OCCURRENCE OF SALMONELLAE IN HEALTHY FARM CATTLE AND BOVINE SALMONELLOSIS IN TANZANIA

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SUMMARY

The occurrence of *Salmonella* infection in dairy cattle in Tanzania was investigated in 1,495 apparently healthy cattle. Cattle were screened for Salmonella on 18 farms located in five geographical regions of Tanzania and clinical cases of salmonellosis were monitored on five farms surrounding Morogoro town. Six out of the 18 herds were found to be infected. Only calves were found to be infected at the rate of 1.8%. Six salmonella serotypes were isolated viz.: *S. typhimurium* (two), *S. zega* (two), *S. somone* (one), *S. chandans* (one), *S. amager* (one) and *S. grumpensis* (one). Six sporadic incidents of bovine salmonellosis were reported from two farms out of the five monitored in Morogoro. Five serotypes were involved, namely: *S. typhimurium* (two), *S. tabligbo* (one), *S. chandans* (one), *S. heidelberg* (one) and *Salmonella* I, 28: d: (26) (one). It is concluded that the sporadic nature of bovine salmonellosis and the low Salmonella infection rate in dairy cattle in Tanzania may partly be explained by the following reasons: semi - intensive husbandry, inavailability of commercial cattle feeds at the time the study was conducted, hot and dry weather for most of the year.

INTRODUCTION

Salmonella infection in cattle, may be either sub-clinical or clinical. Sub-clinical infection occurs in apparently healthy animals which act as carriers and therefore a source of infection to susceptible animals as well as man. The carriers may also succumb to clinical disease following stress.

Salmonellosis in cattle is mainly caused by *Salmonella dublin* and *Salmonella typhimurium*, other serotypes being less frequently involved (Wray and Sojka, 1977). A carrier state usually occurs in adult cattle and not in calves (Field, 1959).

The rate of salmonella infection in healthy cattle may vary from less than 0.1% to 37% (Field, 1959; Werney and Thimm, 1978 and Garg and Sharma, 1979). Clinical salmonellosis is usually sporadic in adult cattle, while outbreaks are frequent among calves (Buxton, 1957, Carter *et al.*, 1983, Minga *et al.*, 1985).

There are three reports of *Salmonella* infection in cattle in Tanzania (Hummel, 1969 and 1974 and Minga and Kikopa, 1983) two of which are based on Salmonella isolations from diagnostic specimens routinely submitted to the Central Veterinary Laboratory, Dar es Salaam(now the Animal Diseases Research Institute)(Hummel,1969 and Minga and Kikopa,1983). The third report was based on Salmonella isolation from slaughter cattle at Dar es Salaam(Hummel, 1974). There appears to be no published report on the occurrence of *Salmonella* in apparently healthy farm cattle or field cases of bovine salmonellosis and yet such information is useful in gauging the magnitude of the problem and in formulating control measures.

In order to determine the occurrence of salmonella infection in cattle in the country, a one year study (1983/84) was undertaken. Apparently healthy cattle were screened for

salmonella using cultural methods on farms located in five geographical regions of Tanzania, in addition, clinical cases of salmonellosis were monitored on farms surrounding Morogoro town.

MATERIALS AND METHODS

Screening for salmonella among apparently healthy farm cattle:

Eighteen dairy farms were selected for screening on the basis of geographical coverage and accessibility, *viz.* two farms were in the Coast region which is hot(min. and max. temps: 20.6 and 30.6°C) with a relatively high rainfall(1003.4mm p.a.), seven were in Morogoro region which is hot(min. and max. temp: 18.5°C and 29.9°C) ,with average rainfall(858mm p.a.), three farms were in Iringa region which is relatively cold(min. and max. temp:14.3°C and 26.2°C) and with relatively low rainfall(649mm p.a.), three were in Mbeya region which is cold(min. and max. temp:9.0°C and 18.7°C) and has a high rainfall(1746mm p.a.). Three farms were in Arusha which is relatively cold(min. and max. temp: 13.8°C and 25°C) and gets an average rainfall(888mm p.a.). Information on calf management was collected from each farm.

