Re- emergence of Contagious Bovine Pleuropneumonia (CBPP): A Case Study of Central River Region, The Gambia

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Abstract

The Gambia was declared CBPP free in 1982 but forty years later (2012), cases of the disease were observed again. Therefore, this study was conducted to evaluate post CBPP re-emergence in Sami district, Central River Region-North (CRR-N) of the Gambia. Three villages were purposively selected and structured questionnaire was used to elicit information from randomly selected fifty three (53) farmers/herders out of population of sixty one (61) in the study location. Data obtained were analysed using descriptive statistics of frequency and percentage with SPSS version 20. The results revealed that all the farmers were male and married (100%). Majority (94.7 %) of the respondents were exclusively farmers and all (100.0%) practiced extensive system. Most of the farmers (89.1%) indicated N'dama to be the most susceptible breed. A high proportion (89.8%) benefitted from mass vaccination campaign of the government. Majority of the farmers (89.8%) benefitted from post vaccination campaign of the government which indicated a good response from the government to address the problem. A high proportion of the farmers (68.9%) recognised difficulty in breathing as the sign of CBPP. Majority of the respondents (92.1%) had no previous training on CBPP preventive strategies and management. Most of the farmers (88.4%) employed the service of Veterinary and Para-veterinary workers in the symptomatic treatment of their livestock. Majority of the farmers (92.4%) did not vaccinate their animals before the re-emergence which probably constituted the major risk factor for the disease. The study showed that most of the respondents (91.6%) did not have training on disease surveillance which could have reduced the extent of the spreads. The study reveals that 75.4% of the respondents lost adult cattle that worth about D112000-D144000 to the disease. It could be concluded that lack of vaccination and previous training on CBBP by the farmers on prevention strategies, could be responsible for the re-emergence of the disease which resulted in significant economic loss to both the farmers and the government , therefore the government and non-governmental organizations should assist in sensitization of farmers about awareness of pre-outbreak vaccinations, quarantine measures in livestock husbandry and regular veterinary check-ups with respect to CBPP.

Keywords: CBPP, Re-emergence, Vaccination, N'dama, Risk factor

Running title: Re-emergence of CBPP in The Gambia

Ré-émergence de la Pleuréopneumonie Contagieuse Bovine (PPCB) : Une étude de cas de la région de Central River, Gambie

Résumé

La Gambie a été déclarée libre de la PPCB en 1982, mais quarante ans plus tard (2012), des cas de la maladie ont de nouveau été observés. Ainsi, cette étude a été menée pour évaluer la ré-émergence de la PPCB après 2012 dans le district de Sami de Central River Region-North (CRR-N) de la Gambie. Trois villages ont été sélectionnés de manière ciblée et un questionnaire structuré a été utilisé pour recueillir des informations auprès de 53 agriculteurs/éleveurs choisis au hasard parmi une population de 61 dans la zone

d'étude. Les données obtenues ont été analysées à l'aide de statistiques descriptives de fréquence et de pourcentage avec la version 20 de SPSS. Les résultats ont révélé que tous les agriculteurs étaient des hommes et mariés (100 %). La majorité (94,7 %) des répondants étaient exclusivement des agriculteurs et tous (100 %) pratiquaient un système extensif. La plupart des agriculteurs (89,1 %) ont indiqué que la race N'dama était la plus susceptible à la maladie. Une proportion élevée (89,8 %) a bénéficié de la campagne de vaccination de masse menée par le gouvernement. La majorité des agriculteurs (89,8 %) ont également bénéficié de la campagne post-vaccination du gouvernement, ce qui indique une bonne réponse de l'État face au problème. Une proportion importante des agriculteurs (68,9 %) a reconnu que la difficulté à respirer était le signe de la PPCB. La majorité des répondants (92,1 %) n'avaient pas reçu de formation préalable sur les stratégies de prévention et de gestion de la PPCB. La plupart des agriculteurs (88,4 %) ont fait appel aux services de vétérinaires et de para-vétérinaires pour le traitement symptomatique de leur bétail. La majorité des agriculteurs (92,4 %) n'avaient pas vacciné leurs animaux avant la ré-émergence de la maladie, ce qui pourrait constituer un facteur de risque majeur. L'étude a montré que la majorité des répondants (91,6 %) n'avaient pas été formés à la surveillance des maladies, ce qui aurait pu limiter la propagation de la maladie. L'étude révèle que 75,4 % des répondants ont perdu des bovins adultes d'une valeur de D112 000-D144 000 à cause de la maladie. Il peut être conclu que l'absence de vaccination et de formation antérieure des agriculteurs sur les stratégies de prévention de la PPCB pourrait être responsable de la ré-émergence de la maladie, entraînant ainsi d'importantes pertes économiques pour les agriculteurs et le gouvernement. Par conséquent, le gouvernement et les organisations non gouvernementales devraient aider à sensibiliser les agriculteurs sur l'importance des vaccinations pré-épidémiques, des mesures de quarantaine dans l'élevage du bétail et des contrôles vétérinaires réguliers concernant la PPCB.

