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An evaluation of the prevalence and intensity of Liver fluke infection in cattle slaughtered in Jos Abattoir with comments on the incidence of amphistome infection.

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ABSTRACT

An evaluation of the prevalence of liver fluke disease of cattle revealed an upward trend for an urban abattoir. A total of 3072 animal gall bladders were assayed between December 1980 and January 1982 and 74.06 + 6.46% were positive. the major fluke species were *Fasciola gigantica* and *Diocrocoelium hospes* with a few cases of *Schistosoma bovis*. The max/min. monthly prevalence rates were 85.42% and 60.00% respectively. The mean rates for D. hospes and *F. gigantica* were 57.95 + 6.58% and 48.71 + 11.66% respectively. T - test assessments showed these means to be significantly different.

The study further showed that for natural infections of cattle mixed infections were more frequent than single infections. The mean values were 32.13% as against X single infection rates of 25.5% and 16.45% for *D. hospes* and *F. gigantica*. Chi-square analysis confirmed that mixed infection rates were significantly higher than single infections for both species.

The fluke species were highly prolific, producing max. egg counts of 50 x 10^3 and 60 x 10^3 e.p.ml for *F. gigantica* and *D. hospes* respectively. there was variation in egg counts due to seasons with significantly more eggs produced in the dry than in the wet season, for freely infected animals. there was suppression of egg production im mixed infections which though affecting both species, had more effect on *F. gigantica*. this resulted in significantly more eggs being produced by either species in single than in mixed infections.

There was significant correlation between the wet liver weight and worm load.

There were comments on the prevalence rate of 80-100% recorded for amphistomiasis in cattle.

INTRODUCTION

Fascioliasis and Dicrocoeliasis in ruminants had earlier been established as being endemic in Northern Nigeria especially North-East from where the bulk of livestock especially cattle originate (Babalola and Schilhorn van Veen 1976). Published articles arising from abattoir surveys in parts of the Northern Nigeria showed evidence of relatively high incidence rates for these liver flukes (Fabiyi 1970; Schilhorn van Veen 1975, 1979; Bogatko 1976; Alonge and

Fasanmi 1979). Schilhorn van Veen (1979) for instance reported 4527 (31.7%) positive cases of liver fluke infection in cattle slaughtered in Bauchi between 1973 and 1974. this figure was a lot lower than what were recorded for a local slaughter slab in the same town by the same worker during the same study period. In the slaughter slab the incidence rates were 65.4% and 56.0% for *Fasciola gigantica* and *Dicrocoelium hospes* infections, out of 1024 cattle checked.

Evidence accruing from intensive research shows that the prevalence of liver fluke disease of cattle is in the increase. this state of affairs was considered by Pugh *et. al.* (1980) and Schilhorn van Veen (1980) to be a result of the increased awareness of the importance of this disease to livestock industry causing more researchers to show greater interest. Also they thought that in recent times there has been improvement on diagnostic techniques, and meat inspection has improved to a greater extent. However there is no getting away from the fact that the prevalence has actually been in the upgrade.

Attempts at proper assessment of the economic implications of liver fluke diseases in livestock has been more or less futile (Hammond and Sewall 1974). Consequently some interested Nigerian researchers have attempted to calculate financial losses resulting from meat condemnation only. this however is by far an under-estimation of the total loss resulting from the chronic and sub-acute phases of the disease e.g weight loss, reduction in milk production, and indefinite extension of the calling period. By this type of estimate, Alonge and Fasanmi (1979) produced a chart of monetary losses for abattoirs in the North of Nigeria between 1975 and 1977. The highest value was recorded for Zaria where N16,960.00 was lost due to condemnation of livers infected by *F. gigantica*. In the United Kingdom where a fairly accurate and complete estimate was possible ICI (1975) put the economic loss at N64.11m annually (Ogunrinade and Ogunrinade 1980). Cawdery (1976) associated Fascioliasis also with the impairment of the reproductive capacity of infected animals causing them to have decreased fertility.

