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Retrospective study on cattle and poultry diseases in Uganda

Joseph Byaruhanga [a], Dickson S. Tayebwa [a,b], Wilfred Eneku [b,c], Mathias Afayoa [b,c], Francis Mutebi [b,c], Susan Ndyanabo [b,c], Steven Kakooza [b], James Okwee-Acai [a,c], Robert Tweyongyere [c], Eddie M. Wampande [b,c], Patrick Vudriko [a,c,*]

[a] Research Center for Ticks and Tick-borne Diseases Control (RTC), College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, P.O. Box 7062, Kampala, Uganda
[b] Central Diagnostic Laboratory, College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, P.O. Box 7062, Kampala, Uganda
[c] School of Veterinary Medicine and Animal Resources, College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, P.O. Box 7062, Kampala, Uganda

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ABSTRACT

Cattle and poultry enterprises are among the major contributors to food security and socioeconomic empowerment of households in Uganda. However, various diseases constrain their productivity. A two-year retrospective study between April 2012 and March 2014 was conducted using records for cattle and poultry diseases diagnosed at the Central Diagnostic Laboratory (CDL) to determine prevalent diseases in Uganda. The laboratory received 836 samples from poultry (36.3%) and cattle (63.7%). Of the 836 samples, 47.5% had a definitive diagnosis of disease causation. Most of the cattle and poultry diseases diagnosed were protozoan diseases (39.3%) followed by bacterial (21.4%), viral (17.1%), helminthiasis (11.1%), nutritional diseases (4%) and others (7.1%). For poultry, viral diseases (29.5%) and protozoan diseases (27.1%) especially newcastle disease (44.3%) and coccidiosis (100%) respectively, were the most diagnosed. While for cattle, hemo-protozoan parasites (52.1%) were the most prevalent, of which 92.9% were east coast fever infection. Bacterial infection (20.5%) in cattle were the second most diagnosed diseases and mastitis was the most diagnosed (46.2%). In summary, coccidioisis, collibacillosis, newcastle disease, gumboro disease, and avian helminthiasis were the most prevalent poultry diseases while in cattle, east coast fever, helminthiasis, mastitis, brucellosis and rabies were the most frequently diagnosed diseases. This study has identified the major diseases that hinder poultry and cattle production in Uganda. The data generated by CDL could be used for surveillance, monitoring and designing strategic interventions for control of poultry and cattle diseases in Uganda.

1. Introduction

The livestock sector in Uganda contributes 3.2% to the national gross domestic product (GDP) and is projected to be rising [1]. A report in 2009 showed that 4.5 million households (70.8%) owned livestock or poultry [2,3]. The increase in animal population followed deliberate efforts by the Government to modernize and restructure agricultural extension services. This was achieved through the introduction of farmer-centered and market oriented extension system called the National Agricultural Advisory Service (NAADs) and distribution of improved breeds to boost household income and food security [4]. Additionally, Non-government organizations like Heifer International and Send a cow Uganda [5], have been distributing livestock to families in the rural communities across the country in a bid to alleviate poverty [6]. However animal diseases constitute a major constraint towards achievement of poverty reduction goals based on improved livestock technologies [7–10]. Therefore, strengthening national animal disease diagnostic capacity is one of the pathways through which diseases can be promptly detected and controlled [11].

In Uganda, animal disease diagnosis and control is the primary role of the Directorate of Animal Resources in the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). It is the mandate of the National Animal Disease Diagnostic and Epidemiology Center (NADDEC) to carry out routine surveillance, monitoring and control of animal diseases. The Central Diagnostic Laboratory (CDL), located at the College of Veterinary Medicine, Animal Resources and Bio-security (COVAB), Makerere University was established

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* Corresponding author at: Research Center for Ticks and Tick-borne Diseases Control (RTC), College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, P.O. Box 7062, Kampala, Uganda.
E-mail address: vpato2011@gmail.com (P. Vudriko).

