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SHORT COMMUNICATION

Pathological findings in animals in Gaborone area

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SSP: Conceived idea, performed necropsies, collected samples, interpreted results, prepared the manuscript

ABSTRACT

A 7-year retrospective study was conducted to determine diseases causing mortalities in animals in Greater Gaborone area. Data came from necropsies records performed on 112 carcasses comprising of 15 cattle, 32 goats, 13 sheep, 9 pigs, 8 dogs, 24 poultry birds, 7 guinea fowls and 4 rabbits received from Notwane Farm of Botswana College of Agriculture and some private farms around Sebele, Gaborone. Helminthosis alone or in combination with either coccidiosis or heartwater were diagnosed in 48% (29 out of 60) ruminants. Two cattle, five sheep and ten goats had succumbed to death due to helminthosis only. Mixed helminthic and coccidial infections were observed in carcasses of six goat kids and two lambs. Helminthosis concurrent with heartwater was diagnosed in one cow and three goats' carcasses. *Haemonchus* was found to be the most widely distributed helminthic parasite in single as well as in the mixed parasitic infections in both cattle and small stock in 69% (20 of 29) of the animals that died. Heartwater alone and in combination with helminthosis was the second most observed condition and 6 cattle, 5 sheep and 10 goats' carcasses were infected. Coccidiosis, enterotoxaemia, and mixed *Rotavirus* and *Cryptosporidium* species were observed in 2 goats1 sheep and 2 young dairy calves' carcasses, respectively. Other disease conditions diagnosed in bovines were metritis, pneumonia, hardware disease, and peritonitis. Colisepticaemia, streptococcal mastitis, heat stress, malnutrition/starvation, contagious ecthyma, and traumatic injuries were other conditions observed in sheep and goats. Necropsy and laboratory examination demonstrated pneumonic pasteurellosis, colibacillosis, warfarin (Rattex) poisoning, and septicaemia in pigs; transmissible venereal neoplasms, ancylostomosis, and canine distemper in dogs; chronic respiratory disease, egg peritonitis, pendulous crop, fatty liver syndrome, toxic fat syndrome, salmonellosis, vent picking, dehydration, and fowl pox in chickens; hypothermia, vent picking, and infectious coryza in guinea fowls and pasteurellosis and coccidiosis in rabbits. This study documents that helminthosis and heartwater asthe most common diseases observed in carcasses of animals submitted to Botswana College of Agriculture (BCA) Animal Health Clinic. However, this may not be a representative of actual infection and death occurring in the field since this study was not a control study. Nevertheless, these results signal the need to establish a properly designed disease management plan and an easily accessible veterinary extension network that focuses on efficient quality animal health services to the relevant stakeholders and implementation of more effective animal disease control measures.

Keywords Bovine, dogs, goats, guinea fowls, heartwater, helminthosis, necropsy, pigs, rabbits, sheep

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INTRODUCTION

Livestock farming provides vital employment opportunity and an important socio-economic and cultural role in the lives of rural communities in Botswana. Animal agriculture contributes more to the gross domestic product (GDP) than crop production. The success of this export is largely dependent on the free-disease herds especially from foot-and-mouth disease (FMD), contagious bovine pleuropneumonia (CBPP) and others. Since 2002, Botswana had been experiencing frequent outbreaks of FMD causing adverse impacts on the sustainability of the livestock industry and national economy. The rural household economies, which are mostly subsistence, have been severely affected in the form of loss of income through the sale of their stock, milk, and draft power.

A study in central Kenya (Kagira and Kanyari 2001) reported deaths of 32% sheep and 26% goats due to helminthosis, while heartwater accounted for 27% and 20% mortality in sheep and goats, respectively. According to Sharma *et al*. (2003) heartwater contributed 37.6% (390/1038), 46.1% (739/1602), and 41.7% (179/429) to mortalities in cattle, goats and sheep respectively during 1997-2002. An outbreak of contagious ecthyma was reported by Kamau and Sharma (2007) in which 80 yearling goats and four yearling lambs of Notwane Farm of BCA were affected. Segwagwe and Sharma (2007) diagnosed cases of swine erysipelas in BCA's piggery farm. As per Botswana National Veterinary Laboratory (BNVL, 2008) report, 69, 20, 18 and 22 cases of helminthosis, coccidiosis, mixed helminthic and coccidial infections and heartwater were diagnosed in bovine

samples, respectively from different veterinary districts. A record of the type and nature of cases reported to BCA Animal Health Clinic has never been reported. Therefore the aim of this study was to document the frequency of different diseases in carcasses/records submitted to this clinic by evaluating necropsy and laboratory records belonging to BCA Livestock Farm and other private farms located in and around Gaborone and make recommendation on disease prevention and cure by farmers.

