Calf Diarrhea: Epidemiological Prevalence and Bacterial Load in Oyo and Ogun States, Nigeria

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Abstract

Key words:
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Diarrhea in calves is one of the most important causes of calf morbidity, mortality and economic losses. The prevalence of diarrhea in calves was studied in 12 farms in Oyo and Ogun states in South Western Nigeria. A total of 825 calves up to 6-months old were sampled over a period of 12 months with 120 (14.5%) of the calves showing signs of diarrhea. Faecal samples of diarrheic calves (n=120) were collected, and screened for bacterial pathogens using standard laboratory procedures. In Oyo and Ogun States, highest prevalence rates of calves with diarrhea were noticed in two farms of Oyo State 50% (25 out of 50 calves) and Ogun State 23% (12 out of 52 calves) were recorded respectively. Only 19 (15.8%) of the 120 calves had bacterial pathogens; Of the calves (n=19) where bacteria were isolated *Escherichia coli* was isolated from 12 calves (63.2%), Salmonella species was isolated from 10 calves (52.6%) and Campylobacter species was isolated from 1 calf (5.3%). The lowest levels of bacterial detection were seen in diarrheic samples from White Fulani calves (8.9%) with the highest levels seen in samples from Jersey calves (50%). Calves of 0-2 months had positivity bacterial cause of diarrhea of 18.4%, calves between 3 and 4 months had positivity of 8.8% and calves of 5-6 months had positivity of 20%.Bull calves had 17.0% positivity while heifers had 14.8% positivity among diarrheic calves. Calves having severe diarrhea had highest percentage positivity (26.1%) of bacterial isolates while calves with moderate diarrhea had the least percentage positivity (13.6%). Calves reared in semi intensive system of management were the most susceptible (18.0%) while those reared under extensive system were least susceptible (13.6%) to bacterial scours. Therefore, *Escherichia coli*, Salmonella and Campylobacter organisms were most prevalent in calf scours. Age, breeds, sex, severity of diarrhea and system of management are predisposing factors of calf diarrhea.

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1. INTRODUCTION

Livestock is an integral part of the Nigerian agricultural production system and it plays a significant role in national development especially as related to the national agricultural transformation agenda policy of the present government of the Federal Republic of Nigeria. It also plays an important role in socio-economic development of millions of rural households (CBN, 1999). Young animals suffer higher mortality than their adult counterparts and this has a major devastating effect on the economy of livestock industry (Radostits et al., 2010). Calf diarrhea is a multifactorial disease entity that can have serious financial and animal welfare implications in both dairy and beef herds. It has been estimated that 75% of early calf mortality in dairy herds is caused by acute diarrhea in the pre-weaning period (Svensson et al., 2006). Diarrhea in farm animals, especially in young cattle is one of the most frequently encountered clinical syndromes by practicing large animal veterinarians. The economic losses occur not only from mortality, but also from morbidity; treatment costs and time spent on care as well as subsequent chronic ill-thrift nature of calf diarrhea and associated reduction in growth rate (Bazeley, 2003). Overfeeding, overpopulation, cold temperature, bad hygiene, artificial feeding and colostrum deprivation are all predisposing factors which can play significant role in the complex etiology of the disease. High calf morbidity and mortality risks represent a major economic loss to the dairy operations (Svensson et al., 2006). In livestock, the commonest cause of calf-hood disease is diarrhea (Wudu et al., 2008), which is always often associated by pneumonia, joint ills and septicemia (Razzaque et al., 2009). In parts of south

western Nigeria, there is paucity of data and information on the clinical prevalence, associated bacterial pathogens of calf diarrhea and variation to susceptibility to the disease in relation to breed, age, sex and system of management in cattle herds. This work was therefore aimed at studying the prevalence of calf diarrhea, associated bacterial organisms and predisposing factors of the disease in 12 cattle herds in Oyo and Ogun states of Nigeria.

2. MATERIALS AND METHODS.

2.1 Study locations
The study was carried out in different cattle farms in Oyo and Ogun States of southwestern Nigeria during the period of January to December, 2014. Twelve different farms, comprising of six farms per state, were visited in the course of the study, the farms were chosen based on their system of management, production type and accessibility for sampling and the farms were subsequently selected based on the outbreak of the condition in the various farms at that period. The farms were identified as A1, B1, C1, D1, E1 and F1 for Oyo state while A2, B2, C2, D2, E2 and F2 were farms in Ogun State. Segregation of sick and apparently healthy calves and examination were carried out carefully using the methods described by Radostits et al. ,(2010), based on behavioral changes, persistent passage of watery and not well formed feaces with odour. A total of 825 calves were sampled comprising 401 (49%) in Oyo and 424(51%) in Ogun states with 498 females and 327 males.