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in 2011 as part of the Joint National Animal Diagnostic Centre (J-NADIC) to complement the efforts of NADDEC. It was envisaged that the data generated from CDL would be a powerful tool for passive surveillance and could inform strategic intervention for nation wide animal disease control. In this retrospective study, records for cattle and poultry diseases diagnosed at the CDL were analyzed to determine prevalent diseases in Uganda from April 2012 to March 2014.

2. Materials and methods

2.1. Study area

This retrospective study was based on records of cases diagnosed at the Central Diagnostic Laboratory (CDL). The laboratory is located at the College of Veterinary Medicine, Animal Resources and Biosecurity (CoVAB), Makerere University, Kampala, Uganda. The CDL has five sections namely; bacteriology, parasitology and hematology, pathology, serology and virology. Samples are received centrally at the laboratory and distributed to the various sections based on the assessment of the resident clinician and/or the request of the client. The major disease diagnostic techniques used at CDL include; inter alia, postmortem examination, histopathology, microscopy, bacteria culture and isolation, antibiotic sensitivity tests, virus culture and isolation, hematology, biochemical tests, enzyme linked immune sorbent assay (ELISA), immunofluorescent antibody test (IFAT), complement fixation test (CFT) and polymerase chain reaction (PCR).

2.2. Study design

A two year retrospective study from April 2012 to March 2014 was conducted on records for cattle and poultry diseases collected from Central Diagnostic Laboratory (CDL) database. The records retrieved from the database included; type of specimen, date of submission, origin, animal species and diagnosis. The sample whose disease causative agent was identified was considered as definitively diagnosed while negative results were those without any identifiable causative agent. The result of diagnosis based on hematological profile were considered inconclusive since the causative agents responsible for the changes in blood picture were not identified. For the definitive diagnosis, the diseases diagnosed were categorized based on the causative agent; bacterial, viral, protozoan, nutritional diseases, helminthiasis, fungal, tumor, co-infections and others.

In this study, data for average monthly precipitation was obtained from the Uganda National Meteorological Authority (UNMA) and used as cross reference to determine whether there was a pattern against disease burden and samples submitted.

2.3. Data analysis

The data were entered into Microsoft excel (Windows version, 2010) to calculate the mean and standard deviation for the number of samples received. SPSS version 21 (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp) was used to generate and summarize frequency tables and a Pearson chi square analysis was done to establish the relationship between variables at 95% confidence interval. A P value ≤ 0.05 was considered statistically significant. GraphPad Prism version 6.00 for Windows (GraphPad Software, La Jolla California USA) was used to calculate the odds ratio (OD) and risk ratio (RR) and generate the graph used in this study.

3. Results

3.1. Samples received in the study period

A total of 836 samples were received during the 24 months period, of which 36.2% (303/836) were from poultry and the rest from cattle 63.8% (533/836) (Table 1). Among the samples received by the laboratory, blood samples were the most frequently submitted 48.7% (407/836) followed by organ specimens 31.5% (263/836). Most of the blood samples were from cattle 406/407 (99.8%) whereas 216/263 (82.1%) of the organ specimens were of poultry origin. Other specimens included carcass or live specimens for autopsy, milk, fecal samples, pus, aspirates and swab.