Sampling:

Rectal faeces were obtained from cattle using plastic gloves. On each farm the animals were divided into age groups for sampling. Wherever practicable, the following age groups were sampled: calves up to six months of age, weaners up to one year, heifers up to about two years of age and cows (dry cows and cows in milk). The large size of the herds, economy on media and availability of some of the animals on the day of visit precluded the sampling of all the animals or a fixed number of animals from each farm. The faecal samples were kept in a cold box until cultured. Table 1 shows the number and groups of animals sampled and the type of housing for calves is also recorded. Calves and weaners are shown as calves while heifer and cows are grouped under adults .

Culture for Salmonella sp:

One to two grams of faeces were cultured in 15ml Selenite broth and incubated at 37°C overnight and then subcultured onto Desoxycholate Citrate Agar (DCA). The colourless non-lactose fermenting (NLF) colonies were sub-cultured onto MacConkey agar after overnight incubation. Triple sugar iron agar (TSI), urea media and salmonella polyvalent 'O' and 'H' antisera were used for preliminary identification. Serotyping was carried out at the State Veterinary Serum Laboratory, Denmark.

Retrospective studies of clinical salmonellosis on farms surrounding Morogoro town:

The occurrence of salmonellosis cases on five farms (UN, KIN, ML, LU, MAZ) around Morogoro, were monitored during a one year period (1983/84). Altogether, six incidents of bovine salmonellosis involving six animals were reported from two (UN and MAZ) of the five farms. Follow-up studies were conducted in four of the incidents. Following an incident, rectal faeces from all cattle in that group were screened for *Salmonella*. The six incidents are briefly recorded in Table 3 under results. Culturing and serotyping was done as described above.

Table 1: **Region, farm, total number of dairy cattle per farm and number of faecal samples taken.**

Farm	Adults	Calves	Housing(calves)
Coast:			
KBA	55/294*	51/70	Singles
RU	24/271	0/160	-do-
Morogoro:			
UN	166/197	67/67	Singles
NG	78**/386	29/209	-do-
KIN	64/267	40/160	-do-
ML	32/49	56/86	Groups
LU	30/230	42/150	-do-
MAZ	33/33	26/26	-do-
KILO	50/156	0/81	-do-
Iringa:			
RH	21/29	0/9	Groups
IH	31/181	0/125	Singles
KBE	44/380	55/220	-do-
Mbeya:			
KI	12/1368	38/420	Singles
UY	82/303	20/100	-do-
IW	70/384	31/200	-do-
Arusha:			
UT	46/170	12/78	Singles
CONS	51/67	31/42	Groups
TEN	53/185	56/91	-do-
18 Farms	942/4950	554/2294	

11 Farms:Singles 7 Farms:Groups

* = No. of faecal samples taken / Total No. animals

** = One sample from a feeding trough.

RESULTS

Salmonella infection in apparently healthy farm cattle:

Six herds out of 18 which were screened for *Salmonella* were found to be infected. Five of the infected herds were in Morogoro and one was in Mbeya (Table 2).

There were eleven Salmonella isolates belonging to six serotypes and one rough form. *S. amager* was isolated three times, *S.typhimurium* and *S.zega* were isolated twice, while *S.somone*, *S. chandans* and *S. grumpensis* were each isolated once. All the salmonella isolates were from calves except one which was from a feeding trough (Table 2). Three out of the six farms which housed