2.2 Age estimation
Age of each calf was determined using the technique of dentition as described by Lasisi et al. (2002) together with farm records where available.

2.3 Breeds of animals
Breeds of all the calves were identified using farm records with morphological features which distinguishes them such as horn shape, body size and coat color as described by Kugonza et al. (2011); Terefe et al. (2015)

2.4 Systems of management
Majority of the farms sampled were on extensive system of management, while few were on semi-intensive system where animals were allowed to graze and having their feed supplemented with concentrates (such as dried cassava peel, wheat offal, maize, guinea corn and ground nut shaft and extracts). This was established from the history, personal interaction with the farm owners and visible assessment of the farm locations and the animals.

2.5 Isolation and identification of bacterial pathogens from diarrheic calves

2.5.1 Collection of samples
A total of 120 faecal samples were aseptically collected directly from the rectum with sterile hand glove from each of the calves showing clinical manifestations of calf diarrhea. Animals manifesting diarrhea with or without blood or mucous were taken to be diarrheic. The samples were kept in cooler with ice packs from the site of collection to the Department of Microbiology, University College Hospital, Ibadan for isolation and characterization of bacterial pathogens. Isolation and identification of bacterial pathogens were performed according to procedures described by (Marchant and Packer,1967; OIE,2000; Cowan et al., 2004).

2.5.2 Isolation and identification of the bacterial from fecal samples
Sterile wire loop was used to pick a small faecal sample after homogenizing the sample with an applicator stick. A streak of the sample picked was made on the solidified agars and broth. The MacConkey agar, Salmonella Shigella agar and Selenite F broth were incubated at 37^0C for 24 hours at room temperature. Campylobacter agar was incubated at 42^0C for 48hours under anaerobic conditions. Sub cultures of the organisms were made by streaking pure characteristic colonies with a sterile wire on the agar plates and incubated as well. Bacteria isolated were identified microscopically by gram staining and by biochemical tests according to (Marchant and Packer,1967; OIE,2000;Cowan et al., 2004).

2.6 Statistical Analysis
All parameters were subjected to one way analysis of variance (ANOVA) to determine the level of their significance as previously described by (Norman and Baily ,1997) using Microsoft excel 2010

3. RESULTS
In this study, only 120 (14.54%) of the 825 calves sampled, showed signs of diarrhea (where there were 88 calves from farms in Oyo State and 32 calves from farms in Ogun State). The highest prevalence of diarrhea recorded in affected animals in farms from Oyo State was up to 50% (Table 1) and the incidence varied among farms. The highest prevalence of diarrhea recorded in affected animals in farms from Ogun state was up to 23% (Table 2) Oyo state had 88 out of 120 diarrheic calves (73%)

compared to Ogun state that had 32 out of 120 diarrheic calves (27%) (Table 1 and Table 2). A total of 120 samples from calves manifesting diarrhea with varying degree of severity were analyzed for *E.coli*, salmonella and campylobacter organisms. *E. coli* (n=12) was isolated in three farms, Salmonella spp was isolated in 10 different samples from four farms, while Campylobacter spp was seen in one sample from one farm, there was correlation between symptoms and pathogens (e.g bloody diarrhea) especially in farm F1 where we had highest occurrence of E.coli 0157 STEC organisms (Table 3). Predisposition to breed susceptibility of calf diarrhea revealed that Jersey breed had highest susceptibility 2 out of 4 (50%), followed by Jersey crosses 3 out of 8 (37.50%), while White Fulani had the least susceptibility 4 out of 45 (8.90%), and followed by Sokoto Gudali breed 6 out of 49 (12.20%), to calf diarrhea (Table 4). Age of susceptibility to calf diarrhea also showed that calves within age brackets 5-6 months had the highest susceptibility 2 out of 10 (20%) while calves within age brackets 3-4months had the least susceptibility 3 out of 34 (8.80%) (Table 5). Variation in susceptibility to calf diarrhea in relation

to sex revealed male calves showing the highest susceptibility 10 out of 59 (16.95%), while female calves had 9 out of 61 (14.75%) level of susceptibility (Table 6). It was also discovered from the study that calves showing severe diarrhea had the highest percentage bacterial positivity 6 out of 23 (26.09%), whereas calves manifesting moderate form of diarrhea had the least percentage bacterial positivity 5 of 38 (13.16%) (Table7). Percentage susceptibility to calf diarrhea in relation to the systems of management indicated highest susceptibility in semi intensive system 11 out of 61 (18.03%), while extensive system of management revealed slightly lower susceptibility rate 8 out of 59 (13.56%) (Table 8). Analysis of Variance for management system to susceptibility of bacterial scours gave level of significance to be 0.590, while its value of age of susceptibility to calf scours was 0.420. ANOVA value for sex predisposition to calf scours was 0.744, ANOVA of breeds of cattle to susceptibility gave a value of 0.102, while ANOVA of severity/nature of diarrhea to scours susceptibility gave 0.331.These indicate no significance in any of the criteria to calf scours susceptibility.

