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COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES

FACULTY OF VETERINARY MEDICINE

PROJECT REPORT FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR AWARD OF BACHELORõS DEGREE IN VETERINARY MEDICINE

Submitted by:

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PROJECT TITLE:

Causes and risk factors associated with calf mortality at Kanyariri Veterinary Farm, Kabete

Supervisor:

PROFESSOR G.K GITAU

DECLARATION

This project is my original work and has not been submitted for award of degree I any University.

SIGNED: _____ DATE _____

MOLOKO SHIELA J30/24474/2008

This project has been submitted and approved by University of Nairobi supervisor

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DEDICATION

This project is dedicated to my late grandfather, Moloko M.D. for all that we have talked about concerning animals, to my neighbourMakuaJ.N. for inspiring me learn more about causes of calf mortality and lastly to my son, Ramolobeng T.K. for inspiring me to work hard.

ACKNOWLEDMENTS

I would like to thank my supervisor Professor Gitau G.K. for guiding me every step of writing this project. I would also like to thank members of staff of the Department of Pathology, Microbiology and Parasitology who played a role in the diagnostic work, Dr Okumu P and Dr Cheriot L.K. for helping me access data and Professor Gachuiri C.K. for helping me understand dairy farm management systems. Lastly I would like to thank my mother and husband for the endless support and encouragement throughout the period of this project.

Table of contents

List of figures

List of tables

Abstract

This project was conducted in order to determine the causes and risk factors associated with calf mortality in Kanyariri Veterinary Farm of the University of Nairobi. Factors associated with calf mortality were determined from information on management procedures carried out inKanyariri Veterinary Farm. Causes of calf mortality were determined from post mortem data of calves submitted in the Department of Pathology, Microbiology and Parasitology, Faculty of Veterinary Medicine, University of Nairobi. The results revealed that out of 70 cases presented, 62.9% (44/70) were females, 28.6% (20/70) were males and 8.6% (6/70) had their sex unclassified. Approximately 92 % of the cases had their diagnosis made through post mortem examination and 8.6% of the cases had inconclusive diagnosis. The proportion of cases whose age were specified (41.4%) was less that of unspecified cases (58.6%). Of the cases whose age were specified, 34.5% were less than 3 months old, 13.8% were between 2-3 months old and 51.7% were more than 3 months old.

Increased calf herd size (>6) and mixing of all age groups of calves in one paddock were found to be some of the factors associated with calf mortality. Pregnant dams and young calves were not vaccinated against diseases e.g.Salmonellosis, that cause high mortality rate in calves. Newborn calves were kept with dams for the first seven days of life. This practicemay have increased the risk of disease transmission to calves especially those born of dams that were sick or are carriers of infections.Dystocia rate was high in the year 2014 and that may have contributed to the higher rate of mortality observed compared the other years.

Introduction

Cattle are a source of food, particularly protein for human diets and they provide income, employment, transport, can serve as store of wealth, provide draft power, organic fertilizers for crop production (Perry et al. 2005; Rushton 2009), milk, hides and fat. Rural Kenyans derive a range of financial benefits from livestock keeping, including the provision of credit, insurance and as a means of sharing risk (IGAD, 2011). According to the Kenya National Bureau of Statistics (KNBS), the value added by livestock to the agricultural sector of the Kenyan economy was 318.971 billion Kenya shillings (Ksh) in 2009, of which 197.018 billion Ksh was from cattle milk and 53.960 billion Kshfrom cattle offtake. This means cattle contributes 78.7 % of the total livestock contribution to GDP (IGAD, 2011). Optimization of animal production is therefore of paramount importance to both Kenyan economy and food security of the nation

However, there are constraints cattle farmers face that hinder optimization of production. A study carried out in the four districts of Machakos, Mumias, Vihiga and Lugari indicates that the major constraints to cattle production were diseases, lack and/or poor artificial insemination (AI) services, lack of feeds and problems of provision and delivery of livestock services (Emongor et al, 2007), with diseases of cattle being the most significant and responsible for most mortality cases.

Diseases and parasites are among the most severe factors that impact livestock production and productivity. Diseases that reduce production, productivity and profitability are associated with the cost of treatment, disruption of local markets, international trade and exacerbate poverty on rural, local and regional communities. Livestock diseases can cause direct losses (mortality, stunting, reduced fertility and changes in herd structure) and indirect losses (additional costs for drugs and vaccines, added labour costs and profit losses due to denied access to better markets and use of suboptimal production technology) in revenue (Rushton 2009). Disease control strategies should be in place in all animal production enterprises; be it small scale farms or large scale farms to ensure increase in productivity.