Table 2: Salmonella infection in apparently healthy farm cattle

Region and Farm	Isolation rate of Salmonella			% Infection		Salmonella Serotype
	Calves	Adult	Overall	Calves	Adults + Calves	
Coast:						
KBA	0/51	0/55	0/106	0	0	
RU	nd	0/24	0/24	nd	0	
Morogoro:						
UN	2/67	0/166	2/233	3	0.9	1 *S.typhimurium* 1 *S.somone*
NG	0/29	1/78*	1/107	0	0.9	1 *S.zega*
KIN	0/40	0/64	0/104	0	0	
ML	2/56	0/32	2/88	3.6	2.3	1 *S. zega* 1 *S.chandans*
LUS	4/42	0/30	4/72	9.5	5.6	3 *S.amager* 1 *S.grumpensis*
MAZ	1/26	0/33	1/59	3.8	1.7	1 *S.typhimurium*
KILO	nd	0/50	0/50	nd	0	
Iringa:						
RH	nd	0/21	0/21	nd	0	
IH	nd	0/31	0/31	nd	0	
KBE	0/55	0/44	0/44	0	0	
Mbeya:						
KI	0/33	0/12	0/45	0	0	
UY	0/20	0/82	0/102	0	0	
IW	1/31	0/70	1/101	3.2	1.0	1 *Salm. I*
rough						
Arusha:						
UT	0/12	0/46	0/58	0	0	
CONS	0/31	0/51	0/82	0	0	
TEN	0/56	0/53	0/109	0	0	
Total	10/549	1*/942	11/1436	1.8	0.7	11 Salmonella strains

nd = not done

* = The isolate was from a feeding trough for milking cows.

calves together were positive as compared to two out of eleven which housed calves singly (Tables 1 and 2). The chi-square analysis showed however that the difference was not statistically significant ($0.25 > P > 0.10$).

***Salmonella* infection in clinical cases:**

Salmonella serotypes which were involved in clinical salmonellosis are shown in Table 3. Five serotypes were identifided viz. *S. typhimurium* (two cases), *S. tabligbo* (one case), *S. chandans* (one case), *S. heildelberg* (one case) and *Salm. I*, 28: d: 26 (one case).

Table 3: Record of incidents of salmonellosis in cattle farms in Morogoro, Salmonella isolations and follow-up studies

Date of incident and farm	No. of animals affected	*Salmonella* serotype and site of isolation	Follow-up studies Date	No. of *Salmonella* +ve
6/6/1983 (UN)	1 cow died	*S. tabligbo* from internal organs	22/6/83	0/30
16/6/83 (UN)	1 calf died	*S. typhimurium* from internal organs	3/8/83	0/14
5/7/1983 (UN)	1 cow with diarrhoea	*S. typhimurium* from faeces	20/1/84	0/31
29/12/83 (MAZ)	1 cow died	*S. chandans* from internal organs	31/1/84	0/26
27/1/84 (UN)	1 yearling calf died	*S. heidelberg* from internal organs	nd	
15/6/84	1 cow with diarrhoea	*Salm. I*, 28:d:26 from faeces	Not done	

DISCUSSION

The *Salmonellae* isolated were mainly from calves at Farm NG, however *S. zega* was isolated from a feeding trough for milking cows. The source of the *Salmonella* in the feeding trough was not established; it might have been from an infected cow, but other possibilities include vermins, wild birds or even from the animal attendants or animal food.

Six of the 18 herds were found to be infected. In Morogoro, five herds out of the seven screened were infected, as compared to one of eleven in the other four zones. Of the farms screened in Morogoro, three housed calves in groups while in the other four calves were penned singly. In the other zones, only three out of eleven farms housed calves in groups. When the *Salmonella* infection is compared between the different herds in all five zones there was no significant difference between housing calves singly or in groups, probably because the sample size was small or simply that the different methods of calf housing did not play a role in *Salmonella* infection.

A similar study by Linton and others showed that calf housing has influence on Salmonella infections in calves (Linton *et al.*, 1974). In a study of *Salmonella* infection on four farms, Linton and co- workers found *Salmonella*

infection rates of 0.7% and 1.8% in two farms where the calves were penned singly while the infection rates were 8.2% and 11.1% in the two farms where calves were penned in groups of 6 and 15 animals respectively.

