

## Communications

### Epidemiology of *Salmonella* infections in Trinidadian livestock farms

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Les fèces de 689 animaux domestiques ont été examinées pour rechercher des salmonelles, et les antibiogrammes des isolats ont été établis. Au total, 29 (4,2 p. 100) animaux présentaient des salmonelles. On a rencontré la plus forte prévalence chez les veaux, puisque 14 sur 293 (soit 4,8 p. 100) étaient *Salmonella* positifs, tandis qu'elle était la plus faible chez les chevreaux, aucune salmonelle n'étant détectée chez les 18 animaux examinés. Chez les porcelets, 12 animaux sur 294 (4,1 p. 100) présentaient des salmonelles, alors que ce chiffre s'élevait à 3 sur 84 (3,6 p. 100) chez les agneaux. Il n'y avait pas de différence statistiquement significative ( $p \geq 0,05$ ;  $\chi^2$ ) entre les animaux soumis à une conduite semi-intensive (4,4 p. 100) et ceux élevés de façon intensive (4,3 p. 100), entre les animaux diarrhéiques (5,0 p. 100) et les non diarrhéiques (3,3 p. 100), entre les femelles (5,2 p. 100) et les mâles (3,4 p. 100). Neuf sérotypes ont été isolés, avec une prédominance de *S. hadar*, *S. gaminara* et *S. typhimurium* respectivement chez les veaux, les porcelets et les agneaux. L'existence des deux sérotypes *S. kinshasa* et *S. virchow* est décrite pour la première fois chez des animaux des Antilles. Toutes les souches de salmonelles ont été sensibles à l'ampicilline et à la gentamycine, alors que la résistance aux tétracyclines était élevée (40 p. 100), ainsi qu'à une préparation base de néomycine, sulfaméthazine et sulfathiazole dénommée "triple sulphur" (30,0 p. 100) et à la streptomycine (26,7 p. 100).

**Mots clés :** Bovin - Veau - Caprin - Chevreau - Porcin - Porcelet - Ovin - Agneau - Salmonellose - *Salmonella* - Épidémiologie - Antibiogramme - Sérotype - Diarrhée - Résistance aux produits chimiques - Trinité - Antilles.

### Introduction

In Trinidad and the West Indies in general, there is a lack of information on *Salmonella* infection in livestock especially in association with diarrhoea. Although *Salmonella* species have been isolated from children with gastroenteritis in Trinidad (8), the only available reports on isolation from animals were from slaughter swine (3) and wild-life (5).

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As part of comprehensive study to determine selected enteric pathogens associated with diarrhoea in livestock in Trinidad, this communication reports the frequency of *Salmonella* from calves, piglets, lambs and kids and the antibiograms of the strains.

### Materials and Methods

Between April and September, 1991, through arrangements with field veterinarians who attend to calls by farmers, weekly visits were paid to several livestock farms for evidence of diarrhoeic animals as part of a study to determine the enteric pathogens associated with diarrhoea in Trinidad. Samples were therefore only taken from farms with diarrhoeic animals. Animals were sampled from 25, 20, 8 and 7 farms raising pigs, cattle, sheep and goats, respectively. During each visit, all diarrhoeic animals were sampled and, where possible, samples were also collected from the same number of non-diarrhoeic controls matched for age, sex and breed. A prepared questionnaire was used to find out the age, sex, husbandry system, experience with diarrhoea and ongoing therapy on the farms. During the six-month period, repeated visits were made to several farms following calls reporting cases of diarrhoea, but no animal was sampled twice.

Faecal samples or rectal swabs were collected as earlier described (9) and isolation and identification procedures described for *Salmonella* (10) were used. Serotypings of *Salmonella* isolates were kindly done at the Caribbean Epidemiology Centre (CAREC), Trinidad.

To determine the antibiograms of strains, the antimicrobial discs (Difco, USA) and concentrations used were as follows: tetracycline (30 µg), triple sulphur (300 µg), streptomycin (10 µg), neomycin (30 µg), nalidixic acid (30 µg), kanamycin (30 µg), chloramphenicol (30 µg), ampicillin (10 µg) and gentamycin (10 µg). Tests were conducted by the disc diffusion method of BAUER *et al* (2).

### Results

A total of 689 animals consisting of 293 calves, 294 piglets, 84 lambs and 18 kids were studied. Of these, 175 calves (59.7 %), 179 piglets (60.9 %), 57 lambs (67.9 %) and 10 kids (55.6 %) were diarrhoeic at the time of sampling. For the four animal species studied, semi-intensively managed animals had higher prevalences of diarrhoea than those kept under the intensive management system. A total of 360 male and 329 female animals were studied. All animals considered in this presentation were less than 6 months old.

In total, 29 (4.2 %) of 689 young livestock sampled were shedding salmonellae. The prevalence of salmonellae was highest amongst calves (4.8 %) and least in kids with no isolation made. Twelve (4.1 %) of 294 piglets and

## Communication

3 (3.6 %) of 84 lambs sampled were positive for salmonellae. The differences in prevalence were, however, not statistically significant ( $P \geq 0.05$ ;  $\chi^2$ ).

Intensively-managed animals had the same *Salmonella* prevalence of 4.3 % (24 of 562) as that detected amongst semi-intensively kept animals 4.4 % (5 of 114). No strain of *Salmonella* was, however, isolated from animals kept under the extensive management system. A larger number of diarrhoeic animals, 5.0 % (21 of 421) yielded salmonellae than non-diarrhoeic controls, 3.0 % (8 of 268), but the difference was not statistically significant.

Twelve of 360 males (3.3 %) and 17 of 329 females (5.2 %) tested were positive for salmonellae.