Mots-clés : PPCB, ré-émergence, vaccination, N'dama, facteur de risque

Introduction

Livestock farmers in Sub-Sahara Africa are faced with challenges of feed/forage shortage, harsh weather condition emanating from changing climate, low productive breeds, poor marketing, diseases and many more (Devendra and Mcleroy,1992). CBPP has been reported in Asian yaks and American bison but never in African buffalos, sheep and goats which are resistant to the disease (Lesnoff *et al*., 2004). In many countries of West Africa, CBPP is endemic and has been for several decades. Sporadic outbreak has been recognized in the Middle East most likely from importation of Africa cattle (Alhaji *et al*., 2020). CBPP is caused by *Mycoplasma mycoides* subspecies *mycoides,* small colony variant (MmmSC) is present in West, Central, East and parts of Southern Africa (Thiaucourt *et al*., 2021). It is important to use appropriate diagnostic tools, especially those with high sensitivity and specificity for the disease (Muuka *et al*., 2011). CBPP in cattle targets the lungs, causing anorexia, fever, and respiratory distress. Naïve/young cattle herds infected with CBPP can experience high mortality rates, and surviving cattle often become carriers that can introduce the pathogen into uninfected herds. It does not infect humans (Thiaucourt *et al*., 2021). Indeed, the situation of outbreaks registered in the countries of the sub-region in recent years shows that with the exception of guinea Bissau, Gambia and Senegal, CBPP remains endemic and sporadic in the most of the countries. The recent evolutions of the epidemiological situation is illustrated by the reappearance for the first time since 1971 and 1992 of the disease, in the Gambia in September 2012 and Senegal in October 2012, respectively (FAO, 2012). These countries had stopped

vaccination several years ago and Senegal was about to declare itself a provisionally CBPP –Free country, in view of its eradication, according to the general principles developed by the OIE (FAO, 2012). CBPP is widely spread in Africa with West Africa accounting for most of the outbreak. In fact it is considered as the biggest threat to cattle production in sub Saharan Africa and is recognized to be present in some countries of Asia and Europe. In Asia CBPP has been reported in recent time from Asian in India, Bangladesh and Myanmar. Sporadic outbreak has been recognized in the Middle East most likely from importation of Arica cattle (Alhaji *et al*., 2020).The Gambia was declared CBPP free in 1982 but the disease re-emerged in 2012 after 42 years in the CRR-N of the country (Daffeh, 2012) and led to loss of thousands of herds of cattle resulting in the depravations of major source of livelihood of cattle farmers in these communities whose main source of livelihood revolved around their animals. Sequel to the re-emergence of the disease in 2012, country wide CBPP vaccination programme was launched and continued for ten consecutive years (2012-2022) and stopped when the funding from FAO and other donors stopped. Collection of samples for laboratory analysis has commenced to assess the effectiveness of the conluded mass vaccination campaign against CBPP (DLS, 2023). However, information about effects of the re-emergence of CBPP on cattle production in The Gambia is scanty therefore, this study was conducted.

Material and methods

Description of study area

The study was carried out at Sami ward, Central River Region/ north of the Gambia, in the Guinea Savannah Zone on latitude 13° 35′ N and longitude 14° 35′ W. With an estimate annual rainfall of 840mm and average temperature of 38°C. It lies on an altitude of 1meter above the sea level and characterized by two seasons wet (June- October) and dry (November-May). The main activity found in Sami ward was livestock and crop production and major ethnic groups found in Sami ward are Madinkas, Fulas and Wolofs.