3.2. Cattle and poultry diseases diagnosed

Of the 836 samples received, 47.5% (397/836) had a definitive diagnosis while 52.5% (439/836) were either negative 42.4% (186/439) or inconclusive 57.6% (253/439). For both poultry and cattle, protozoan diseases were the most prevalent 39.3% (156/397), followed by; bacterial infections 21.4% (85/397), viral infections 17.1% (68/397), helminthiasis 11.1% (44/397), nutrition diseases, 4.0% (16/397), others 2.7% (11/397), co-infections 2.3% (9/397), tumors 1.2% (5/397) and fungal diseases 0.75% (3/397), (Tables 2 and 3). For the cattle samples with a definitive diagnosis (Table 3), hemo-protozoan parasites were the most prevalent 52.9% (100/189), with east coast fever being the most diagnosed 92% (92/100), whereas for bacterial diseases, mastitis was the most diagnosed 47.3% (18/38). Of the 208 poultry samples with a definitive diagnosis (Table 2), viral diseases 29.3% (61/208) were the most diagnosed and newcastle disease was the most prevalent 44.3% (27/61). Bacterial infections were the second highly diagnosed 22.2% (47/208) in poultry of which collibacillosis was frequently diagnosed 61.7% (29/47), (Table 2). Nutritional diseases 7.7% (16/208) were only diagnosed in poultry and avian

Table 1
Type of samples submitted to the Central Diagnostic Laboratory for diagnosis between April 2012 and March 2014.

Sample type	Quantity of samples per laboratory unit							Total
	Bacteriology		Pathology		Parasitology and hematology	Virology	Serology	
	Poultry	Cattle	Poultry	Cattle	Cattle	Poultry	Cattle	
Blood	1	30	0	4	360	0	12	407
Organ specimens	34	4	176	39	3	6	1	263
Fecal	0	5	0	0	43	0	0	48
Carcass for autopsy	10	0	32	0	0	2	0	44
Live specimens for autopsy	6	0	35	0	0	0	0	41
Milk	0	27	0	0	0	0	0	27
Pus	0	4	0	0	0	0	0	4
Aspirate	0	1	0	0	0	0	0	1
Swab	1	0	0	0	0	0	0	1
Total (%)	52 (6%)	71 (8%)	243 (29%)	43 (5%)	406 (49%)	8 (<1%)	13 (2%)	836 (100%)

Table 2
Poultry diseases diagnosed in Uganda by the Central Diagnostic Laboratory between April 2012 and March 2014.

Category of diseases	Poultry diseases diagnosed	No of cases
Bacterial	Collibacillosis	29
	Fowl typhoid	9
	Necrotic enteritis	3
	Fowl cholera	2
	Mycoplasmosis	2
	Pseudomonas infection	1
	Corynebacterium infection	1
Viral	Newcastle	27
	Gumboro disease	17
	Avian encephalomyelitis	9
	Infectious bronchitis	3
	Avian leucosis	2
	Fowl pox	2
	Lymphoid leucosis	1
Protozoan	Coccidiosis	56
Nutritional	Avian encephalomalacia	11
	Gout	2
	Avitaminosis A	1
	Malnutrition	1
	Rickets	1
Helminthiasis	Avian helminths	7
Fungal	Aspergillosis	2
	Fungal pneumonia	1
Tumors	Adenocarcinoma	1
	Osteoblastic osteosarcoma	1
Co-infections	Collibacillosis and coccidiosis	3
	Newcastle and collibacillosis	3
	Coccidiosis and helminthiasis	1
	Newcastle and coccidiosis	1
Others	Amyloidosis	1
	Ascitis syndrome	1
	Gastritis	1
	Salpingitis	1
	Septicemia	1
	Traumatic hepatitis	1
	Traumatic gastritis	1
	Multiple hepatic necrosis	1
Total		208

Table 3
Cattle diseases diagnosed in Uganda by the Central Diagnostic Laboratory between April 2012 and March 2014.

Category	Cattle diseases diagnosed	No of cases
Bacterial	Mastitis	18
	Brucellosis	9
	Collibacillosis	4
	Contagious bovine pleural pneumonia	4
	Pasturellosis	3
Viral	Rabies	6
	Lumpy skin disease	1
Protozoan	East coast fever	92
	Babesiosis	4
	Anaplasmosis	2
	Trypanosomosis	1
	Coccidiosis	1
Helminthiasis	Helminthiasis	37
Tumors	Hepatocellular carcinoma	2
	Papillomatosis	1
Co-infection	East coast fever and anaplasmosis	1
Others	Interstitial nephritis	1
	Poisoning	1
	Telangioectasis	1
Total		189

encephalomalacia 68.8% (11/16) was the leading nutritional disease diagnosed. Other diseases included aspergillosis, tumors and co-infections (Table 2).