Minor constraints to cattle production identified included lack of water, low genetic potential, low fertility, lack of labour and marketing of livestock (Emongor et al, 2007).

In the tropics, cattle are at risk of various tick-borne diseases and worms, all of which can cause significant production losses (Frisch, 1999) and mortality. Some native cattle breeds i.e. *Bosindicus* (e.g. Zebu and Nguni) are less susceptible to infestations than the imported ones i.e. *Bostaurus* (e.g. Friesian, Jersey, Ayshire) (E. Lamy et al, 2012). All these constraints increase losses and hinder optimization of production in livestock farms.

The most significant loss in dairy or beef enterprises is associated with calf mortality (Radostitis, 2005). It is roughly estimated that a calf mortality of 20% may reduce net profit to 40% (Blood and Radostits, 1989).Targets (optimal) for acceptable calf mortality are; 1% perinatal, 1-3% neonatal, 1 % old calf and 3-5% annual for all calves (Radostitis, 2005).

Kanyariri Veterinary farm of the University of Nairobi has a dairy unit that is not immune to the above mentioned challenges. The farm is located on a 375 acre piece of land in Kanyariri village of Lower Kabete. It is 2 KM to the West of Upper Kabete Campus and 15 KM from Nairobi city astride the Fort Smith Road. It is mainly a teaching farmfor the Faculty of Veterinary Medicine and Faculty of Agriculture of University of Nairobi, with trained and experienced staff in the areas of animal production and health.The farm keeps a herd of dairy cattle, a flock of Dorper sheep, and has a piggery unit and layer poultry unit.

The breeds of dairy cattle kept are; Friesian, Jersey, Ayrshire and Guernsey breeds. Female calves are reared to become replacement heifers and bull calves are sold for income generation to the ready market in the surrounding areas. The farm has various forage fields for feeding animals (direct grazing and hay making), teaching and income generation. These include 50 acres of hay field, 40 acres of maize field, Napier grass and Desmodium. There are also 740 cubic mts tower silos.

It is **hypothesized** that gastroenteritis and pneumonia are the leading causes of calf mortality and that proper management of calves play a significant role in reducing the rate of calf mortality.

The**objective**of this project was to assess thecauses andmanagement factors associated with calf mortality at Kanyariri Veterinary farm, Kabete, Kenya.

The objectives of this project were:

1. To determine the prevalence and causes of calf mortality at Kanyariri Veterinary farm
2. To assessthe management and husbandry practices at Kanyariri Vet farm in order to identify factors associated with calf mortality.

Literature review

Calf mortality is caused by both infectious and non-infectious causes (Singh et al, 2009).

Non-infectious causesof calf mortality

These include poor management factors, inadequate circulating immunoglobulins, parturition problems and parity, sex and birth weight of the calf (Singh et al, 2009).Age of the calf is a risk factor that predisposes calves to disease infections and mortality.

Management factors

A previous study in Pakistan showed that in a poorly managed dairy farm, the crude mortality rate was found to be as high as 90% (Razzaque et al, 2001). High losses of young calves were due to inadequate management practices leading to diarrhoea, pneumonia, dehydration, and infection by *Esherichia coli*, Salmonella species, Rotavirus and *Pasturellahaemolitica* and coccidiosis(Razzaque et al, 2008). Razzaque et al (2009) reported that a reduction in calf mortality rates by introduction of improvement management and disease control intervention had a positive impact on gross margins. Important aspects of management include; ventilation and house structure, neonatal and dam care, provision of colostrum, proper feeding and provision of clean portable water,herd size, regular cleaning and disinfection, good record keeping, prevention and disease control, parasite control and breeding management.

Other management strategies that reduce calf mortality include;isolation of calves to the clean individual calf pens and providing heating/cooling as needed. In cases of increased population density (e.g. crowded dairy barn) and in the presence of known disease it may be necessary to transfer the newborncalf to non-infectious environment i.e. individual pen away from the dam because adult cows shedding enteric pathogens are a risk to calf infection.This reduces the severity of neonatal diarrhoea and pneumonia and risk of mortality compared to calves allowed to remain with the dam (Radostits 2005). Individual housing of dairy calves, either indoors or outside, is generally linked with improved calf health. There is a long-term recognition of the benefit to dairy calf health of outdoor housing in hutches, especially for the prevention of infectious diseases because this avoids navel sucking and other methods of direct-contact transmission of disease.

