



Prevalence of Endometritis and Its Associated Risk Factors in Dairy Cattle of Central Uganda

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Authors' contributions

This work was carried out in collaboration between all authors. Authors DST, GB designed the study and wrote the study protocol and collected the data. Authors DST, JB and KIK wrote the first draft of the manuscript, managed analysis and performed statistical analysis. All authors read and approved the final manuscript for submission.

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ABSTRACT

Aims: Endometritis is a major postpartum disease that affects dairy cattle productivity which is accompanied by heavy economic losses to the farmer. The status of Clinical endometritis (CE) and Sub-Clinical Endometritis (SCE) in sub-Saharan Africa is poorly understood, thus the study was carried out to provide information on the prevalence and associated risk factors that are responsible for the occurrence of SCE and CE in dairy cattle of Central Uganda.

Study Design: This was a prospective study involving 140 dairy cattle within 60 days postpartum from 35 commercial dairy farms in Central Uganda. The dairy herds were visited in both the dry (n=90) and wet season (n=50) and subsequent visits were conducted after 3 months and 5 months

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to collect data for reproductive performance

Methodology: A metricheck® device was used to collect the cervico-vaginal discharge which was examined for color, odor, texture, and measurement of its pH during the postpartum period for diagnosis of endometritis. Further examination of the reproductive tract was carried out using a vaginal speculum and subsequently rectal palpations were performed. The objectives of the study were to determine the prevalence of CE and SCE in the Central Uganda and assess the risk factors involved.

Results: In this study, the prevalence of CE and SCE was established at 3.6% and 18.6% respectively, this burden was slightly higher in the wet than in the dry season but with no statistical significance $P=0.126$. Dairy cattle that had calved more than three times were shown to be associated with a higher body appearance (BCS > 3) than those that had calved down fewer times. Dystocia, Retained After Birth and Abortion were identified as associated risk factors ($P = 0.00$) to SCE and CE whereas infertility and Prolonged days calving to conception (>90 d) were postpartum implications ($P=0.00$) associated with SCE and CE in this study. This would be attributed to the poor management of postpartum dairy cattle in the farms visited as no farm was found with a maternity pen. SCE caused infertility in 65.5% of the dairy cattle whereas the CE is a major influencing factor to long calving to first AI and calving to conception interval ($306d\pm90.6$), On basis of reproduction, there was no major difference towards use of AI or Natural service.

Conclusion: Management of endometritis in the region should address pre-partum and postpartum dairy herd management through improved extension service delivery and technical farm support to construct maternity pens, Endometritis is a multifactorial disease that requires a multidisciplinary approach to boost nutrition and health thus reducing incidence of risk factors such as dystocia and Retained fetal birth) .subsequent studies should be carried out to explore the national burden of SCE and ascertain the cause of the abortion.

Keywords: Endometritis in dairy cattle; dairy production systems in Uganda; reproductive performance.

1. INTRODUCTION

Microbial disease of the female reproductive tract is a major concern in dairy cattle production systems [1]. This is because microbial infections are highly associated with infertility as they disrupt uterine and ovarian function. Uterine disease within a week of parturition (metritis) has been shown to be common to dairy cattle [2]. The clinical presentation of endometritis has been clearly elaborated in previous studies, and it has been shown to include both Clinical Endometritis (CE) and Sub-Clinical Endometritis (SCE) [2-5]. CE has been shown to be characterized by an enlarged uterus and a watery red-brown fluid to viscous off-white purulent uterine discharge, which often has a fetid odor [1]. SCE on the other hand is associated with inflammation of the endometrium that results in a significant reduction in reproductive performance in the absence of signs of clinical endometritis [6]. The inflammation is presumably associated with recovery of the tissues after clinical endometritis, trauma or other non-microbial disease. SCE has been shown to be defined by polymorphonuclear neutrophils (PMNs) exceeding between 5.5% of cells and 10% of cells in samples collected by flushing the uterine lumen [1].