3.3. Regional distribution of samples received and diagnosed

Within the study period, the Central Diagnostic Laboratory (CDL) received samples from 38 districts across the four regions of Uganda; central 55.3% (21/38), east 10.5% (4/38), west 28.9% (11/38) and north 5.3% (2/38). With respect to the number of samples submitted, central region submitted the highest 87.1% (728/836) followed by western 9.4% (79/836), the rest from eastern and northern parts of Uganda (Table 5 and Fig. 1). Among the districts from central Uganda, submission from Wakiso accounted for almost half 42.5% (309/728) of the overall samples received by CDL followed by Kampala 20.2% (147/728). In the western region, Kiruhura district had the highest samples 36.7% (29/79) while in the eastern region, Mbale district contributed majority of the samples 70.4% (19/27) whereas Nwoya and Lira districts from northern Uganda submitted only one sample each.

The regional distribution of diseases diagnosed by the CDL was 83.9 (333/397), 10.6% (42/397), 5.0% (20/397) and 0.5% (2/397) for central, western, eastern and northern regions of Uganda respectively (Table 4). Among the nine disease categories identified in this study (Table 2), the central region had all the nine diseases with protozoan infections being the most dominant 24.6% (82/333) followed by viral diseases 21.0% (70/333). Hemoprotozoan diseases were only diagnosed in cattle while majority of viral diseases 91.4% (64/70) were diagnosed from the poultry samples. Of the five disease categories recorded in western region, protozoan diseases were the highest 35.7 (15/42) followed by bacterial diseases and helminthiasis both at 28.6% (12/42). In the eastern region seven of the categories were recorded and hemoprotozoan diseases were the most diagnosed 30% (6/20). From

Table 4
Regional distribution of poultry and cattle diseases diagnosed in Uganda by the Central Diagnostic Laboratory between April 2012 and March 2014.

Region	Diseases diagnosed	Species		Total
		Poultry	Cattle	
Central	Protozoan	52	83	135
	Viral	6	70	76
	Bacterial	43	26	69
	Helminthiasis	5	25	30
	Others	8	2	10
	Co-infections	8	0	8
	Nutritional	6	0	6
	Fungal	3	0	3
	Tumors	0	2	2
	Total	189	144	333 (84%)
Western	Protozoan	3	12	15
	Bacterial	0	12	12
	Helminthiasis	0	12	12
	Viral	1	1	2
	Tumors	1	0	1
	Total	5	37	42 (11%)
Eastern	Protozoan	3	6	9
	Viral	4	0	4
	Nutritional	2	0	2
	Tumors	1	1	2
	Bacterial	1	0	1
	Helminthiasis	1	0	1
	Others	0	1	1
	Total	12	8	20 (5%)
Northern	Bacterial	0	1	1
	Helminthiasis	1	0	1
	Total	1	1	2(<1%)

N = 397.

Table 5
Poultry and cattle samples received by Central diagnostic Laboratory from various districts in Uganda between April 2012 and March 2014.