MATERIALS AND METHODS

During 2006-2012, a total of 112 carcasses comprising of 15 cattle, 32 goats and 13 sheep, 9 pigs, 8 dogs, 24 poultry birds, 7 guinea fowls and 4 rabbits were submitted for postmortem examination. Majority of the animals (81%, 91 of 112) belonged to College Notwane Farm and the remaining 19% were from other livestock farms located in and around Gaborone. The carcasses belonged to different breeds of the animals. The signalment, history and clinical signs were obtained from farmers and managers at the time of the submission of the carcasses. Gross pathological lesions were recorded and biological samples were collected using appropriate preservatives for necropsy examination. Brain crush smears were prepared from the brain cortex, stained with Giemsa or Diff-Quick stains and examined microscopically for *Ehrlichia ruminantium* organisms. Samples were subjected to bacteriological, parasitological, and histopathological examination. Bacterial pathogens were isolated and identified by a technique described by Quinn *et al.,* (1998). Faecal specimens were analyzed for helminthic eggs, worms and coccidial oocysts using a modified McMaster method (MAAF, 1986). For identification of helminthic eggs, faecal samples were incubated at 26-30°C for a week. Nematode larvae were separated by standard Baerman method, identified and counted *per* gram of faeces (MAAF, 1986). Abomasal contents were cleaned, sieved and examined for worms. Tissue samples were processed for histopathological examination following the procedure of Luna (1968). The diagnoses of animal diseases were based on the history, clinical signs, macroscopic lesions, and analyses of laboratory results.

RESULTS

Cattle and Small Stock

Helminthosis was diagnosed in 2 bovines, 5 sheep and 10 goats. Abomasal and caecal contents demonstrated moderate to severe helminthic infection caused by single or multiple parasites. The most common nematode genera were *Haemonchus* followed by *Trichstrongylus* and *Bunostomum* in cattle. *Haemonchus, Trichstrongylus Oesophagostomum*, *Chabertia* and *Cooperia* genera in sheep and goats and *Haemonchus* was the dominant species. *Haemonchus* was widely distributed, accounting for 69% (20 of 29) of infections. Faecal egg counts (FEC) of 1025 ± 75 and 3211 ± 217 eggs *per* gram (epg) were observed in bovines and small stock, respectively. The highest FEC from trichostrongylid parasites of 5650 epg were observed in a 2-year-old Tswana goat. Abomasal mucosae in one Tswana goat and a Dorper sheep were found to be congested and the fluidy contents harbored large number of *Haemonchus* worms. Six goat kids and two lambs were found to have a combined helminthic and coccidial infection. A mixed helminthic and heartwater infection was diagnosed in a cow and three goats. Two 5-month-old Tswana goat kids carcass was found with coccidiosis eggs of 6025 ± 225 oocysts /g. Carcasses of these kids were emaciated and dehydrated with faecal smudged sperineums, tails and hind limbs. Both small and large intestines of these goats were severely congested with bloody contents. Mild coccidial infections with oocyst counts varying from 350 to 3100/g were detected in a heifer, two yearling goats and one adult sheep. Few *Paramphistomum* conical flukes were found attached to the ruminal mucosa of an adult goat.

Diagnosis of heartwater was confirmed by observing typical macroscopic lesions and detecting *E*. *ruminantium* organisms in the brain capillaries of stained brain crush smears. The gross lesions in such cases were hydropericardium, hydrothorax, pulmonary congestion and oedema, ecchymotic or petechial haemorrhages on endocardium, hyperaemia and oedematous abomasal mucosa, and congested intestines and kidneys. Six out of 15 bovines, 5 of 13 sheep and 6 of 32 goats died as a result of peracute and acute heartwater. Other disease conditions found less frequently in cattle were hardware disease, metritis, and pneumonia each affecting an animal, peritonitis in two adult cows and a combined *Rotavirus* and *Cryptosporidium* species infection in two calves. Hardware disease was observed in a cow and a goat. On necropsy examination of a Friesian cow and a Tswana goat, approximately 18 and 1.3 kilograms of ropes, plastic materials and sand were recovered from their rumens, respectively. Mixed *Rotavirus* and *Cryptosporidium* species infection was detected in 2 dairy calves aged less than a month with a history of gastroenteritis. Colisepticaemia, streptococcal mastitis, contagious ecthyma, pediculosis, starvation and traumatic injuries were diagnosed to have caused death of a goat each.