Table 1: Prevalence of diarrhea in calves from six farms in Oyo state, Nigeria.

Farm	Total No. of calves sampled	Number (%) of calves not diarrheic	Number (%) of calves diarrheic	Prevalence of diarrhea (%)
A1	70	64 (91)	6 (9)	8.6
B1	50	25 (50)	25 (50)	50
C1	63	54 (86)	9 (14)	14.3
D1	71	64 (90)	7 (10)	9.9
E1	75	63 (84)	12 (16)	16
F1	72	43 (60)	29 (40)	40.3
Total	401	313 (78)	88 (22)	21.9

Table 2: Prevalence of diarrhea in calves from six farms in Ogun state, Nigeria.

Farms	Total calves sampled	Number (%) of calves not diarrheic	Number (%) of calves diarrheic	Prevalence of diarrhea (%)
A2	100	97(97)	3(3)	3
B2	82	78(95)	4(5)	4.9
C2	87	78(90)	9(10)	10
D2	43	41(95)	2(5)	4.7
E2	60	58(97)	2(3)	3
F2	52	40(77)	12(23)	23
Total	424	392(92)	32(8)	8

Table 3: Prevalence of *Escherichia coli*, Salmonella and Campylobacter organisms in diarrheic calves from studied farms in Oyo and Ogun states, Nigeria.

Farms	NO.OF samples from diarrhoiec calves	NO. POSITIVE	NO. NEGATIVE	E.COLI 0157	SALMONELLA	CAMPYLOBACTER
(A1)	6	2	4		2+	
(B1)	25	0	25			
(C1)	9	0	9			
(D1)	7	2	5		2+	
(E1)	12	2	10	2+		
(F1)	29	9	20	8+	5+	1+
(A2)	3	3	0	2+		
(B2)	4	1	3		1+	
(C2)	9	0	9			
(D2)	2	0	2			
(E2)	2	0	2			
(F2)	12	0	12			
Total	120	19	101			

Table 4: Breed distribution of calves with diarrhea

BREED	TOTAL SAMPLE	POSITIVE	NEGATIVE	% POSITIVE
WHITE FULANI	45	4	41	8.90%
SOKOTO GUDALI	49	6	43	12.20%
RED BORORO	5	1	4	20%
N'DAMA	3	1	2	33.30%
JERSEY	4	2	2	50%
JERSEY CROSSES	8	3	5	37.50%
WHITE FULANI CROSS	6	2	4	33%

Table 5: Age distribution of calves with diarrhea.

AGE	TOTAL SAMPLED	POSITIVE	NEGATIVE	% POSITIVE
0-2 MONTHS	76	14	62	18.42%
3-4 MONTHS	34	3	31	8.80%
5-6 MONTHS	10	2	8	20%

Table 6: Sex distribution of calves with diarrhea

SEX	TOTAL SAMPLE	POSITIVE	NEGATIVE	% POSITIVE
MALE	59	10	49	16.95%
FEMALE	61	9	52	14.75%

Table 7: The severity of calve diarrhea in the study farms and their percentage bacteria positivity

SEVERITY OF DIARRHEA	TOTAL	POSITIVE	NEGATIVE	% POSITIVE
MILD	59	8	51	13.56%
MODERATE	38	5	33	13.16%
SEVERE	23	6	17	26.09%