The risk of respiratory diseases is lowered if calves are housed individually in naturally ventilated calf barns with solid dividers on the side of pens (Lago et al, 2006). Inadequate ventilation of calf barns increases the risk of diseases due to build-up of high levels of humidity and noxious gases, dust and bacterial contact (French et al, 2001). Ammonia concentrations are enhanced by the accumulation of urine and faeces, which emphasizes the need for regular cleaning and provision of dry bedding, together with adequate ventilation. High levels of noxious gases lead to adverse effects on the respiratory system (Wudu et al, 2007).

Isolation of late pregnant cows in clean maternity barns prior to their delivery and assisting cows during calving reduces rate of calf mortality (Razzaque 2009). Dystocia may result in physical injuries, hypoxia, oedema of parts of the newborn and consequently reduced vigor and viability of the newborn calves (Radostits 2005). Dystocia in dams increases the rate of mortality in neonates (Razzaque 2009). Calves with reduced vigor do not consume adequate colostrum and these increases the susceptibility of calves to infectious agents (Radostits 2005). Incidence of dystocia is higher in primiparous dams than in multiparous dams and is also significantly higher when the calf is male but lower when the calf is female (Mee, 2008). As parturition problem decreases with age and parity of the dam, the amount of colostrum available and concentration of colostralimmunoglobulins increases (Sangwan et al, 1985). The immune status is better in calves from multiparous than primiparous cows.

Timely colostrum feeding is also another important management practice. Calves without adequate circulating immunoglobulins are four times more likely to die and twice as likely to

become ill as calves with adequate circulating immunoglobulins (White and Andrews, 1986). Absorption of immunoglobulins continues up to 48 hours in calves, but maximum absorption occurs within the first 6-8 hours of life (Blom, 1992), if feeding of colostrum is delayed from this period, it results in hypo or agammaglobulinemiain calves (McGuire et al, 1976). Cleaning/ disinfecting of navels of newborn calves and removal of mucus from the mouth and nose reduces calf morbidity and mortality rates (Fink, 1980).

The specific resistance of the newborn to infectious diseases may be enhanced by vaccination of the dam during pregnancy to stimulate the production of specific antibodies which are concentrated in the colostrum and transferred to the newborn after birth. Vaccination of the dam can provide protection for the neonate against enteric and respiratory diseases (Radostitset al, 2000).

Nutrition of the calves and cows in calf play a role in overall calf health. Feeding calves below maintenance protein and energy intake has been shown to impair numerous aspects of the animalôs immune response (Quiqley, 2013). Greibel et al (1987) found that immune cells taken from calves fed diets limited in protein and energy were less able to respond to challenge with an antigen. However, when calves were switched from the low plane of nutrition to one similar to control calves, the ability of lymphocytes to respond to challenge increased within seven days to those at or above pre-treatment levels.

Maternal under- and over-nutrition can restrict nutrient supply to the foetus (Schoonmaker, 2014). Altered maternal nutrient during the first trimester primarily impacts animal metabolism with long-term implications for progeny energy balance and body composition. Altered maternal nutrition during last trimester primarily impacts the extent of foetal growth, affecting birth weight and having potential implications for long-term growth and body composition (Schoonmaker, 2014). Corah et al (1975) observed that progeny born to energy restricted cows had increased rates of morbidity and mortality.

Overcrowding, no regular cleaning and disinfection prolongs the survival rate and increases the number of pathogens in the environment of the calf. This predisposes various disease of calves, especially of the respiratory tract leading to high calf mortality (Fedida et al, 1985). Calves should be born in an environment that is clean, dry and sheltered (Radostits et al, 2000).

The study carried out by Razzaque et al (2009) in Pakistan determined that poor record keeping systems makes it difficult to carry out economic assessment of calf mortality and decision making process in farms. Therefore cost/benefit analysis data of calf rearing become unavailable, as a result, dairy producers resort to import dairy heifers as an only option.

Prompt treatment of calves for scours, pneumonia and dehydration, feeding appropriate milk replacer as per NRC (2001), standard weighing of calves at 90 days and isolating them for group feeding were also important elements of management.Nematodes were reported to caus poor growth rates and high mortality in undrenched calves when weaning preceded the wet season (0wen et al, 1983). Thereforeregular deworming and control of ectoparasites is of paramount importance.

Calf risk factors

Sex and birth weight of calf play a role in calf mortality. Mortality is higher in male than female neonatal calves (Kaushik et al, 1980), reason for this higher mortality might be due to serum immunoglobulins, which absorb less in male than female calves (Sangwan et al,1985) and therefore male calves are more prone to bacterial diseases than female calves (Kaushik et al, 1980). Birth weight had a significant effect on mortality. Calf mortality decreases gradually with increase in birth weight (Singh et al, 1980).

