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PREVALENCE OF *ESCHERICHIA COLI* AND *SALMONELLA* SPECIES IN DIARRHOEIC CALVES OF SEDENTARY FULANI HERDS AND AN INSTITUTIONAL FARM IN GIWA LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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ABSTRACT
The multifactorial nature of calf diarrhoea constitutes the basis for its debilitating effects on the progress of cattle production. In this study, Escherichia coli and Salmonella species were identified in diarrhoeic calves of Sedentary Fulani Herds (SFH) and an Institutional Farm (IF) in Giwa Local Government Area, Kaduna State. A total of 50 diarrhoeic calves comprising of 34 from SFH and 16 from the IF were sampled. Rectal faecal samples were obtained from each calf, and subjected to bacteriological examination using standard techniques. Results revealed an overall prevalence of 72.0% (95% CI = 59.5–84.4) with prevalence of 12.0% (95% CI = 3.0–21.0) recorded for E. coli O157:H7, 44.0% (95% CI = 30.2–57.8) recorded for other E. coli and 16.0% (95% CI = 42.2–69.8) recorded for Salmonella sp. In Sedentary Fulani herds, prevalence of 14.7% (95% CI = 95% CI = 2.8–26.6), 41.2% (95% CI = 95% CI = 24.7–57.7), and 11.8% (95% CI = 1.0–22.6), were recorded for E. coli O157:H7, other E. coli, and Salmonella sp., respectively. In the Institutional Farm, the prevalence recorded for E. coli O157:H7, other E. coli, and Salmonella sp., were 6.3% (95% CI = -5.6–18.2), 50.0% (95% CI = 25.5–74.5) and 25.0% (95% CI = 3.8–46.2), respectively. This study demonstrated E. coli and Salmonella sp. as pathogens in calf diarrhoea. Therefore, preventive measures should be implemented to minimize interaction of calves with these pathogens so as to reduce the occurrence of calf diarrhoea.
Keywords: calf diarrhoea, *E. coli*, *Salmonella*, Sedentary, Institutional

INTRODUCTION
Calf diarrhoea (CD) remains an important problem of calf rearing in dairy farms as it causes significant losses worldwide (Justyna *et al.,* 2015). The economic implications of calf diarrhoea included calf losses, treatment and time costs and reduced live weight gain (Lorenz, 2006). Multiple pathogens such as bacteria, viruses and parasites have been incriminated in calf diarrhoea (Acha *et al.,* 2004: Chalmer *et al.,* 2011; Bhat *et al.,* 2013). Infected animals constituted the primary reservoir for these pathogens with their faeces serving as the common source of environmental contamination. These pathogens are mainly transmitted via the faeco-oral route either by infected dam or other calves (Scott *et al.,* 2004). However, some non-infectious factors which contributed significantly to disrupted calf rearing, mortality and morbidity included management during calving season, access of the calf to colostrum, calf housing, feeding system and hygiene (Justyna *et al.,* 2015). Hence, the control and prevention of calf diarrhoea is posed with challenges resulting from this multifactorial nature of the disease (Hamnes *et al.,* 2006). In Northern Nigeria, there is paucity of information on calf diarrhoea associated with *Escherichia coli* and *Salmonella* in Fulani Herds. Hence in this study, *Escherichia coli* and *Salmonella* sp were identified in diarrhoeic calves of Sedentary Fulani Herds and an Institutional Farm in Giwa Local Government Area, Kaduna State, Nigeria.

MATERIALS AND METHODS

Study area

The study was carried out in selected Sedentary Fulani Herds and an Institutional farm at Giwa Local Government Area (LGA), Kaduna State. Giwa lies between latitude 11º and 18´N and between longitude 7º and 27´E, with an average annual maximum and minimum temperatures of 31.8 ± 3.2ºC and 18.0 ± 3.7ºC, respectively. The monthly average relative humidity is 71.1 ± 9.7%. Two districts and two villages in Giwa LGA (Shika and Tsibiri districts; Biye and Mahuta villages) were used in the study.

Study population and sample collection

Calves with evidence of diarrhoea in the selected Sedentary Fulani herds and Institutional Farm with herd sizes greater than 20 animals whose owners consented to the study were sampled.

Faecal samples from all diarrhoiec calves in the selected Sedentary Fulani herds and Institutional Farm were taken aseptically using clean polythene bags. A total of 50 faecal samples (34 from Sedentary Fulani herds and 16 from Institutional farm) were collected for this study. The samples were placed on an ice pack and transported to the bacteriology Laboratory of Veterinary Public Health and Preventive Medicine Laboratory of the Ahmadu Bello University, Zaria for culture and isolation

Bacteriological culture and isolation

Bacteriological culture and isolation was carried out using standard bacteriological techniques.

Biochemical characterization

The conventional biochemical tests were carried out on the isolates as earlier described by Khandaghi *et al.* (2010).

Data Analysis

Data were presented using tables. Prevalence was calculated and subjected to Chi-square analysis for differences. Values of $P \leq 0.05$ were considered significant.