Pigs

Pneumonic pasteurellosis, colibacillosis, salmonellosis, swine erysipelas, gastric torsion and warfarin poisoning were diagnosed in pigs. A grower pig with a history of clinical signs of respiratory distress, fever, cyanosis and sudden death in conjunction with isolation of *Pasteurella multocida* from lung tissues confirmed the diagnosis of pneumonic pasteurellosis. A few diamond-shaped skin lesions on the hind quarters, presence of petechial haemorrhages in the subcutaneous tissues and demonstration of Gram positive *Erysipelothrix* organisms on bacteriological culture of liver and kidney tissues established the diagnosis of swine erysipelas in an adult male pig. Another grower pig with the clinical history of foaming at mouth, lot of discomfort and staggering of gait was suspected to have consumed warfarin/Rattex, a

rodenticide. The gross pathological lesions included reddening of ventral skin and multiple petechial and ecchymotic haemorrhages on the internal organs, thigh muscles of the right hind limb and few white nodules in the liver. Other conditions diagnosed at the postmortem facility included colibacillosis in two piglets, salmonellosis and gastric torsion affecting a pig each.

Dogs

Two cases of transmissible venereal tumors (TVT) in a male Alsatian and female Rottweiler dogs with history of constant dripping of blood from the proximal part of penis in the male dog and vulva of a female dog for more than a week were presented. In view of the poor prognoses and requests of the owners, both dogs were euthanized and necropsied. The bitch had a tumor mass in the vagina and multiple small white nodules in the lungs, liver, spleen and kidneys. A few red nodular growths were detected on the shaft of penis in the male dog. On microscopic examination of tissue sections from the affected organs of the bitch, cellular anaplasia was evident with sheets of pleomorphic neoplastic cells with hyperchromatic nuclei, several mitotic figures and lightly stained cell cytoplasms indicating metastases or malignancy. Sections of heart, liver and spleen tissues and the nodules excised from the penis of the male Alsatian dog did not demonstrate any mitotic figure and anaplasia. The carcasses of two Tswana pups aged 4 weeks with a history of blood-stained diarrhea for 5 to 6 days were presented. Coprological examination of the bloody intestinal contents of these pups revealed 1050 and 2150 *Ancylostoma caninum* eggs *per* gram of faeces confirmed the cause of their death as ancylostomosis. The diagnosis of canine distemper in a 7-month- old Tswana dog was based on the clinical signs of fever, vomiting, mucopurulent oculonasal discharge, ataxia and respiratory distress in conjunction with postmortem lesions of oedematous and congested lungs and interstitial pneumonia. Haematological examination revealed leucopenia. Parvovirus infection was suspected in two young dogs with haemorrhagic enteritis and sudden death. Postmortem and laboratory examination revealed congested and blood filled small intestine. Parasitological and bacteriological findings were inconclusive

Poultry

In view of the clinical signs of dyspnoea and pathological lesions showing cheesy material and the cloudiness of air sacs, fibrinous coverings on livers, and congestion of trachea and conjunctivae in three poultry birds, chronic respiratory disease was suspected. Other conditions detected in birds were fatty liver syndrome in 2 layers and 1 broiler with greasy livers and lot of fat in the abdominal cavities. A pendulous crop filled with rancid fluidy cornmeal contents was observed in 2 broilers while egg peritonitis with resorbed yolks was found in 2 hens and a free yolk in the abdomen of a hen. Toxic fat syndrome was recorded in 4 chicks with ascites, hydropericardium and swollen pale livers and fowl pox in 2 birds with small nodules and scabs on combs, wattles and skin of face. Fowl paratyphoid was diagnosed in 3 chicks with history of gastroenteritis and *Salmonella* species organisms were isolated from the diarrhoeic faecal samples of these chicks.

Haemorrhagic eviscerated intestines and the bleeding external genitalia in 4 layers were found to be due to vent picking or cannibalism. Two birds with severely impacted intestines including caeca and cloacae with faecal contents and the egg shells were found to be dehydrated. No definite diagnosis could be made in 5 birds.

Guinea fowls

Hypothermia, vent picking and infectious coryza were recorded duringpostmortem examination of 7 guinea fowls. Deaths of 3 birds with history of cold exposure and subcutaneous edema in the ventral body walls were suspected to be due to hypothermia. Infectious coryza was confirmed in 2 birds with swollen wattles and faces, respiratory distress and by isolation of Gram negative *Haemophilus gallinarum* organisms from the tracheal swabs. Characteristic haemorrhagic lesions on the external genitalia were suggestive of vent picking or cannibalism in 2 birds.