The present requirement of increased food production in Nigeria, more than anything else created the need for regular re-assessment of the status of the fluke diseases in cattle since it is the main source of animal protein. there is also need for a comprehensive study and evaluation of the intensity and the effect of inter-specific factors like competition on egg production. In fact, the collection of basic information with an aim of evolving control measures for these parasitic warms of livestock will continue to be paramount in a developing country, like ours, more so now that increased food supply is politicised and the nation at large has intensified daming for irrigation purposes. Usually perennial water supply associated with bad water management in Irrigation programmes results in increased snail borne diseases and intensifies the disease in question. Schilhorn van Veen (1980) reviewing fascioliasis in West Africa noted that occurrence is specifically dependent on the availability of suitable freshwater habitats for snails. Reid *et. al.* (1970) earlier observed that increase in this disease is associated with the decrease in the quality and availability of pastures, which force the herdsmen to graze their cattle in freshwater river basins.

Using the observations mentioned as guidelines, this study sets out to reassess the prevalence of liverfluke disease in cattle slaughtered in Jos urban abattoir. To compare prevalence in the disease caused by the two dominant species of flukes. To compare tendencies towards single/mixed infections. To estimate egg production in naturally infected cattle. To investigate possible factors affecting egg production in naturally infected animals. To investigate possible correlation between wet weight of liver, worm burden and egg output. To comment on the prevalence of amphistomiasis in cattle.

MATERIALS AND METHODS

Most of the cattle slaughtered in Jos were not raised here but in the North-Eastern parts of the country.

The abattoir where the study was carried out is located on the South-East aspect of the town, off the level crossing on the main outlet to the South. It is a fairly modern abattoir, with the necessary infrastructural facilities including wheeling machines.

Sampling techniques:

Observation of fluke eggs/adults suspended in bile was used as criterion for confirming infection in slaughtered cattle. Usually the researcher was positioned at the meat inspection plat-form at which point gall bladders were detached from the livers and handed over to him prior to the regular inspection of the livers by the Veterinary Officer. The researcher on receiving each gall bladder immediately tied up the bile duct to prevent loss of bile. Usually the Veterinary Officer condemned highly parasitised livers and the researcher negotiated with the cattle owner for the purchase of such livers. When purchased, discarded livers were immediately weighed and weight recorded. Each of such livers was put in a separate polythene bag along with the gall bladder from it. Collection of gall bladders and damaged livers was twice each week and continued from December 1980 to January 1982.

On reaching the laboratory, the volume of bile per gall bladder was recorded before transfer to litre beaker. The beaker of bile was usually stirred vigorously, and assuming random distribution of suspended matter, samples were taken in triplicate and transferred into 5.0 by 2.5cm specimen tubes for storage. each gall bladder collected passed through similar treatment so that each week a fluctuating number of specimen tubes with bile samples ready for assay were collected. During assay, each tube was properly agitated by shaking and then 0.1ml of bile drawn up a ml pipette, and distributed on several chamber counter slides. counts of fluke eggs were under a microscope and were done in triplicate for each tube. The average of the three counts were recorded as no eggs per 0.1ml and later corrected to eggs per ml of bile. When egg counts were impossible due to heavy egg load a serial dilution technique was adopted but usually corrected to egg/ml of original solution. In case of negative finding to confirm absence of fluke eggs, the original solution. In case of negative finding to confirm absence of fluke eggs, the original solution was allowed to settle and the sediment viewed under the microscope. In such cases the egg counts were not used in the determination of intensity but for evaluating prevalence.

Damaged livers brought to the laboratory were cut into pieces through their bile ducts to remove adult worms. Only worm pieces with the head region (oral/ventral suckers) were grouped into species and counted. the gall bladder of each liver was treated in the manner already described and the egg count recorded (egg/ml).

Adult worms found trapped within the gall bladders were also grouped into species and counted.

RESULTS

A total of 3072 gall bladders from slaughtered cattle were assayed and 74.06 + 6.46% were with fluke eggs from *F. gigantica* and *D. hospes*. the condemned whole livers contained in addition to the two already mentioned, a third species *Schistosoma bovis*. Maximum infection rate of 85.52% was recorded in the mid-rains period (July) while the lowest was in November (Fig. 1A). Fig. 1B&C are curves showing monthly fluctuation of total *F. gigantica* and *D. hospes* infection rates respectively. Prevalence was higher for *D. hospes* during the dry months of the 14 months study period but lower during the rainy season, (May-July). On the whole, the X monthly infection rate due to *D. hospes* was found to be significantly higher than that due to *F. gigantica* in cattle.