Sample size and sampling technique

There are 16 villages in Sami Ward out of which, three (3) villages from Sami ward were purposively selected based on the former and suspected cases of CBPP in the communities and their relative high cattle population which was estimated at 5572 according to the record from region livestock office. Twenty-nine (29) farmers out of thirty-three (33) from Sami Pachonki, eleven (11) from Sami Suruwa Kunda out of thirteen (13) and Sinch Baya thirteen (13) out of fifteen(15) were randomly selected for the study given a total of 53 cattle farmers as the sample size out of 61 total population of the farmers in the study areas.

Data collection

Focus group discussions (FGD) was conducted with selected farmers held in their various communal gathering platforms locally known as "Bantabaa" and structured questionnaire was used to elicit and validate information from fifty-three (53) randomly selected respondents out of 61 total farmers in the study area. Personal interview was conducted in diverse languages during questionnaire administration. The interviews were conducted both in the morning and evening. Arrangements were made through personal contact with the farmers.

Data analysis

Data obtained were subjected to descriptive statistics such as frequency and percentage by using SPSS version 20.

Results

Socio-economic characteristics of cattle famers

Table 1 shows the socio-economic characteristics of cattle farmers in selected villages of CRR North of The Gambia. The results revealed that majority of the famers were male and (100%) of them are married and mostly (34.9%) above 41 years. The Educational background of the famers

was Arabic (96.3%) and they depended on Animal husbandry for livelihood.

Table 1: Socio-economic characteristics of respondents in the study area

	Villages			
Parameters	Pachonki	Suruwa kunda	Sinchu Baya	Average (%)
Gender				
Male	96.5	100.0	100.0	98.89
Female	3.5	0.0	0.0	1.11
Total	100%	100%	100%	100.00%
Marital Status				
Single	3.4	0.0	0.0	1.10
Marriage	96.6	100.0	100.0	98.90
Total	100%	100%	100%	100%
Age(years)				
20-30	17.2	0.0	7.7	8.3
31-40	37.9	27.3	7.7	24.3
41-50	20.7	45.5	38.5	34.9
>50	24.1	27.3	46.2	32.5
Total	**100**	**100**	**100**	**100**
Occupation				
Famer	93.1	90.9	100.0	94.7
Civil Servant	0.0	0.0	0.0	0.0
Private(Business)	6.9	9.1	0.0	5.3
Total	100%	100%	100%	100%
Ethnic Group				
Fula	0.0	0.0	100.0	33.33
Madinka	100.0	100.0	0.0	66.67
Total	100%	100%	100%	100.00%
Educational Level				
Primary	3.4	0.0	0.0	1.1
Secondary	0.0	0.0	7.7	2.6
Tertiary	0.0	0.0	0.0	0.0
Arabic	96.6	100.0	92.3	96.3
Total	**100**	**100**	**100**	**100**

Source: Field survey, 2023

Livestock production in study areas

The result of the livestock production in the study area is presented in table 2. The study revealed that all the animals (100%) were owned by the family and practiced extensive system. Most farmers (55.6%) had over thirty years' experience in cattle production. Wells and streams were the sole (100%) sources of water for the cattle. Majority (87.2%) of the respondents were keeping cattle primarily for manure and milk. Most of the respondents (91.6%) kept only N'dama breed.

Table 2: Livestock production in the study areas

	Villages			
Parameters	Pachonki	Suruwa Kunda	Sinchu Baya	Average (%)