Age is a calf risk factor that predisposes a calf to mortality.Studies from the temperate countries report that the calf is at greatest risk of death soon after birth, and the risk decreases as the calf ages (Curtis et al, 1988). Young calves are highly susceptible to infectious diseases as a result of lower immunity which could be exacerbated by inadequate colostrum intake (Oluokun and David-West; 1988, Brenner, Orgad and Gat 1989).

Congenital defects are present in all breeds of cattle. In most herds, they are rather uncommon; however, occasionally the frequency within a herd will be high enough to be of considerable economic importance. Congenital defects are abnormalities of structure or

function present at birth and may account for a high percentage of calf losses from just before to just after calving.

Infectious causes of calf mortality

Infectious livestock diseases remain a major threat to attaining food security and are source of economic and livelihood losses for people dependant on livestock for their livelihood. Knowledge of the vital infectious diseases that account for the majority of deaths is crucial in determining disease control strategies and the allocation of limited funds available for disease control. Several studies in East Africa have pointed to multifactorial causes of calf mortality within small holder systems, mainly related to maternal factors including genetics and mothering abilities, farm management practices and to infectious agents (Gitau et al, 1994; Muraguri et al, 2005; Swai et al, 2009).

A systematic literature review on causes of morbidity and mortality among smallholder dairy farms in Eastern and South Africa identified tick-borne diseases, diarrhoea and trypanosomisis as the most commonly documented causes of mortality (Phiriet al, 2010). Study by Gitau et al (2010) in Peri-urban areas of Nairobi, documented diseases and conditions of the respiratory system as the most common cause of calf mortality, withpneumonia as the most significant cause.

The gastrointestinal tract were the second most affected system with enteritis diagnosed in most cases. Infectious causes of calf diarrhoea reported are Rotavirus, Corona virus, Enterotoxigenic *Escherichia coli*, Salmonella and Cryptosporidium (Singh et al, 2009). Bloat was reported in a few cases. Severe calf malnutrition and septicaemia were reported as the third andtick-borne diseases (ECF most occurring) the fourth most common causes of calf mortality. The other least causes of calf mortality were helminthiasis and poisoning. Disease problems affecting the cardiovascular, musculoskeletal and nervous systems and the liver were the least reported causes of calf mortality (Mulei et al, 1995).

Some of the pathogens that cause infectious infertility (e.g. Brucella species) result in birth of weak calves which most of them die in the perinatal or postnatal period. McGowan et al (2003) documented that Leptospirosis, *Neosporacaninum* and Bovine Viral Diarrhoea were

recognised as causes of calf loss. This could be reduced by breeding management and control of infectious diseases of infertility.

The majority of the disease conditions documented as the causes of calf mortality could be avoided by the application of proper management procedures(Mulei et al, 1995)

Materials and methods

The areas of study were Kanyariri Veterinary Farm and the post mortem laboratory of the Department of Veterinary pathology, Microbiology and Parasitology.

Post mortem data of calf carcasses from Kanyariri Veterinary Farm was obtained by perusing through post mortem records of an 11 year period, between 2004 and 2014, kept in the virology laboratory of the Department of Veterinary Pathology, Microbiology and Parasitology, University of Nairobi, Kabete. Both male and female calves of ages ranging from 1 day to 10 months were investigated. The calves were representative of the following breeds; Ayshire30% (31/70), Friesian 51.4% (36/70), Guernsey 2.9% (2/70), Jersey 5.7% (4/70), Cross 1.4% (1/70) and unclassified calves 8.6% (6/70).Calves that had died of experimental procedures were excluded from the study.

The diagnoses were based on the history and clinical signs (reported), macroscopic post-mortem lesions and histopathological and microbial findings. Tissues taken for histopathology were fixed in 10% buffered formalin, processed and embedded in paraffin wax. The sections were cut at thickness of 5-7 um, then stained with heamatoxillin and eosin and Periodic Acid Schiff (PAS) and examined under the microscope. These were used to confirm diagnoses of conditions such as meningitis, hepatitis and pneumonia. The diagnoses of tick-borne diseases were confirmed by examination of lymph-node smears (ECF) and blood smears (anaplasmosis and babesiosis). Faecal samples were used to confirm helminths and coccidial infestations while bacterial diseases e.g. salmonellosis, collicbacillosis and septicaemia were confirmed by findings microbial culture. The samples taken for microbial culture were blood, gastrointestinal contents and organs showing pathological lesions. The methods employed for microbial culture and identification were described by Stevenson B (2006) and Michael et al (2002). History, clinical signs and absence of specific post-mortem lesions were the bases for diagnoses of diseases such as tetanus and poisoning.