$X^2 = 33.85 > 22.36$ @ $p = 0.05$ df = 13.. The mean infection rate for the species were 57.95 ± 6.58% and 48.71 ± 11.66% for *D. hospes* and *F. gigantica* respectively. Despite the higher mean value recorded for the former; the latter had the higher maximum prevalence of 75% as compared to 67.71% A t-test of both means gave a significant difference between the means since 4.32 > 2.05, at p = 0.05. similarly the fluctuation in single infection rates due to the two flukes were compared (Fig. 2B & C) and the pattern was like in Fig. 1 B & C with *D. hospes* being higher at the dry ends and lower mid-rain (April-June). The mean values for single infection were 25.50 + 7.83% and 16.47 + 4.20% for *D. hospes* and *F. gigantica* respectively. the maximum single rate of 35.48% was recorded for the former. A t-test of the mean single rates was significant with 5.83> 2.056, at = 0.05. Fig. 2.A showing fluctuation in double infection rate by the two flukes is evidence that double infection rate by the two flukes is evidence that double was more frequent than single infection involving either of the parasites. the mean value of double was 32.13% as opposed to 25.50% and 16.47% single infection for *D. hospes* and *F. gigantica* respectively. Double infection rate was found to be highest during the rainy season (March - July) when also *F. gigantica* infection rate was also highest. A chi-square test showed that there was significantly higher tendency for double infection to occur in liver fluke infection of cattle than single due to either of the two flukes; $X^2 = 78.70 > 10.38$ at p= 0.001. Another chi-square test relating sampling time to infection rate showed that the later varied significantly with time, $X^2 = 109.88 > 54.05$ at $p = 0.001$, for *F. gigantica* infection, and $X^2 = 159.02 > 54.05$, for *D. hospes* infection.

INTENSITY OF INFECTION:

Maximum bile volume recorded for cattle gall bladders was 1.2 litres and the max. egg count per ml of bile was 50,000, and 60,000 for *F. gigantica* and *D. hospes* respectively. Both values were recorded in August 1981. The mean egg count per ml were 597 and 500 for *F. gigantica* and *D. hospes* respectively. Analysis of variance test showed no significant difference between-X egg output of both parasites Fig. 3 however shows that intensity in naturally infected animals fluctuated to a large degree throughout the survey period. An attempt to relate time and species interaction to egg production by both parasites using an analysis of variance test proved significant for both variables. Egg production was proved to be significantly influenced by time of sampling and species interaction with $F^7{}_{oC}$ being 3.229 and 2.94 respectively. Also a Chi-square test proved that in wild infections *F. gigantica* produced significantly higher numbers of eggs than *D. hospes* throughout the study period. $X^2 = 69.57 > 22.36$ was significant at p = 0.05.

A comparison of egg production in naturally infected animals in dry and wet seasons showed that egg output was significantly higher in the wet than in the dry seasons for both fluke species $X^2 = 32.34 > 0.84$ was significant at p = 0.05. Fig. 4 compares egg production rate in single than in double infection. $X^2 = 193.64 > 34.53$ at p = 0.001. Similar observation was made for *D. hospes* where $X^2 = 142 > 34.53$ at p = 0.001. It was however noted that suppression of egg output in *F. gigantica* was higher than in d. hospes where the observed egg output in mixed was higher than expected. Fig. 5 & 6 is the graphical representation of egg production in double/single infections for *D. hospes*.

Correlation between liver wet wt. worm burden and egg output:

Fig. 7 shows relationship between wet wt and egg load of bile of cottle. the graph gave an impression of a positive correlation between the variables. A scatter diagram was plotted which showed no linear relationship between wet wt and worm burden of *F. gigantica*. A scatter diagram shown in Fig. 8b indicated a positive linear relationship between the variables. the correlation coefficient (r) was calculated and was + 0.7944 which was significant at p = 0.05. Fig. 9 relates worm burden to egg count of bile. the fig indicated an inverse relationship between the variables. However the correlation was not significant.

Effect of the presence of adult worms in the bile on egg output:

The trend observed for X monthly egg output in bile containing adult worms and those not containing adults were similar, indicative that presence of these adults physically within the gall bladder did not increase egg count. Further investigation using regression analysis showed that there was no significant correlation between number of adults in gall bladder and egg production.

Paramphistome infection in cattle:

This fluke disease of the rumen of cattle was recorded from 80-100% of all cattle slaughtered daily in the abattoir for the entire study period.