Production experience				
1-10yrs	13.8	0.0	7.7	7.2
11-30	72.4	63.6	30.8	55.6
>31	13.8	36.4	61.5	37.2
Total	100%	100%	100%	100%
Purpose of Cattle Rearing				
Manure and milk	100.0	100.0	61.5	87.2
Commercial	0.0	0.0	0.0	0.0
Draught	0.0	0.0	0.0	0.0
All of the above	0.0	0.0	38.5	12.8
Total	100%	100%	100%	100%
Management practices				
Intensive	0.0	0.0	0.0	0.0
Extensive	100.0	100.0	100.0	100.0
Both	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%
Source of water				
Well and Stream	100.0	100.0	100.0	100.0
River	0.0	0.0	0.0	0.0
Others	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%
Types of Breed raised				
N'dama	93.1	81.8	100.0	91.6
Zebu	0.0	0.0	0.0	0.0
Both	6.9	18.2	0.0	8.4
Total	100%	100%	100%	100%
Source of stock				
Purchase	3.4	9.1	23.1	11.9
Family own	96.6	90.9	76.9	88.1
Entrusted	0.0	0.0	0.0	0.0
Total	**100**	**100**	**100**	**100**

Source: Field survey, 2023

Knowledge of CBPP by the farmers

Results of the study indicates a high proportion (93.5%) of cattle producers had knowledge about CBPP as shown in Table 3. Majority (92.1%) of the respondents said, they have not benefitted from any training on disease surveillance while less (7.9%) number reported to have benefitted from organised training. Records shows that, difficulty in breathing is the most observed sign and symptom of the disease by greater (68.9%) number of the respondents .Few (23.6% of the farmers observed all the three most common signs of the disease namely: difficulty in breathing, neck distended with head facing wind direction and animal standing elbow out. From the result, most (90%) of the famers could identify the disease in cattle and they can differentiate the sign and symptom of the disease from other diseases. The signs they observed mostly is difficulty in breathing which is called "Joffeh" in Fula and "Neefakurangho" in Madinka language.

Table 3: Knowledge of CBPP

	Villages			
Parameters	Pachonki	Suruwa Kunda	Sinchu Baya	Average (%)
Previous case				
Yes	89.7	90.9	100.0	93.5
No	10.3	9.1	0.0	6.5
Total	**100**	**100**	**100**	**100**
Previous training on CBPP				
Yes	6.9	9.1	7.7	7.9
No	93.1	90.9	92.3	92.1
Total	100%	100%	100%	100%
New stock Introduced				
Yes	20.7	18.2	15.4	18.1
No	79.3	81.8	84.6	81.9
Total	100%	100%	100%	100%
Signs and symptoms				
Breathing difficulty	62.1	90.9	53.8	68.9
Neck distended, head facing the wind direction	6.9	0.0	7.7	4.9
Animal standing elbow out	0.0	0.0	7.7	2.6
All of the above	31.0	9.1	30.8	23.6
Total	**100%**	**100%**	**100%**	**100%**

Source: Field survey, 2023

The epidemiology of CBPP and estimated loss

The result in Table 4 showed that the mortality was very high. Majority (85.6%) of the farmers recorded between 1-15% mortality rate while 76.8% reported the same rate for mortality The category of cattle mostly affected were between 11-20 months. N'dama breed was the most susceptibility as indicated by 89.1% by the respondents followed by the cross breed (10.1%). Most of the respondents (49.1%) indicated cattle within 11-20 months were the most susceptible to CBPP.

Table 4: Epidemiology of the disease and estimated loss

	VILLAGES			
Parameters	Pachonki	Suruwa kunda	Sinchu Baya	Average
Breed susceptibility				
N'dama	93.1	81.8	92.3	89.1
Cross Breed	6.9	18.2	7.7	10.9
Zebu	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%
Age category affected(months)				

6-10	34.5	0.0	30.7	21.7
11-20	31.0	54.5	61.5	49.1
>21	34.5	45.5	7.7	29.2
Total	100%	100%	100%	100%
Morbidity rate (%)				
1-15	82.8	81.8	92.3	85.6
16-30	17.2	9.1	7.7	11.3
>31	0.0	9.1	0.0	3.0
Total	100%	100%	100%	100%
Mortality rate (%)				
1-15	65.5	72.7	92.3	76.83
16-30	31.1	18.2	7.7	18.97
31-47	3.4	9.1	0.0	4.2
>48	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%

Source: Field survey, 2023. 1USD ($) = D20 as at 2024. * Average cost of cattle = D16000

Economic loss of the diseases

According to the result shown in Table 5 many of the famers (61.7%) have lost their animals due to this disease. On average, 61.7% of the farmers have lost 4-6 adult cattle while 64.1% lost 1-3 young cattle. The estimated cost of young cattle is more than D16, 000 and adult D18, 000.