Management risk factors associated with calf mortality

A set of questions about management and animal husbandry were formulated and presented to the veterinarian, Dr Cheriot L.K atKanyaririVeterinary Farm. Topics of investigation were neonatal and calf care, dam management, calf housing, hygiene and nutrition as well as breeding and disease control and prevention.

The student also surveyed the farm to assess the hygiene status, feeding procedures as well as the body condition and general health of calves.

Data management and analysis

Data related to causes of calf mortality were analysed in proportions (%). Proportional cause mortality rates were calculated as the proportion of calves which had died from a specific cause (e.g. gastroenteritis) divided by the total number of calves which had died from all reasons. Results were presented as Tables (Tables 1, 2 and 3) and Figure 1. Table 4.a and 4b. summarize data of management practices obtained from the veterinarian at Kanyariri Veterinary Farm.

Results

The results are summarised in Tables 1, 2, 3, 4a, 4b and Figure 1. Furthermore, results affecting various body systems are described below. A total of 70 carcasses of calves were examined at the post mortem facility during an 11-year period, 2004-2014. The proportion of female calves presented for post mortem examination was almost double that of male calves.The number of female, male and unclassified calves were 67.9% (44/70), 28.6% (20/70) and 8.6% (6/70) respectively (Figure 1). 41.4 % (29/70) of the carcasses had their age specified (Table 2) and 58.6% (41/70) not specified (Table 3). Of the cases specified by age, 34.5% (10/29) calves were less than a month old, 13.8% (4/29) were between 1 month and 3 months and 51.7% (15/29) were more than 3 months old. For calves whose age was specified, respiratory conditions and GIT were both the leading causes of mortality in calves less than 3 months old. GIT conditions and inconclusive cases were the leading cause of mortality followed by respiratory conditions in calves greater than 3 months old (Table 2).

For calves whose age was not specified, GIT conditions were the leading cause of mortality followed by respiratory conditions (Table 3).

No diagnosis was established in 2.8% (2/70) cases, the results were inconclusive because the carcasses were decomposed. Four of the 70 (5.1%) cases died due to conditions in minor categories, i.e. generalised lymphadenopathy, suspected anthrax, umbilical hernia and deformed mandible.

Details of the major disease conditions diagnosed during post mortem are described below according to the body system affected.

Digestive system

The digestive system was involved in 50% (35/70) of the total number of cases presented. Thirty percent of the cases were due to gastroenteritis (21/70). Helminthiasis and bloat affected 5.7% [(4/70) X2] each. Other deaths were associated with intussusception, rumen impaction and indigestion, each killing 1.4% of the calves [(1/70) X3]. Peritonitis and Traumatic-Reticuloperitonitis affected 1.4% (1/70) and 2.9% (2/70) respectively.

Respiratory system

Disease conditions affecting the respiratory system were encountered in 28.6% (20/70) (Table 1) of the cases. Pneumonia was the second leading cause of death after gastroenteritis in calves, affecting 18.6% (13/70) of the cases. Pulmonary oedema and aspiration pneumonia affected 4.3% (3/70) and 1.4% (1/70) cases respectively. The other deaths were associated with atelectasis, bronchopneumonia, granulomatous pneumonia and purulent pneumonia, each killing 1.4% [(1/70) X4] of the calves.

TABLE 1.The common causes of calf mortality in Kanyariri Vet Farm, as diagnosed at the post-mortem facility, according to years.

System, organ or condition	Year											
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total (%)
Gastroenteritis	0	2	2	2	3	1	1	5	1	1	3	21 (30)
Helminthiasis	0	1	0	1	2	0	0	0	0	0	0	4 (5.7)
Bloat	0	0	1	0	1	1	0	0	1	0	0	4 (5.7)
Other digestive system conditions	0	0	0	0	0	0	1	1	0	1	3	6 (8.6)
Respiratory System	0	1	1	0	4	0	2	2	2	3	5	20 (28.6)
Tick-borne Infections	0	0	0	0	0	0	0	0	0	0	1	1 (1.4)
Septicaemia	1	0	0	0	0	0	0	1	0	0	0	2 (2.8)
Omphalitis	0	0	0	1	1	0	0	0	0	1	0	3 (4.3)
Malnutrition	0	0	0	1	0	0	0	0	0	0	0	1 (1.4)
Cardiovascular System	0	0	0	0	0	0	1	0	0	0	0	1 (1.4)
Musculoskeletal System	0	0	1	0	0	0	0	0	0	0	0	1 (1.4)
Inconclusive/ Others	0	1	1	0	2	0	1	0	0	1	0	6 (8.6)
Total (%)	1 (1.4)	5 (7.1)	6 (8.6)	5 (7.1)	13 (18.6)	2 (2.8)	6 (8.6)	9 (12.9)	4 (5.7)	7 (10)	12 (17.1)	70 (100)

Tick-borne infection

Tick-borne infection affected only 1.4% (1/70) of the carcasses. Anaplasmosis was established to be the cause of mortality in that case.