DISCUSSION

The X infection rate of 74.06 + 6.46% recorded for liver fluke disease of cattle in the present study, compared with 31.7% reported by Babalola and Schilhorn van Veen (1976) confirmed an upward trend in the prevalence of diseases caused by the flukes. This upgrade in livestock diseases was established for *F. gigantica* which is transmitted by a freshwater snail *Lymnaea natalensis* since its prevalence was 48.71 + 11.66. The prominent epidemiological feature of Northern Nigeria which played significant role in this trend is extensive irrigation of arid lands, resulting from new government policies on increased food production. Furthermore it was observed that the recent upgrade in prevalence of fluke diseases was to a larger extent due to increases in *D. hospes* infection rate which had exceeded that of *F. gigantica*. Earlier observation by Schilhorn van Veen *et. al* (1980) in a local slaughter slab showed that mean rates for *F. gigantica* was higher than that of *D. hospes* (65.4% and 56.0%) respectively. In the present study the figures were 48.71 ± 11.66% and 57.95 ± 6.58% respectively for the Jos urban abattoir.

The peak infection rate occurred during the wet season and this was consistent with the observation made by Schilhorn van Veen *et al* (1980), who gave wet season as the peak period for fluke diseases. From graphical representations, it was obvious that the prevalence of *D. hospes* was higher all through the dry season months while that of *F. gigantica* was higher during the rainy season months of the 14 months study. this was consistent with Sequine (1975) report that the infection rate of the ant intermediate host of *D. hospes* was lowest during the humid wet season and increased in the dry season. Also the fact that the wet season high relative abundance of *L. natalensis* correlated with increased prevalence of *F. gigantica* during that season (Schilhorn van Veen *et al* 1980).

In cattle, it was observed that the liver flukes tended to occur more frequently in mixed infections than in single. A similar observation was reported by Schilhorn van Veen *et al* (1980). There is little explanation for this observation apart from the fact that large liver size might tend to promote large worm burden and possibly a variety of species too. This observation was contrary to that observed in smaller ruminants. Mixed infection was higher in the wet season than in the dry and this could be explained by Kendall (1967) observation of a self cure mechanism in cattle infected with *F. gigantica*. If the animal got infected mainly in the wet season extending to early dry season, that would explain the high incidence of mixed infection in that season. With loss of infection deep into the dry season the tendency would be a reduced mixed infection rate during that season.

Evidence from the study of egg output (intensity) e.p.ml showed that the liver flukes were highly prolific with *D. hospes* producing the higher egg count for a single bile sample. This aspect of the epidemiology of the diseases was considered of importance since it related to the transmission dynamics of the worms, and so is an essential base-line information. Little is known about the monthly variation in egg production and other factors that might affect it. In the present study, it was observed, with statistical analysis, that significantly more eggs were produced in the dry than in the wet season. *F. gigantica* on the whole produced significantly more eggs than *D. hospes*. In mixed infections involving both fluke species, a suppression effect was observed since the parasites produced significantly more eggs in single than in mixed infections. This observations was contrary to what was the case in smaller ruminants (goats and sheep). The observed suppression affected *F. gigantica* more than *D. hospes* since for the later worm the observed egg output exceeded the expected but for the former the opposite was the case.

In a series of regression analysis, it was noted that the number of apparently adult worms found in suspension with the gall bladder was not significantly correlated to egg count of the bile; that egg load (e.p.ml) of bile did not correlate significantly to wet weight of liver; that the worm burden of liver was not significantly correlated to egg count. There was however significant positive correlation between liver wet weight/worm burden. the earlier observation showed that some juveniles penetrated the gall bladder and developed in suspension in the bile. the fact that while in suspension they did not increase the egg count significantly would mean that they were unable to attain sexual maturity within the bile or that egg release was inhibited while in suspension in the same substrate. Histological observation of such suspended worms, *D. hospes* and *F. gigantica* showed that they contained eggs. It is therefore likely that egg release is normally prohibited.

Paramphistome infection of the rumen of cattle was very common. this infection of smaller ruminants was reported earlier by Schilhorn van Veen (1980) in his survey in Zaria. the amphistomes are transmitted by freshwater *Bulinus truncatus* (Audouin). this observation indicated that wide distribution of snail vectors of schistosomiasis which also serve to transmit the amphistomes and suggests an equivalent high risk to human communities that grow these livestock to human snail borne diseases.

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