Region	District	Species		Total
		Poultry	Cattle	
Central	Wakiso	131	178	309
	Kampala	69	78	147
	Mukono	21	29	50
	Kiboga	21	17	38
	Gomba	0	34	34
	Mpigi	16	13	29
	Mityana	4	23	27
	Luwero	8	19	27
	Sembabule	0	16	16
	Nakaseke	1	13	14
	Masaka	5	9	14
	Nakasongola	0	11	11
	Kayunga	0	2	2
	Lyantonde	0	2	2
	Kalangala	0	2	2
	Buikwe	0	1	1
	Butambala	0	1	1
	Kalungu	1	0	1
	Lwengo	1	0	1
	Mubende	0	1	1
	Rakai	1	0	1
	Total	279	449	728 (87%)
Western	Kiruhura	0	29	29
	Mbarara	6	16	22
	Kabarole	0	12	12
	Ibanda	0	7	7
	Ntungamo	0	3	3
	Isingiro	0	1	1
	Kamwenge	0	1	1
	Kyenjojo	0	1	1
	Masindi	0	1	1
	Mitoma	0	1	1
	Kiryandongo	0	1	1
	Total	6	73	79 (9%)
Eastern	Mbale	16	3	19
	Jinja	1	4	5
	Busia	0	2	2
	Iganga	0	1	1
	Total	17	10	27 (3%)
Northern	Lira	1	0	1
	Nwoya	0	1	1
	Total	1	1	2 (<1%)

N = 836.

the northern region only two samples were received and diagnosed for helminthiasis and bacterial infection.

3.4. Relationship between laboratory sample reception, diseases diagnosed and rainfall pattern

The highest monthly sample submission was 89 for cattle and 28 for poultry in March and August 2013 respectively. The least sample submission was 2 samples each for cattle and poultry in August and March respectively. Across the 24 months the laboratory received on average, 22.2 ± 18.1 samples for cattle and 12.6 ± 6.6 samples for poultry. On average, CDL received 25.3 ± 11.3 poultry samples and 44.4 ± 23.2 samples for cattle per month of the calendar year. There was no significant correlation in the number of samples received and seasonal pattern (rainy or dry season); $P = 0.635$ for avian and $p = 0.823$ for cattle sample submission (Fig. 2). Further analysis showed more likelihood of disease occurrence in the dry season than wet season (OD, 0.67. RR, 1.29, $P < 0.01$) for cattle but no significant difference was observed for poultry (OD, 1.18, RR, 1.0, $P > 0.1$).

4. Discussion

The poultry and cattle industries are among the dominant and economically viable animal enterprises in Uganda [8]. This is due to the rising demand for meat and eggs in the local and regional markets [2]. The two enterprises are attractive ventures for government and private sector investment for livelihood and economic empowerment of the rural communities. To further promote the growth of the poultry and cattle industry, the Japanese government through the Animal Disease Control project (ADC) established the Central Diagnostic Laboratory (CDL) to strengthen disease diagnosis and control in Uganda. Since its establishment, the laboratory has become one of the referral facilities for routine animal disease diagnosis. The contribution of the CDL towards animal diseases control in Uganda is evidenced by the countrywide distribution of poultry and cattle samples received for diagnosis (Fig. 1).

The current study also found that viral (especially newcastle disease) and protozoan diseases (especially coccidiosis) were the most predominant diseases affecting poultry, consistent with what was documented in previous reports [12,13]. On the other hand