Table 5: Economic losses of the disease in the study area

	Villages			
Parameter	Pachonki	Kuruwa kunda	Sinchu baya	Average (%)
Mortality in past ten years				
Mortality of adult cattle				
1-3	13.8	18.2	69.2	33.7
4-6	72.4	81.8	30.8	61.7
7-9	13.8	0.0	0.0	4.6
>10	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%
Mortality of young cattle				
1-3	51.7	63.6	76.9	64.1
4-6	34.5	27.3	0.0	20.6
7-9	13.8	9.1	23.1	15.3
>10	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%
Estimated loss of adult cattle				
D16,000-D480000	10.3	0.0	7.7	6.0
D64000-D96000	31.1	9.1	15.4	18.5
D112000-D144000	58.6	90.9	76.9	75.4
Total	100%	100%	100%	100%
Estimated loss of young cattle				
D10,000-D30000	6.9	90.9	76.9	58.2
D40000-D60000	24.1	9.1	15.4	16.2

D70000-D90000	68.9	0.0	7.7	25.5
	Total	100%	100%	100%

1USD ($) = D64 as at November 2023. D= Gambia dalasi. *Average cost of adult cattle = D16000 and young cattle = D10, 000

Source: Field survey, 2023

Government intervention on CBPP in the study areas

The government intervention is showed in Table 5. Majority (86.5 %) of the famers in the selected villages benefited from mass vaccination campaign. It also showed that the symptomatic treatment by the Veterinarian was the most adopted (88.4%) by the farmers, and only (1.1%) of the famers were using local treatment and 92.4% of the famers did not vaccinate before the outbreak, the cost of treated adult was (51.3%) and the cost for treated young was (55.4%). A high (89.8%) of the farmers enjoyed post vaccination reaction campaign by the government and only few (23.9%) did secondary treatment for their cattle.

Table 6: Government intervention of CBPP in the study area

	Villages			
Parameters	Pachonki	Suruwa kunda	Sinchu Baya	Average (%)
Vaccinated before outbreak				
Yes	13.8	9.9	0.0	7.6
No	86.2	90.9	100.0	92.4
Total	100%	100%	100%	100%
Mode of symptomatic treatment				
Local	3.4	0.0	0.0	1.1
Veterinary	89.7	90.9	84.6	88.4
Both	6.9	9.1	15.4	10.5
Total	100%	100%	100%	100%
Cost for treating adult cattle				
D100	31.0	18.2	15.4	21.5
D150	37.9	54.5	61.5	51.3
>150	31.0	27.3	23.0	27.1
Total	100%	100%	100%	100%
Cost for treating young cattle				
D75	34.5	45.5	53.8	44.6
D100	65.5	54.5	46.2	55.4
>150	0.0	0.0	0.0	0.0
Total	100%	100%	100%	100%
Benefitted from mass vaccination campaign				
Yes	93.1	81.8	84.6	86.5
No	6.9	18.2	15.4	13.5
Total	100%	100%	100%	100%
Benefitted from Post Vaccination reaction				
Yes	86.2	90.9	92.3	89.8
No	13.8	9.1	7.7	10.2
Total	100%	100%	100%	100%
Did secondary treatment				

Yes	13.8	27.3	30.8	23.9
No	86.2	72.7	69.2	76.0
Total	100%	100%	100%	100%

D = Gambia dalasi (1$ = D64 as at November, 2023

Source: Field survey, 2023

Discussion

Majority of the respondents were male which is in agreement with (FAO, 2016; GLSR, 2010) that majority of cattle were predominantly owned by men. Small ruminants were mostly raised by women (FAO, 2016).The reason for the gender parity between cattle and small ruminant ownership might be alluded to the large size of the cattle which require more energy to manage as compared to small body size of the small ruminants. This can also be associated with culture according to Waitangi *et al*. (2015) who reported (90%) of cattle ownership and significantly higher ($p<0.01$) than the (67%) by women. Almost all the respondents were married probably due to the general belief of the people in the study location that cattle husbandry is mainly for the old people. Agro-pastoral farming is the primary occupation for most of the respondents which is in consonance with the finding of Iyiola-Tunji (2021) that this system can be a strategy of climate smart agriculture in the tropics against negative effect of climate change.