Rabbits

Pasteurella species organisms were isolated from the pus collected from the small abscesses present on the ventral abdomen, lungs and kidneys of a rabbit. Trachea, pleura and lungs were found congested and the spleen enlarged. Intestinal coccidiosis caused deaths of 2 rabbits with complaints of profuse diarrhea and paralysis. Examination of the faecal samples of these birds demonstrated significant number of *Eimeria* species oocysts.

DISCUSSION

Information on important diseases affecting animals has not been extensively documented in Botswana. Results from this study, though not a representative of any population gives a snippet of what may be happening in the field. Results revealed that the gastrointestinal infections and heartwater were associated with the majority of mortality. Of these, helminthosis alone and in association with coccidiosis and heartwater infections were important. Concurrent presence of up to 6 nematode genera was recorded and *Haemonchus* was the most dominant strongyle genus. Earlier parasitological surveys carried out in Botswana, Ethiopia, Kenya and South Africa reported that amongst helminthoses, haemonchosis was the leading cause of mortality among ruminants and small stock in particular (Kagira and Kanyari, 2001; Tsotetsi and Mbati, 2003; Sissay *et al*., 2007; BNVL , 2008, 2009; Kanyari *et al*., 2009; Tsotetsi *et al*. 2013) a trend consistent with the current study. Herlich (1978) estimated that the total annual loss due to helminthic infections worldwide is equivalent to 30 million goats and sheep. According to Allonby (1975) and Mukhebi *et al*. (1985), the annual economic loss due to haemonchosis is US$ 26 million in small stock in Kenya, and returns could be increased by 470% through parasite control. In Botswana, Segwagwe

and Ramabu (1999) reported helminthosis/coccidiosis and heartwater in sheep and goats accounting for 43.9% and 14.6% and 40.1% and 18.1% deaths in 1994, respectively. A survey by Sharma and Busang (2013) in southern Botswana found, helminthic and *Eimeria* species infection rates averaged 16.2 and 12.0 % in young ruminants respectively with high proportion of helminthic in small stock. There is a need to pay particular attention to nematode parasite in young small stock in order to improve productivity by small scale farmers.

In the present study, heartwater ranked the second most diagnosed disease associated with mortality among ruminants. High mortality rates due to heartwater are usually due the location of farms in the heartwater-endemic region, non-immunization against heartwater by farmers, and minimal or no deticking of animals, high cost of therapeutic drugs and acaricides for resource-poor and small stock farmers, and the non-availability of a rapid diagnostic test to detect heartwater in live sick animals. Vachiéry *et al*. (2013) expressed the need for rapid and multi-pathogen assays that would enhance the efficacy and the cost-effectiveness of heartwater diagnosis. Mortalities in cattle, sheep and goats due to heartwater has previously been reported in Botswana during 1998 to 2003 (Sharma and Losho 2005). Gross pathological lesions recorded in the peracute and acute cases of heartwater in the current investigation were similar to those described by Allsopp *et al*. (2004), Radostits *et al*. (2007) and Allsopp (2009). As per Minjauw and McLeod (2003), more than 150 million animals are at risk to *E*. *ruminantium*, heartwater causing organism in sub-Saharan region and this disease is one of the major causes of stock losses. Thus, Allsopp (2009) advocated for the development of a safe, cheap and effective recombinant vaccine for the control of heartwater.

Other miscellaneous disease conditions associated with deaths in ruminants in this investigation were recorded and included hardware disease, colibacillosis, mastitis, hydatidosis, starvation, contagious ecthyma, and traumatic injuries. An outbreak of contagious ecthyma was reported by Kamau and Sharma (2007) from Botswana in which 80 yearling goats and four yearling lambs from Notwane Farm were affected. Similar disease conditions have also been recorded in ruminants from different veterinary districts of Botswana (BNVL 2008, 2009). There is a need to assess their relative frequency and economic importance in livestock production in the country.