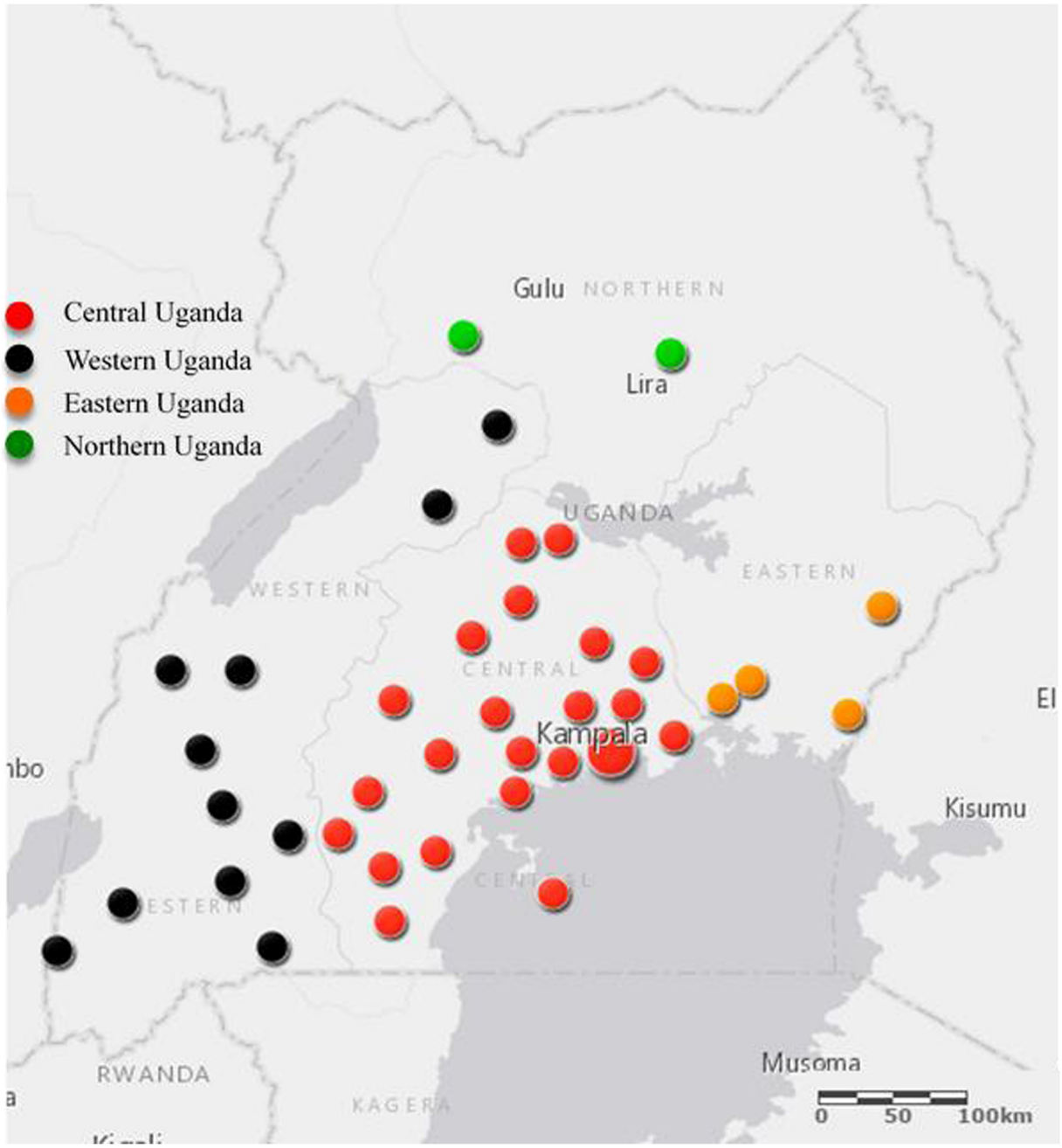

Fig. 1. Map of Uganda showing the districts which submitted samples to CDL during the two year study period.

east coast fever, a tick-borne hemo-protozoan disease caused by *Theileria parva* was the most frequently diagnosed cattle disease. Previous studies [14,15] have reported tick transmitted hemo-protozoan parasites particularly east coast fever (ECF) as a major hindrance to the livestock sector. The findings on the high burden of *T. parva* may be attributed to the challenges in effective tick control due to the emergence of acaricide resistance reported in Uganda [7]. Among the bacterial diseases of cattle, mastitis was the most frequently diagnosed disease (Table 3), this was in agreement with previous studies [16,17] that reported a prevalence of over 50%. Brucellosis was also frequently diagnosed at CDL (23%), consistent with earlier reports [18–21]. Nutritional diseases were more frequently diagnosed in chicken compared to cattle. This may be due the fact that poultry reared in the intensive management systems consume formulated feeds and the quality of feed determines their health status.