The primary purpose of cattle production in the study location was for family use as sources of milk for consumption and manure for their farm as reported by FAO (2016) that cattle were raised primarily in The Gambia for milk and manure followed by sales or financial purpose. All villages practice semi-intensive management systems exclusively, with 100% in each village. The uniform adoption of extensive systems suggests the old traditional practices, which encourages mixing of animals from different sources and easy transmission of disease. This report is in tandem with FAO (2016) that reported herding and extensive management system in The Gambia during the raining and dry season respectively. It also agreed with (World Bank, 2015) report of extensive system in Senegal for ruminant production. The study revealed that N'Dama is the dominant breed due to its trypanotolerant nature and is in tandem with FAO (2016) that N'Dama dominates all the cattle breeds in The Gambia. The major source of drinking water was well and agreed with FAO (2016) that well and stream are the major sources of water in the rainy and dry season respectively which might also the risk factors in the spread of the disease to other parts of the country as the carrier animal mix and mingles with the healthy ones (Elniema *et al*., 2011).

Most of the farmers could recognize CBPP probably because of their long experience in cattle production and active sensitization by the Government as they even had a name for difficulty in breathing as "Joffeh" and "Neefakurangho" in Fula and Madinka languages respectively. Difficulty in breathing was a major symptom of the disease (Weisberg *et al*., 2004). The disease constitutes a great economic loss in cattle business with loss of about 500 head of cattle during the re-emergence in CRR (FAO, 2012) and concurred with FAO (2016) report that the major exit of cattle in The Gambia was through disease followed by slaughter. The great economic loss was also reported in 1995 through re-introductions of CBPP in Botswana which led to the slaughter of 320000 cattle at a cost of US$100 Million, with f400 further indirect losses estimated at US$400 million (Chandapiwa, 2011). Majority of the farmers identified N'dama as the most susceptible breed probably due to its genetic make-up that doesn't favour production of effective antibodies against the disease. (Mbengue *et* al., 2013) also adduced that it is

mainly aged females N'dama which are the main carriers of antibodies to mycoplasma mycoides subsp. This was also in agreement with FAO (2012) that the N'dama cattle is highly susceptible to CBPP.

The study revealed that majority of the farmers (92.4%) did not vaccinate their animals before the outbreak which could be the major critical factor for the re-emergence as carrier of CBPP could be easily moved into the herd from neighboring countries especially from Mali which has never been declared CBPP free to Senegal then The Gambia, Daffeh (2012), argued that inflow of cattle from neighboring countries due to the free trade and movement of cattle within the sub-region coupled with the current weak state of the National Veterinary Services which left the cattle unvaccinated for ten years at a time were possible cause of re-introduction of CBPP in The Gambia. A high proportion (89.8%) of farmers benefited from cattle mass vaccination campaign programme of the government and active farmers sensitization after the outbreak. This was corroborated by FAO (2012) report that mass vaccination campaign was launched in 2013 and to be followed by annual vaccination on cattle not yet infected with the disease using the T144 Lyophilized CBPP vaccines and farmers adequate sensitization strategy. Central drinking water arrangement either through well or stream, mingling and direct contact between the sick and healthy animals could accelerates the spread of the disease (Daffeh, 2012; Jamilu *et al*., 2015)).

Conclusion

The study showed that majority of the farmers benefited from government intervention of mass vaccination and post vaccination reaction campaigns occasioned by CBPP re-emergence. However, before the campaigns, the disease had already resulted into the death of many cattle, both young and adult which constituted serious economic loss to the cattle owners. It can therefore be concluded that lack of vaccination and adequate previous training of farmers on CBPP management to include prevention strategies, physical observation of cattle on early detection of signs of the disease and reporting was responsible for the re-emergence and spread of the disease and eventually the serious economic loss incurred by the farmers. Therefore, the government should design appropriate vaccination schedule and training programs for cattle farmers on CBPP management, including early detections and prevention strategies. A strict restriction and effective quarantine measures should be put in place at the borders to prevent the inflow of the disease from neighbouring countries.

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