General systemic conditions

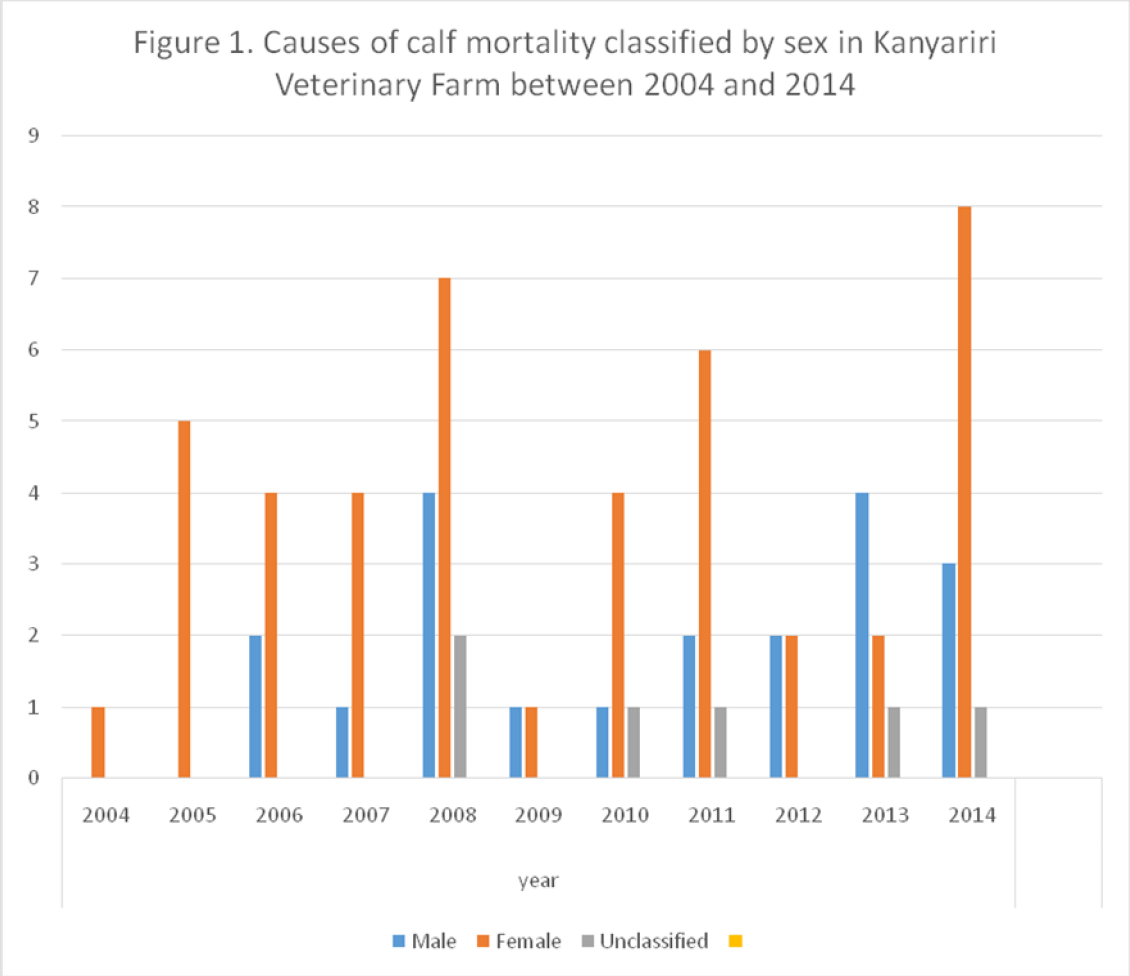
Two of the seventy (2.8%) cases died of septicaemia. One of them due to *Escherichia coli*and the other due to undifferentiated cause (based on post mortem findings only).

Musculoskeletal and cardiovascular systems

One ofseventy (1.4%) cases died of myocardial infarction and another one (1.4%) had severe traumatic injury on the left flank.

Malnutrition and Omphalitis

One of 70 (1.4%) calves died of severe malnutrition. It was severely emaciated, no other underlying disease condition(s) were associated with the cause of death and the gastrointestinal tract had little contents. Problems associated with omphalitis were diagnosed in 3 of the 70 (4.3%) cases.