The prevalence of SCE and CE in Sub-Saharan Africa is not clearly known, but studies in Germany have shown it to be close to 15% to 20% in dairy cattle respectively [7,8]. In dairy cattle, uterine infections are not life threatening and often unavoidable; however, they reduce fertility and increase the production costs of properties [9]. The major risk factors that have been identified associated with the endometritis include: health status, parity and body condition score (BCS) of cows, and calving date and it has been shown that the first service conception rate is lower in dairy cattle suffering from endometritis which significantly decreases reproductive performance of dairy herds [10]. The study was carried out to provide information on the prevalence and assessment of risk factors that are responsible for the occurrence of sub/clinical endometritis in Central Uganda.

2. MATERIALS AND METHODS

2.1 Farms and Animals

This was a prospective study carried out for a period of 13 months involving dairy farmers in the Central region (Kampala, Mukono and Wakiso districts) of Uganda. A total of 35 Commercial dairy farms were randomly visited for

examination of dairy cows (n=140) within 60 days postpartum, involving both local and exotic dairy breeds. Herd size was not an inclusion criteria but the farms visited were free stall (45.7%) majority, paddocking (31.4%), Zero grazing (22.9%) with average herd size of 35.8±0.05, 70.3±22.5 and 12±10.1 respectively. Classification of the management system was based on; farms keeping their animals strictly in a pen feeding them on cut and carry grass, forage with peelings from bananas (*Musa acuminata*) supplements as zero grazing farms, those with a stall for feeding the cows on cut and carry grass, forage but with one or two paddocks around the stall where the animals graze, free stall; while paddocking farms were those that entirely let the animals graze on pasture within fenced perimeters without any supplementation. The farmers were visited initially once in the dry (n=90, June - August 2013) and wet (n=50, April - June) seasons in a study area that experiences a bimodal rainfall pattern through the year separated by two short dry seasons from December to March and June to August. Monitoring visits (2), after 3 and later at 5 Months were scheduled for monitoring reproductive performance (return to heat, service and conception). All dairy cattle within 60 days postpartum were included in the study using farm reproductive records, among details taken were: breed, age, date of last calving, date of last AI (Artificial Insemination), calf health, prior to the physical examination and rectal palpation. The stage of parity was classified into three groups i.e. young (< 2 times), prime (3 times), mature (> 3 times). The body condition score (BCS) was recorded using a rank of 1-5 [11]; the dairy production systems and farm descriptive data were recorded through observations that were made. Any complications at the time of calving were recorded by use of farm records and discussion with the farmer or herdsman and those taken into account included, dystocia; if the cow had assisted delivery, Abortion; when the cow lost the fetus before term, Retained After birth; if expulsion of the placenta was assisted after 24hrs and non-reproductive related diseases such as tick borne diseases were classified as ill health.

2.2 Sample Collection and Reproductive Examination

A metricheck® device was used to collect the cervico-vaginal discharge and observations for the characteristic of the discharge (appearance, color, texture odor) were made and recorded, the

pH of the discharge was measured using a pH test paper (BTB role type, Advantec®). Subsequently, further examination was carried out using a vaginal speculum (4 cm in diameter and 35 cm in length) and a torch light for observations of the cervix status (closed or open), mucous and or pus origin (uterus or vagina) and rectal palpation was performed to check the status of the ovaries, cervix and uterine horns as well as any other anomalies in the reproductive system [12,13], Endometritis was clinically diagnosed based on discharge characteristics and pH reading, the discharge was considered normal if it was clear or slightly cloudy without pus specks, a foul smell and pH (6.4-6.8). Mucopurulent (approximately 50% pus and 50% mucous with no foul smell and pH > 7.0) was considered SCE and purulent (> 50% pus with foul smell, pH > 7.2) was considered abnormal, indicating CE [8]. Microscopic examination of the cervico-vaginal discharge was not conducted.

Reproductive performance data was collected after 3 and 5 months, records were taken for; date when seen on heat, date of service (AI/bull), production disease (Milk fever, Downers cow syndrome, Mastitis), rectal palpation was done to confirm pregnancy of animals served and check for cases of Infertility (cystic ovaries, silent heat, acyclic ovaries, return to heat), animals that had not conceived were subjected to further examination using a vaginal speculum to check for health status of the reproductive tract.

2.3 Statistical Analysis

Data was recorded in Microsoft excel (version 2010) before transferring it to SPSS statistics data editor (version 17) for expression of frequencies and descriptive data using Chi-square at a Confidence Interval (CI 95%), a P value < 0.05 was considered statistically significant for all the tests performed. The graphical output was done with (Graph Prism version 6).