A total of nine serotypes were isolated with a predominance of *S. hadar* (7 of 15), *S. gaminara* (5 of 12) and *S. typhimurium* (3 of 3) amongst strains from calves, piglets and lambs, respectively. *S. typhimurium* was the only serotype commonly isolated from calves, piglets and lambs while the other serotypes of strains isolated from calves were distinctly different from those recovered from piglets. In calves, other isolated serotypes were *S. typhimurium* (1 isolate), *S. newport* (4), *S. virchow* (1), *S. kinshasa* (1) and *S. infantis* (1). In piglets, other isolated serotypes were *S. agona* (3), *S. derby* (2) and *S. typhimurium* (2). A calf was positive for serotypes *S. hadar* and *S. newport*. Twenty-two (73.3 %) of the 30 isolates of *Salmonella* were recovered from diarrhoeic animals compared to only 8 (26.7 %) strains recovered from non-diarrhoeic controls.

All calves positive for *Salmonella* were aged 2 to 7 weeks while the age groups of piglets and lambs positive to *Salmonella* were 2 to 8 weeks and 4 to 6 weeks, respectively.

All 30 strains were sensitive to ampicillin and gentamycin, but resistance was rather high to tetracycline (40.0 %), triple sulphur (30.0 %) and streptomycin (26.7 %). Resistance was highest to tetracycline and streptomycin amongst isolates from calves with 7 (46.7 %) of 15 each resistant.

Fifteen (50.0 %) out of 30 isolated strains were sensitive to all 9 antimicrobial agents tested whilst 3, 7, 4 and 1 strains were resistant to one, two, three and four antimicrobial agents, respectively. The most common patterns were streptomycin-tetracycline (4 strains), tetracycline-triple sulphur (3 strains) and streptomycin-tetracycline-triple sulphur (3 strains).

### Discussion

Failure to detect a statistically significant association between isolation of *Salmonella* and occurrence of diarrhoea in the experimental animals was a surprise. This is because salmonellae have been associated with diarrhoea in livestock (11, 15, 16). HULL *et al.* (8) in the

same environment established a correlation between isolation of *Salmonella* and occurrence of diarrhoea in children in Trinidad.

KWAGA *et al.* (9), however, found a similar lack of association between *Salmonella* infections and diarrhoea in cattle in Nigeria. A factor that may be partly responsible is that the clinical disease is most common in calves 2 to 4 weeks old and a small proportion of animals remain infected after clinical recovery (12). In the present study, one-day to 6 month-old calves were sampled. Other factors that may be important are the role of maternal immunity in young animals and the presence of recovered or recovering carriers which may, at sampling time, be non-diarrhoeic but shedding salmonellae. The fact that samples were only collected from farms with diarrhoeic animals should not be ignored either.

The rates of isolation of salmonellae from intensively and semi-intensively managed farms were similar. It has been suggested that *Salmonella* are isolated with a higher frequency from animals under the intensive husbandry system, because it is conducive to the spread of infection (14). It is however known that variables such as type of specimen and techniques of isolation influence the rate of isolation (6) while management practices within each of the systems may also affect spread of *Salmonella* between animals.

The well documented diversity of *Salmonella* serotypes (6) was evident with nine different serotypes detected amongst 30 strains of *Salmonella*. *S. typhimurium*, a serotype, which together with *S. dublin*, *S. cholera-suis* and *S. abortus-ovis* were responsible for 91.6 % of *Salmonella* infections in animals in England and Wales (17) again exhibited its being ubiquitous with its isolation from the three animal species positive for *Salmonella*.

The isolation of two serotypes, *S. gaminara* and *S. virchow*, hitherto unreported in livestock in Trinidad but earlier documented in human infections confirms the introduction of new serotypes into farm animals.

It was of interest to detect a clear-cut predominance of *Salmonella* serotypes in the 3 animal species positive for the organism, *S. hadar* in calves, *S. gaminara* in piglets and *S. typhimurium* in lambs. These serotypes may have aetiological significance since 6 of 7 isolates of *S. hadar*, 4 of 5 porcine isolates of *S. typhimurium* were recovered from diarrhoeic animals. Establishment of the complete absence of all other enteric pathogens in the animals infected by these serotypes is needed to confirm their significance. It is, however, necessary to consider these serotypes in the epidemiology of salmonellosis in the different animal species.

The prevalence of antibiotic resistance amongst *Salmonella* strains from livestock in Trinidad is much higher than that reported for developed countries like the United Kingdom (18), New Zealand (7) and the USA (13). A

similar prevalence of resistance to antibiotics was, however, reported for sheep and goat isolates of *Salmonella* in Nigeria.

The detection of a relatively high prevalence of resistance (30.0 %) to triple sulphur was not a surprise. This may be due to the fact that a commonly used anti-diarrhoeal preparation, available in almost all farms visited, contained neomycin, sulfamethazine and sulfathiazole, the latter two agents in high concentrations. The uncontrolled use of these anti-diarrhoeal drugs may have resulted in the development of resistance amongst *Salmonella* isolates in livestock.

In conclusion, it is difficult to ascribe any aetiological significance to the *Salmonella* serotypes isolated because their prevalences in the diarrhoeic and non-diarrhoeic livestock were not significantly different. The possible role of other enteropathogens not assayed for in obscuring any existing trend cannot be ignored. Finally, a commonly used anti-diarrhoeal preparation in Trinidad may be responsible for a relatively high resistance to triple sulphur.

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**Key words :** Cattle - Calf - Goat - Kid - Pig - Piglet - Sheep - Lamb - Salmonellosis - *Salmonella* - Epidemiology - Antibiogram - Serotype - Diarrhoea - Chemical resistance - Trinidad - West Indies.