Males (20/70) =28.6%

Females (44/70) =62.9%

Unclassified (6/70) =8.6%

Table 2. Causes of calf mortality by age in Kanyariri Veterinary farm between 2004 and 2014

System, organ or condition	<1 month (%) -	>1-< 3 months (%) -	> 3 months (%)	Total (%)
Gastroenteritis	3	1	4	8 (27.6)
Helminthiasis	0	0	2	2 (6.9)
Bloat	0	0	1	1 (3.4)
Other digestive system conditions	1	0	2	3 (10.3)
Respiratory System	4	1	2	7 (24.1)
Tick-borne Infections	0	0	0	0
Septicaemia	0	1	0	1 (3.4)
Omphalitis	1	0	0	1 (3.4)
Malnutrition	0	0	1	1 (3.4)
Cardiovascular System	0	0	0	0
Musculoskeletal System	1	0	0	1 (3.4)
Inconclusive/ Others	0	1	3	4 (13.8)
Total (	10 (34.5)	4 (13.8)	15 (51.7)	29 (100)

Table 3. Causes of calf mortality by unclassified age of calf in Kanyariri veterinary farm between 2004 and 2014

System, organ or condition	Total	Percentage (%)
Gastroenteritis	13	31.7
Helminthiasis	2	4.9
Bloat	3	7.3
Other digestive system conditions	3	7.3
Respiratory System	13	31.7
Tick-borne Infections	1	2.4
Septicaemia	1	2.4
Omphalitis	2	4.9
Malnutrition	0	0
Cardiovascular System	1	2.4
Musculoskeletal System	0	0
Inconclusive/ others	2	4.9
Total (%)	41	100

Calves were kept with the dam for the first seven days of life to ensure adequate ingestion of colostrum before they were separated into the calf paddock. Navels were disinfected with Iodine soon after birth to prevent omphalitis and despite this practice, 4.3% (3/70) of cases were diagnosed with omphalitis. Different age groups of calves are kept together in one paddock. Male calves are sold at a young age and therefore a large proportion of calves on the farm are females.

Upon visiting the farm for assessment of farm structure and housing, feeding procedures and the calves, most of the calves were in a poor to fair body condition, the Veterinarian stated that production of adequate feed to meet high demands of exotic breeds they are keeping is the main challenge and there was a high prevalence of dystocia cases between 2013 and 2014. Table 4a and Table 4b summarise the information on management practices in Kanyariri Veterinary Farm.

Table 4.a. Summary of calf and dam management inKanyariri Veterinary Farm

Calf and dam management	Yes/No	Other attributes/remarks
Where calved		In maternity pen
Feeding of colostrum	Yes	
Care of orphans	Yes	Foster mother or bucket feeding
Number of times fed per day		Four
Separation of calves from dams	Yes	After seven days
Calves separated according to age groups	No	
Age at weaning		3 months
Disinfection of umbilical cord	Yes	Iodine
Use of clean feeding equipments	Yes	
Provision of clean water	Yes	*Ad libitum*
Isolation of sick animals	Yes	In isolation pens
Assist dystocia deliveries	Yes	By veterinarians
Mastitis control	Yes	Teat dipping, stripping of clinical cases and intramammaryantibiotics
Record keeping	Yes	Manual

Table 4b. Summary of calf housing, nutrition, breeding and disease control and prevention in Kanyariri Veterinary Farm.

Calf housing and nutrition	Yes/No	Other attributes/remarks
Introduction of solid feed		Two weeks of age(Desmodium and Napier grass)
Age turned to pasture		Three months of age depending on body condition score
Type of feed		Desmodium and Napier grass in form of calf pellets and hay
Frequency of manure removal from calf pens		Once a month
Use of footbath during wet season	Yes	Copper Sulphate ($CuSO_4$)
Cleaning and hygiene of calf pens	Yes	Removal of mud and cleaning once a week
Breeding and disease control and prevention		
Vaccination of herd	Yes	Anthrax, Blackquater, Lumpy skin disease and Foot and Mouth Disease
Deworm	Yes	Calves every 3 months and adults every 4 months
Ectoparasites control	Yes	Spray every 2 weeks
Mating method	Yes	Artificial Insemination with semen imported from America and from Kenya Animal Genetic Resources Centre (KAGRC)
Mean age at first calving		28 months
Mean intercalving interval (days)		170-180 days
Mean intercalving to conception (days)		450-460 days

Discussion

The results of this project showed that 91.4% (64/70) of all the causes of calf mortality were associated with specific causes and 8.6% (6/70) with non-specific causes or belonged to other minor categories. These observations were in agreement with previous studies, which reported about 80% and 90% of the causes of mortality being specific (Gitauet al, 2010; Mulei et al, 1995).