3. RESULTS AND DISCUSSION

The study revealed that the prevalence of Clinical Endometritis (CE) and Sub-clinical Endometritis (SCE) is at 3.6% and 18.6% in the study as shown in Table 1.

It was shown that the prevalence of Endometritis was the slightly higher in the rainy season than in the dry season but no statistically significant differences existed (P=0.126) regarding the prevalence. The predominant breed in the study

was the Holstein Friesian thus the mostly affected by both CE and SCE, Following the government's recent efforts to improve the livestock industry through the National Agricultural Advisory Directorate Services (NAADs) project that provided mainly Holstein Friesian to farmers countrywide, the major breeds of most farmers in Central Uganda were found to be composed of *Bos taurus* (Table 2). The majority of the dairy cattle affected by SCE were shown to be associated with a BCS > 3, as well as those with parity ≥ 2 as shown in Table 2.

Further analysis of the different breeds and location showed no marked inferences ($P > 0.05$). Dystocia, abortion and retained after birth were identified as the major risk factors to both CE and SCE in this study ($P=0.003$), while infertility was shown to be the major postpartum complication in dairy cattle that suffer from SCE (69.2%, $P=0.000$). the study showed that 100% of cattle that suffered from CE had a long calving to conception interval >180 days, this is scenario is quite replicated SCE, where 76.9% of animals that suffered this disease had days calving-conception > 180 ($P=0.000$), this hinders achieving the reproductive index of a calf per cow per year, thus imposing loss to the dairy farmer.

The SCE prevalence reported in this study highlights the risk raised by several sub-clinical reproductive infections in the dairy industry as it has been shown to have high economic implications [7]. This is important since farmers in the region have often been reported to institute treatment without necessarily seeking the services of professional veterinarian as a result of the liberal drug industry [14,15]. This has continuously curtailed the farmer and animal health scientists to easily diagnose diseases that continue to cripple the productivity of the livestock industry especially those of sub clinical nature. The identified risk factors; RAB, abortion and dystocia are thought to be responsible for the poor involution of the uterus thus causing the high prevalence of SCE, thus leading to infertility and lengthened calving-conception which is in agreement with a recent study [1]. The incidence of endometritis i.e. both CE and SCE was shown to be relatively the same in both seasons, illustrating that disease occurrence is independent of the time of study and not associated with Endometritis ($P = 0.126$) which was in agreement with recent findings [1].

The risk factors; dystocia and RAB were strongly associated with occurrence of SCE and CE in

this study. This would be due to the poor management, no farm had a maternity pen and feed supplementation program for cows in dry period among the farms visited. Dairy cattle that had a higher body condition score ($BCS > 3$) were associated with a higher burden of SCE contrary to what had been illustrated in a previous study [1]. These discrepancies may reflect differences in the geography, the study population and management practices. The drop in BCS from the previous parturition postpartum has been shown to increase pregnancy loss probably accounting for the low parity associated with this group [9]. Co-existing nutritional deficiencies that the postpartum dairy cattle probably would be suffering from such as Sub-Clinical Ketosis (SCK) are probably responsible for the loss of the protective advantage gained prepartum [16]. The abnormally lengthened calving intervals due to endometritis have been shown to be associated with low productivity and thus serious financial implications to the farmer as productivity of the livestock herd is reduced severely [5,17]. This is partly responsible for the poor reproductive performance of most of the dairy cattle in Central region thus making the realization of the millennial developmental goals impossible at the moment. Like in many cases, endometritis as shown in Table 2, the most prevalent is the subclinical form (SCE, 18.6%) thus treatment and management is very minimal because farmers and extension workers have limited knowledge to diagnose this disease, [15]. The bacteria often infect the endometrium and proliferate without ceasing causing high cases of infertility. A recent study has shown that the accumulation of interleukins and ovarian steroids estradiol and progesterone have little or no impact on inflammatory responses to inflammation of the endometrium [2], as such proper diagnosis, management and treatment with antibiotics is the way to reduce the impact of this disease and improve productivity and income of the dairy farmer in Central Uganda.