In pigs various diseases were observed. Pathological lesions recorded for swine erysipelas were similar to those described by Segwagwe and Sharma (2007). The continued persistence of *Erysipelothrix rhusiopathiae* organism on the College piggery unit, the etiological bacterium of swine erysipelas, is a cause of concern and may limit productivity of the pig unit. The zoonotic implications of the bacterium for the animal handlers, veterinarians and abattoir workers should be considered too. The College farm manager was apprised on the resistant nature of this bacterium to most of the chemical disinfectants. Immunization, adoption of good hygienic and biosecurity measures to prevent the spread of swine erysipelas to other herds was suggested by Brooke and Riley (1999), and Radostits *et al*. (2007). The suspected warfarin poisoning in a grower pig could not be confirmed due to the lack of an appropriate diagnostic kit. Cases of gastric torsion, colibacillosis and pneumonic pasteurellosis have also been reported from several veterinary districts of this country (BNVL, 2012). Rapid diagnostic tools and treatment are also required to minimize the incidences and to control these disease conditions in piggery farms.

According to Render and Carlton (2001), TVT is endemic in areas with large populations of stray dogs and primary neoplasms are usually present on the external genitalia of both sexes. TVT is thought to arise from a specific genetic alteration of dog histiocytes, followed by transmission of abnormal cells from dog to dog through coitus (Acland, 2001). Ancylostomosis diagnosed in two Tswana pups in the present investigation has been frequently reported in dogs less than one year old and young pups (Urquhart *et al*., 1996). Conclusions for an 8-month-old dog suspected to have died of canine distemper were consistent with those described by López (2001).

For poultry birds received at College postmortem facilities, the pathological lesions suggestive of airsacculitis/chronic respiratory disease caused by *Mycoplasma gallisepticum* were consistent with those reported by Chauhan (1993) and Herenda and Franco (1996). Cases of fatty liver syndrome were found to be associated with the feeding of excessive high-energy rations. The history of the cases indicated that the birds were being fed rations consisting of 22% crude protein (CP) for layers as opposed to the requirement of 16% CP and it is the likely cause of fatty liver and is consistent with report by Avipath (2013). The explanation for occurrences of egg peritonitis, pendulous crop, cannibalism, and toxic fat syndrome provided by Chauhan (1993) and Herenda and Franco (1996) is as follows: underdeveloped oviduct, ovarian regression, ovarian rupture, and secondary infection of free yolk in the abdominal cavity by *Escherichia coli* may cause egg peritonitis. Pendulous crops can be caused by vagal paralysis and muscular weakness of the crop, excessive consumption of water and partial blockage of proventriculous or gizzard (Chauhan 1993; Herenda and Franco 1996). Insufficient feed intake and competition for feeding and drinking space, leading to fighting between birds are some of the causes responsible for vent picking or cannibalism. Toxic fat syndrome in grower chicks may point out the presence of some toxic factor in the feed. Pathological lesions recorded in cases of fowl paratyphoid, fowl pox and dehydration in this study were similar to those described by BNVL (2012).

The occurrences of coccidiosis, hypothermia, and infectious coryza in guinea fowls and pasteurellosis and coccidiosis in rabbits have been reported earlier and our observations were consistent with those of Prabu (2005), Alyssa (2011), Moreki *et al*. (2011), Anonymous (2013), Praag (2013). Moreki *et al*. (2011) using disease data from BNVL (2010) noted higher prevalence of coccidiosis and helminthiasis in guinea fowls and advocated for the need for extension service to intensify farmer training on health management of the birds.

Based on the findings of the current investigation, disease conditions and diagnosed to be associated with mortality among domestic animals were gastrointestinal parasitism and tick-borne heartwater in ruminants; colibacillosis, swine erysipelas and salmonellosis in pigs and transmissible venereal tumors, canine distemper and ancylostomosis in dogs. Some other important disease conditions recorded in poultry were toxic fat syndrome, chronic respiratory disease, vent picking, fatty liver syndrome and fowl paratyphoid; infectious coryza, vent picking and hypothermia in guinea fowls; and coccidiosis and pasteurellosis in rabbits. It is hypothesized that the frequent occurrence of these diseases at farm level is compounded by reduced contact between extension agents and farmers.

The findings of this study, though not representative of any population, may be useful in designing integrated disease control strategies including education of the relevant stakeholders. The shortage of extension services to farmers is somehow superficial since extension staff is often assigned duties which are not extension in nature (TAHAL, 2000). In Botswana quality veterinary services are not easily available to livestock farmers because of the preoccupation of the scarce skilled Government veterinarians in the administrative duties and supervision of vaccination campaigns, quarantine camps and cordon fences. It would be worthwhile to transfer delivery of some veterinary services to the private sector. There is also a clear need to strengthen the existing extension network to focus on primary animal health care in order to achieve better livestock productivity, and sustain and expand beef export market.

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Conflict of Interest None

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