Of the 6 cattle samples diagnosed for viral diseases, 5 were positive for rabies. Rabies is a notifiable zoonotic disease of public health importance [22]. In this study the 5 cases of rabies detected in cattle samples could be an indicator for the underlying disease burden among stray dogs and cats from the districts of origin. This warrants investigation and surveillance. Overall, there was low cases of cattle viral diseases diagnosed at CDL. This is partly due to the fact that most viral diseases of cattle are categorized as notifiable and samples are sent by the district veterinary office to NADDEC for diagnosis, outbreak notification and response.

The study found that 52.5% (439/836) of the samples analyzed at CDL were either negative for any disease 42.4% (186/439) or the diagnosis was inconclusive 57.6% (253/439). The high proportion of negative and inconclusive diagnoses could probably be explained by prior treatment of the animals by farmers or

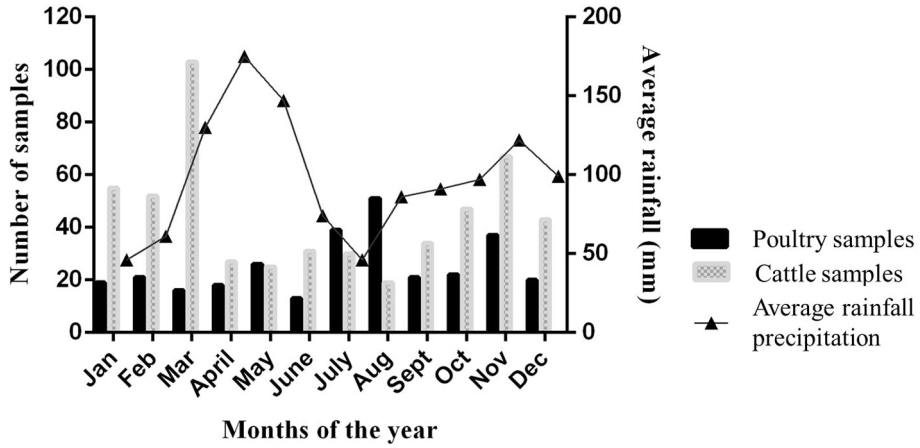

Fig. 2. The monthly samples received by CDL with respect to the rainfall precipitation per month.

clinicians [3,7,16,23] while others might have used ethno pharmacological practices [9].

Poor management and biosecurity remains a major problem among the small scale farmers in Uganda due to the costs involved in attaining recommended farm standards [24]. Therefore diseases associated with inadequate management practices such as coccidiosis and helminthiasis remain a major problem. This study documented a high prevalence of coccidiosis among the poultry samples while helminths were prevalent among both poultry and cattle (Table 2). Seasonal variation has been associated with variations in the immunity, environment pressures and stress and increase of vectors in certain seasons which is likely to influence the disease burden in certain seasons of the year [25,26]. However, this study found that cattle diseases were more diagnosed during the dry season than rain season. This may be attributed to movement of cattle in search for pasture and water (pastoralism) leading to spread of diseases during the dry season. On the other hand, poultry diseases showed no association with season because samples were mainly submitted from intensively reared poultry, where management practices such as hygiene and bio-security are likely to determine disease trends other than.

5. Conclusions

In this study, coccidioisis, collibacillosis, Newcastle disease, gumboro disease, and helminthiasis were the most diagnosed poultry diseases while east coast fever, helminthiasis, mastitis, brucellosis and rabies were the most prevalent diseases of cattle diagnosed at CDL within the study period. Overall these results indicate that diseases are among the major hindrance to livestock production and productivity but more profoundly validate the role veterinary diagnostic laboratories play in active disease diagnosis. The data generated could be useful for surveillance, monitoring and designing of appropriate interventions for diseases control in Uganda.

Competing interests

The authors declare no conflict of interest with respect to the research, authorship, and/or publication of this article.

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