 0.18 ug/ml respectively.

Effect of anthelmintic treatment on the development of resistance in sheep vaccinated or experimentally infected with Dictyocaulus filaria


AUTHOR'S SUMMARY: This investigation was undertaken to study the immune response of Iraqi sheep vaccinated with Dictyocaulus filaria larvae (Filaria) and to determine the effect of tetramisole on the development of resistance to reinfection. The findings confirm the effectiveness of Filaria in conferring protection against experimental infection with D. filaria. However, the administration of anthelmintic four weeks after such vaccination interfered with the development of immunity. Termination of D. filaria infection at 28 days by tetramisole treatment also prevented the immune response.

Occurrence of Bovine Squamous Cell Carcinoma in Kenya

The Kenya Vet., 1984, 8 (1) 5.

AUTHOR'S SUMMARY: An investigation was conducted to assess the prevalence and to identify the predisposing factors of bovine squamous cell carcinoma in Kenya. The prevalence was found to be 0.77% for ocular carcinoma and 1.59% for vulva carcinoma in grade cattle of Kenya. The factors predisposing cattle to squamous cell carcinoma were identified as breed, age, lack of pigmentation of the skins of eyelids and labia vulvae. The highest prevalence of ocular carcinoma was observed in Hereford cattle while Ayshire cows showed the highest prevalence of vulva carcinoma. A hypothesis is advanced that a breeding programme designed to raise Hereford cattle with red around the eye and Ayshire cattle with high levels of melanin pigmentation on the vulva would be a feasible long term measure to reduce the prevalence of squamous cell carcinoma in these breeds.

IBAR/1984 F.R. RURANGIRWA, W.N. 28 MAŠIGA and E.K. MUTHOMI
Immunisation of goats against contagious caprine pleuropneumonia using sonicated antigens of F-38 strain of mycoplasma


AUTHOR'S SUMMARY: Three groups of 15 goats each were immunised against contagious caprine pleuropneumonia (CCPP) using sonicated antigens of the F-38 strain of mycoplasma incorporated in incomplete Freund's adjuvant (IFA), emulsified in aluminium hydroxide and phosphate buffered saline respectively. Three months after immunisation, five goats from each group were challenged by the in-contact method. The goats immunised with the anti-
gen incorporated in IFA were all solidly immune to the challenge whereas only two of five of the goats in the other two groups were challenged six months after immunisation, those immunised with the antigen in IFA were still solidly immune while only two goats from each of the other two groups were protected. These results show that effective immunity against CCFP caused by the F-38 strain can be induced by vaccination with sonicated F-38 antigens emulsified in IFA.

IBAR/1984 R.A.S. WHITE, E.L. GERRING, P.G.G. JACKSON and D.E. NOAKES Persistent vaginal haemorrhage in five mares caused by varicose veins of the vaginal wall

_Vet. Rec., 1984, 115 (11) 263._

AUTHOR’S SUMMARY: Persistent bleeding from the vulva was the only presenting clinical sign in five non-pregnant pluriparous mares varying in age from eight to 20 years. These were two hunter types, one shire, one thoroughbred and one Arab pony. The haemorrhage originated from ulcerated varicose veins present on the dorsal wall of the vagina adjacent to the vestibulovaginal junction. All five mares were successfully treated, by sub-mucosal resection (two), ligation of vessels (two) or diathermy (one). In four mares there was evidence of vulval incompetence caused by depression of the perineum. The importance of this and the role of impaired venous return during and after pregnancy are discussed.

IBAR/1984 I. JOHNSTONE 30 Electroejaculation in the domestic cat

_Aust. vet. J., 1984, 64 (5) 155._

AUTHOR’S SUMMARY: A method of electroejaculation for tomcats is described. Normal sperm counts in 4 cats ranged from 6 to 13 x 10^6/ejaculate. There was a great deal of variation between collections when assessing the fertility of a tomcat. Sperm counts were higher in the latter half of the year, at the time of increased sexual activity for cats in the Brisbane area. The volume of semen collected by electroejaculation increased in direct proportion to the length of electrical stimulation, hence, volume is not a reliable criterion for the appraisal of semen. However, results have indicated that semen volume tends to increase from July to December, thus indicating increased accessory gland activity during the breeding season. As this procedure does not cause any apparent discomfort or harmful effects there seems no reason to assume that it could not be used routinely on stud cats.

IBAR/1984 L.C. LLYOD, R.T. BADMAN, J.R. ETHERIDGE, K. McKECHNIE and H. IYER Assessment of a Complement Fixation Test to Detect _Mycoplasma hyopneumoniae_ Infection in Pigs


AUTHOR’S SUMMARY: Serums from pigs slaughtered at abattoirs were treated for evidence of _Mycoplasma hyopneumoniae_ infection using a complement fixation (CF) test which avoids the procomplementary effect of pig serum. To establish a diagnosis of enzootic pneumonia, the lungs from all sampled pigs were examined for pathological and histological changes consistent with the disease and cultures were made for mycoplasms and bacteria. The study was carried out at Parkville and Bendingo 160 km, apart at different times and all serums were tested at both laboratories. The results agreed closely.

Thirty-six of 97 pigs at Parkville and 46 of 99 at Bendigo had enzootic pneumonia. About 80% were positive in the CF test. Sixteen per cent of porkers and 36% of baconers gave false negative reactors, that is, a negative test though lesions were present. About 18% to 36% gave false positive reactions but the level in the porkers in the Bendigo group was significantly higher (P < 0.02). Possible explanations include, for the false negatives, loss of reactivity caused by circulating antigen and for the false positives, cross reacting antibody produced by another infection or failure to appreciate that lesions of EP were present in lungs because either they were not identified as such or they were not detected. The validity of any serological test for this disease cannot be established while there is a possibility that the present methods used for diagnosis, gross and microscopic examination and recovery of _M. hyopneumoniae_, fail to detect some infected animals. Other criteria may have to be adopted.
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