In the present study the infection rate was highest in farm LU (9.5%) where up to 150 calves were housed in one large room. The infection rates found at farms UN, ML, IN and MAZ were almost the same (3 - 3.8%). Similar infection rates in calves have been reported in other parts of the world(Field,1959 and Osborne *et al.*,1974), although some other workers have reported lower infection rates while others have found higher infection rates in calves(Buxton, 1957; Rankin *et al.*, 1969; Edel and Kampelmacher, 1971; Osborne *et al.*, 1974; Werney and Thimm, 1978; and Hinton *et al.*, 1984).

In the present study, *Salmonella* was not isolated from adult dairy animals which may result from their semi-intensive husbandry or from the concentrates being compounded locally at the farms and the rations contain little if any animal protein.

One feature is evident in the six incidents of clinical salmonellosis reported in this study (Table 3), all the cases were sporadic and single animals were involved in each incident. Five cases occurred on farm UN but the different incidents were not related since different serotypes were isolated from each of the cases, except for *S. typhimurium* which was involved in two incidents one of which involved a calf while the other involved a cow. Since these two incidents occurred within 19 days of each other, it is possible that the incidents were related. However, it was not possible to study the two isolates further by phage typing or biotyping to confirm the relatedness of the two incidents.

The observations presented here with regard to salmonellosis in adult cattle are in agreement with those of Field who stated that clinical disease in adult cattle was sporadic and seasonal (Field, 1959). Similarly, Hinton noted that salmonellosis manifested by abortion occurred sporadically and that only one or two animals were affected at each incident (Hinton, 1977). However some other workers have reported incidents with the magnitude of outbreaks (Robinson, 1966; Hummel,1969; Van Dreumel *et al.*, 1969; Takesue *et al.*, 1979 and Minga *et al.*, 1985).

As stated previously, dairy cattle husbandry is semi-intensive in Tanzania and this has been shown by other workers to reduce *Salmonella* infection among cattle and hence a build-up of infection and cross-infection will be minimal (Heard *et al.*, 1972), so infection rates will be low and sporadic. At the time this study was conducted, commercial dairy feeds were not available and therefore commercial feeds would not be as important as in other countries where they have shown to be an important vehicle of infection. Like-wise slurry systems which have a potential of contaminating pastures(Jack and Hepper,1969) are not used in Tanzania. In many areas in Tanzania the weather is hot and dry without an overcast sun for over half the year. These factors and probably others as well, are inimical to the introduction, build-up, spread, and maintenance of *Salmonella* infection in cattle. No *Salmonella* was isolated when follow-up cultural studies were made in four incidents. This is in contrast to four outbreaks which occurred in Denmark where there was a prolonged period of Salmonella excretion of up to three months even in some of the animals which had not suffered from clinical disease (Minga *et al.*, 1985).

Salmonella amager was the most frequently isolated serotype from healthy farm cattle in the present investigation and has not been recorded previously in cattle in Tanzania (ADRI Records).

The six cases of bovine salmonellosis are too few to form the basis for a generalized statement regarding the prevalent serotypes which are of importance as causes of bovine salmonellosis in Morogoro. However, the fact that five different serotypes were involved in six incidents indicates that a wide variety of serotypes may cause salmonellosis in cattle in Tanzania.

Hummel observed that *S. typhimurium, S. dublin* and *S. enteritidis* were the only serotypes which could cause clinical disease in cattle in Tanzania, and that the rarer types were of minor importance (Hummel, 1974). The present results however, have shown that the rarer types *viz. S. tabligbo* and *S. chandans* could also cause clinical disease in Tanzania.

Salmonella grumpensis and *S. somone* which were isolated from apparently healthy farm cattle and *S. tabligbo* and *Salmonella I*,28: d: 26 which were isolated from bovine cases are being reported for the first time from animals in Tanzania. The wide diversity of serotypes, some of which appear to be uncommon, whilst reflecting the situation in Tanzania may indicate infection from other sources such as wild life especially reptiles.

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