RESULTS

Out of the 50 diarrhoeic calves examined, bacteria were isolated in 36 (72.0%; 95% CI = 59.5 – 84.4) in which *E. coli* had prevalence of 56.0% (28/50; 95% CI = 42.2 – 69.8) and 16.0% (8/50; 95% CI = 42.2 – 69.8) recorded for *Salmonella* sp. (Table 1). Based on location, Sedentary Fulani herd recorded a prevalence of 67.6% (23/50; 95% CI = 51.9 – 83.3) and 81.3% (13/50; 95% CI = 61.8 – 100.2) were from the Institutional Farm, and these showed no significant ($P > 0.05$) difference in prevalence based on location (Table 2). In Sedentary Fulani herds, prevalence of 14.7% (5/34; 95% CI = 2.8 – 26.6), 41.2% (14/34; 95% CI = 24.7 – 57.7), and 11.8% (4/34; 95% CI = 1.0 – 22.6), were recorded for *E. coli* O157:H7, other *E. coli*, and *Salmonella* sp., respectively, and these were significantly ($P < 0.05$) different. In the Institutional Farm, the prevalence recorded for *E. coli* O157:H7, other *E. coli*, and *Salmonella* sp., were 6.3% (1/16; 95% CI = -5.6 – 18.2), 50.0% (8/16; 95% CI = 25.5 – 74.5) and 25.0% (4/16; 95% CI = 3.8 – 46.2), respectively, and these showed significant ($P < 0.05$) differences (Table 2).

DISCUSSION

Diarrhoea in calves constitutes one of the leading causes of morbidity and mortality with consequent economic losses to the cattle industry, and several species of bacterial pathogens have been incriminated. From this study, the overall detection of *E. coli* and *Salmonella* sp. was 72.0% with distribution of 12.0% (*E. coli* O157:H7), 44.0% (other *E. coli*) and 16.0% (*Salmonella* sp.) in Sedentary Fulani herd (67.6%) and Institutional farm (81.3%). This overall detection rate is lower than the 93.7% reported in Egypt (El-Seedy *et al*., 2016). The 56% detection rate recorded for *E. coli* is higher than the 25% (Yeshiwas and Fentahun, 2017) reported in Ethiopia but lower than the 63.2% (Olaogun *et al*., 2016) reported in Nigeria (Oyo and Ogun States). The 16.0% detection rate for *Salmonella* sp. is lower than the 52.6% (Olaogun *et al*., 2016) reported in Nigeria (Oyo and Ogun States) and 18.1% (El-Seedy *et al*., 2016) in Egypt but higher than the 13% (Eguale *et al*., 2016) in Ethiopia. Differences in sex, age, breed, immune status of calves, farm size, geographical location, season, management system and detection method might be responsible for the variations between detection rates observed in this study and those by other researchers.

Table 1:Overall occurrence of *Escherichia coli* and *Salmonella* sp. in diarrhoeic calves in Sedentary Fulani herds and an Institutional farm in Giwa Local Government Area, Kaduna State, Nigeria

	Number examined	Number positive	Occurrence (%)	95% CI
Escherichia coli	50	28	56.0	42.2 – 69.8
Salmonella sp.	50	8	16.0	5.8 – 26.2
Total	50	36	72.0	59.5 – 84.4

Table 2:Distribution of *Escherichia coli* and *Salmonella* sp. isolated from diarrhoeic calves in Sedentary Fulani herds and an Institutional farm in Giwa Local Government Area, Kaduna State, Nigeria

	Sedentary Fulani Herd	95% CI	Institutional Farm	95% CI	Total	95% CI
Number of diarrhoeic calves	34		16		50	
Number of calves positive for *E. coli* O157:H7	5(14.7)	2.8 – 26.6	1(6.3)	-5.6 – 18.2	6(12.0)	3.0 – 21.0
Number of calves positive for other *E. coli* n(%)	14(41.2)	24.7 – 57.7	8(50.0)	25.5 – 74.5	22(44.0)	30.2 – 57.8
Number of calves positive for *Salmonella* sp.	4(11.8)	1.0 – 22.6	4(25.0)	3.8 – 46.2	8(16.0)	5.8 – 26.2
Total	23(67.6)	51.9 – 83.3	13(81.3)	61.8 – 100.2	36(72.0)	59.5 – 84.4

The higher occurrence of *E. coli* and *Salmonella* sp. in Institutional farm compared to Sedentary Fulani herd might be due to decreased immune status of calves resulting from decreased colostrum intake. Cattle in Sedentary Fulani herd comprised of white Fulani breed which are believed to be most resistant to infections among Zebu cattle, thus are less susceptible to calf diarrhoea. This might be another possible reason for higher occurrence in Institutional farm compared to Sedentary Fulani herd. The extensive management system in Sedentary Fulani herd might have resulted in continuous exposure to these infectious agents leading to adaptation to the local microflora and development of immunity (Hailemariam *et al*.,1993). The semi-intensive management system in Institutional farm might have resulted in an unhygienic condition and poor maternal immunity in calves resulting in increased susceptibility to these bacterial agents of calf diarrhoea. Also, animals under semi-intensive management system might have been fed with contaminated concentrates, hay and forages, thus lack option of feeds (Olaogun *et al*., 2016) and so are exposed these agents.

The enterotoxigenic *E. coli* (ETEC) strain that produce K99 (F5) adhesion antigen (commonly referred to as *E. coli* K99+) and heat-stable enterotoxin are most implicated in neonatal diarrhoea, although other *E. coli* pathogroups have been involved (Nataro and Kaper, 1998). *Escherichia coli* induce diarrhoea by infection of the

gut epithelium, multiplication in the enterocytes, vilous atrophy and up-regulation of chloride secretion into the gut by heat-stable toxin leading osmotic pulling of water into the lumen, hence, secretory diarrhoea (Cho and Yoon, 2014). In *Salmonella*-induced diarrhoea in calves, *Salmonella* pathogenicity island 1 (SPI-1) and SPI-5 were suggested to influence the type III secretion system leading to secretory diarrhoea (Collazo and Galán, 1997).

CONCLUSION

This study demonstrated *E. coli* and *Salmonella* sp. as potential pathogens in calf diarrhoea. Therefore, preventive measures should be implemented to minimize interaction of calves with these pathogens so as to decrease the occurrence of calf diarrhoea.

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