Table 8: Management systems and calf diarrhea outbreak in the study farms

MANAGEMENT SYSTEM	TOTAL	POSITIVE	NEGATIVE	% POSITIVE
SEMI INTENSIVE	61	11	50	18.03%
EXTENSIVE	59	8	51	13.56%

4. DISCUSSION

The prevalence of diarrhea among all calves in this study was 14.54%. This finding is similar to the findings of Olsson et al. (1993) and Viring et al.(1993) in which the workers observed low prevalence of calf diarrhea in Swedish herds. Results from studies in other countries show higher prevalence rates of diarrhea especially (McDonough et al.,1994). Findings in our study revealed that one farm each from the two states of study had high prevalence rate of calf diarrhea. This finding is in agreement with the finding of Acha et al.(2004) where they discovered high prevalence in one farm in each of the two different locations sampled. These relatively high prevalence rates might be associated with the relative large herd sizes in the two farms, operating semi intensive system of management with unhygienic practices which may precipitate more cases of diarrhea in calves. Bacteria are parts of the many major causes of scours in calves. Very few of the sampled calves were positive for pathogenic bacterial causes of scours which included *E. coli, Salmonella* spp and very rarely C*ampylobacter* spp, this findings affirms the work of Raji (2014) .This present work also confirms the work of Nasr et. al. (2014) where they reported similar prevalence of E.coli, followed by Salmonella and others in pathogenic bacteria associated enteritis in lambs in Behera provinces,Egypt. who described *E. coli* as the leading cause of diarrhea in Nigeria cattle. However, our finding also correlates with the findings of Hoque and Samad, (1996) who isolated 9.61% *Salmonella* from calves, Joon and Kaura,(1993) that isolated 23(23%) *E. coli* and 5 (5%) *Salmonella* from 100 fecal samples, our findings also agreed with El-Rahman et al. (2016) where they detected that 13% of diarrheic calves and 6.6% of diarrheic cattle, were positive to Salmonella organism, The results are not in agreement with the result of Hemashenpagam et al.,(2009) who isolated 75% *E. coli* (12 positive samples from 16 samples) and the work of Oporto et al., (2008) who reported that the prevalence of *E. coli* in bovine herds was 35.9%. That Jersey breed had the highest susceptibility to calf diarrhea is

worth noting and that White Fulani breed had the least susceptibility to calf diarrhea. This observation agrees with the deduction of many researchers that white Fulani breed of cattle seems to be the most resistant breed to infections among the zebu breeds of cattle, as the Jersey breed is less resistant. Zebu cattle are indigenous while Jersey cattle are exotic, therefore the former are adapted to the unhygienic environments with their robust immunity solidly built while the latter are more susceptible to infectious agents, Zebu cattle are well adapted to the local microflora which has occurred overtime. While the placement of Jersey cows perturbs what might be their natural microflora in addition to the potentially harsher conditions in Nigeria making them more susceptible to local strains (Hailemariam et al.,1993).

Calves in age group 3 to 4 months were least susceptible while that age group 0-2 months and 5-6 months were more resistant. The high resistance shown by calves in age group 0-2 months is in agreement to other findings that the incidence of disease is lowest during the early age. Groutides and Michell,(1990) suggested that resistance is due to passive immunity acquired from the colostrum and absorbed into the circulation from the gut. The result also shows that the calves with severe diarrhea had highest percentage positivity to bacterial scours. This affirms the virulent ability of the organism to destroy the mucosa of the intestinal lining which affects the absorption and secretion ability of the gastro intestinal system and result in profuse watery foul smelling diarrhea.

Management system of the farm also played a role in bacterial scours. The semi intensive system of management had high percentage positivity to the disease while that with an extensive system of management had low percentage of positivity. It can be inferred that calves reared in extensive management have low risk of infection and are more resistant while those reared in semi intensive are exposed to causes of infection and less resistant to infection. Reasons for this could be poor hygiene in semi intensive, feeding animals with contaminated concentrates, hay and forages. The inability of the

animal to make choice of what to eat could also be a contributing factor (Lorenz et al.,2011). Therefore, adequate and necessary attention should be given to management of calf by ensuring that the environment where calving takes place is disinfected properly from bacteria from previous calving, colostrum is taken by calf in the first few hours of life, in case of difficultly in feeding, and calf should be hand fed with feeders. Overcrowding of calves and lack of proper ventilation of the pen is also a risk factor and should be prevented as much as possible. Calf kept in housed pens should be housed individually in clean pens. Farms practicing semi intensive system of farming should pay utmost attention to hygiene since they are at greater risk of the infection. We acknowledged limiting ourselves to isolation of bacterial pathogens in calves diarrheic cases in the course of this study due to the facts that other etiological agents such as viral, parasitic, fungal and even mycotic agents are not as common as bacterial pathogens, also approach to management of this condition require the use of an appropriate and most sensitive antibacterial agent. There are needs for further study to elucidate antibiogram and sensitivity pattern of commonly used antibacterial agents to these isolated bacterial pathogens. The authors also recognized the limitation of culture and isolation methods adopted during the study, when compare with molecular techniques (eg. PCR or ELISA) which is more reliable and more sensitive.

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