Approximately 41% (29/70) cases were classified according to age compared to 58.5% (41/70) whose age was not specified. Of the calves specified according to age, 34.5% were less than a month old, 13.8% were between 2-3 months of age and 51.7% were more than 3 months old. This pattern of calf mortality is incoherent with previous studies. In general, calf mortality is higher in perinatal and neonatal calves and decreases with increase in age (Gitau et al, 2010).

Proportion of females mortality cases was almost double that of males. This pattern is not in agreement with previous studies. Riley et al (2004) reported that the risk of low vigor and death was higher among male calves compared with females. This could be because male calves are sold at a young age and as a result the herd contains a high proportion of female calves than male calves.

The two most important infectious conditions observed from this study were gastroenteritis and respiratory conditions. These observations are in agreement with studies by Gitau et al (2010) and many which reported diarrhoea and pneumonia as the first and second important disease complexes affecting calf health (Bhat et al, 2012).Omphalitis was observed in 4.3% of the cases despite the use of iodine for navel disinfection soon after birth (Radostits et al, 2000)stated that the efficiency of the disinfection of the umbilicus after birth is uncertain and that many cases of omphalophlebitis still occur in calves in herds swabbing or ñdunkingò of the navel in iodine solution.

Calves in Kanyariri Veterinary farm were fed adequate amounts of colostrum especially within the first 36 hours of life to strengthen immunity of the calves, however other management practices may have increased the risk of disease transmission to calves.

Calves of different age groups were all housed together in Kanyariri Farm and young calves were continuouslyadded to the group. This kind of practice increases the rate of calf mortality. Studies have shown that mortality was highest in larger calf groups i.e. of more than six calves (Losinger et al, 1997) and tended to be lower in small groups compared with either individual housed calves or calves kept in large groups (Svensson et al, 2006). Svensson et al (2006) further reported that the prevalence of both diarrhoea and respiratory disease was high among calves in dynamic (where new calves were continuously introduced to and exited group housing) compared to stable groups.

Newborn calves were kept with the dam for the first seven days of life and then separated to join the group of calves. Keeping the calf with the dam increases the risk of contracting infectious disease e.g. enteric conditions if the dam is infected with such a condition(Radostits et al, 2000). Despite high prevalence of gastroenteritis and respiratory diseases, dams in calfor young calves are not vaccinated against disease conditions such as Salmonellosis, other diarrhoea causative agents and respiratory diseases in Kanyariri Veterinary Farm. These practices are the risk factors that contribute to the high mortality rate of calves in the farm.

Higher mortality rates were observed in 2008 (18.6%) and 2014 (17.1%). In 2008, 4/13 and 3/13 cases of pneumonia and gastroenteritis were diagnosed respectively. This might havebeen due to the nutritional stress as a result of drought that hit Kenya in 2008-2009.

According to the veterinarian at the farm, there had been an increase in cases of dystocia at the farm in 2014 andmost of these calves developed with pneumonia and died within a short period of time. Calves which survive dystocia experience lower passive immunity transfer, higher mortality and higher indicators of physiological stress (Barrier et al, 2013). Kanyariri Veterinary farm imports semen from America and recent studies indicates that reported dystocia rates in dairy cattle internationally are generally <5%, apart from those in the United States, where they are generally higher (Mee et al, 2008). Phenotypic dystocia trends are generally increasing internationally and this trend has been partially attributed to the introduction of Holstein genes (Mee et al, 2008).

Conclusion

This study showed that gastroenteritis and respiratory diseases are the leading causes of calf mortality in Kanyariri Veterinary Farm. This results are in agreement with studies of causes of calf mortality in the neighbouring farms in Kabete and Peri-Urban areas of Nairobi (Mulei et al, 1995; Gitau et al, 2010) and in other places across the world according to various studies on calf mortality. These conditions are preventable through proper management especially during the early period of calvesô lives. There are certain aspects of management of calves in Kanyariri Veterinary Farm that are risk factors of calf mortality, and improving on these aspects could reduce the rate of calf mortality and increase production in this farm.

Recommendations

It is recommended that;

1. Efforts should be made to separate the calves according to age and keep them in small groups rather than one large group.
2. Implementation of pregnant dams and/or calvesô vaccination programs to protect calves from infectious diseases.
3. Research must focus on the causative agents of calf diarrhoea and calf pneumonia in order to prevent and control economic losses due to these diseases.

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