This study highlighted that there is significant relationship between the burden of SCE and infertility rate as illustrated in Table 3 with the highest rate 65.5 recorded for those animals that suffered from SCE ($P=0.000$, CI 95%), whereas CE has been shown to highly increase the calving to conception interval to over a year. This probably explains the extremely low conception rate shown at first service for animals suffering from both CE and SCE. This does not pinpoint but illustrates the potential of CE and SCE to infertility, culling and loss to the farmer.

Incidentally there was no significant difference in the success of AI or natural service, similar with the conception rate.

The study showed a peculiar trend between the calving's and the rainfall pattern (seasonal variations) with the highest number of calving's (41.4%) registered in July during the dry season, the month with the least amount of rainfall registered per year as shown in Fig. 1. This may explain the low burden of CE in regards to the reduced chances of contamination at the time of

parturition given the management state of the farms in the region that have no maternity pens, cows tend to produce from the pens or the farms and if this coincides with high rainfall and a damp, dirty environment, complimented by farmers self-reliance to assist parturition without seeking veterinary help. Such natural circumstances like cows calving in the dry season may contribute positively to the low prevalence of CE and SCE.

Table 1. Showing the overall prevalence of endometritis in commercial dairy cattle in Central Uganda

Endometritis	Clinical endometritis / CE (%)	Sub-clinical endometritis / SCE (%)	Negative	Total
Prevalence	5 (3.6)	26 (18.6)	109 (77.8)	140 (100)

Table 2. Showing CE and SCE prevalence and factors associated with its occurrence in dairy cattle

PARAMETERS	VARIABLES	Normal	CE	SCE	Total	Chi square & P- value, CI (95%)
Breed	Holstein	93(85.3%)	4(80.0%)	22(84.6%)	119(85%)	
	Friesian					
	Guernsey	10(9.2%)	0(0%)	1(3.8%)	11(7.9%)	
	Jersey	2(1.8%)	1(20.0%)	2(7.7%)	5(3.6)	7.305
Body Condition Score	Indigenous	4(3.7%)	0(0%)	1(3.8%)	5(3.6%)	0.294
	< 3	26(23.9%)	2(40.0%)	7(26.9%)	35(25%)	
Parity	= 3	25(22.9%)	1(20.0%)	4(15.4%)	30(21.4%)	1.366
	>3	58(53.2%)	2(40.0%)	15(57.7%)	75(53.6%)	0.850
	< 2	47(43.1%)	0(0%)	10(38.5%)	57(40.7%)	3.75
Season	≥ 2	62(56.9%)	5(100%)	16(61.5%)	83(59.3%)	0.153
	Dry	74(67.9%)	2(40.0%)	13(50.0%)	89(63.6%)	4.145
Location	Wet	35(32.1%)	3(60.0%)	13(50.0%)	51(36.4%)	0.126
	Kampala	18(16.5%)	1(20.0%)	2(7.6%)	21(15%)	
	Wakiso	30(27.5%)	2(40.0%)	12(46.2%)	44(31.4%)	4.171
	Mukono	61(56.0%)	2(40.0%)	12(46.2%)	75(53.6%)	0.383
Risk factors						
Complications at Birth	Non	103(94.5%)	0(0%)	19(73.1%)	122(87.1)	
	RAB	0(0%)	2(40.0%)	1(3.8%)	3(2.1%)	
	Dystocia	0(0%)	1(20.0%)	2(7.7%)	3(2.1%)	
	Abortion	0(0%)	2(40.0%)	1(3.8%)	3(2.1%)	92.915
	Ill health	6(5.5%)	0(0%)	3(11.5%)	9(6.4%)	0.000
Postpartum implication						
Calving to conception	Within 90 Days	27(24.8%)	0(0%)	2(7.7%)	29(20.7%)	
	90-180 Days	37(33.9%)	0(0%)	4(15.4%)	41(29.3%)	15.943
	> 180 Days	45(41.3%)	5(100%)	20(76.9%)	70(50%)	0.003
Postpartum Complications	Non	90(82.6%)	4(80.0%)	4(15.4%)	98(70%)	
	Infertility	5(4.6%)	1(20.0%)	18(69.2%)	24(17.1%)	
	Production Diseases	14(12.8%)	0(0%)	4(15.4%)	18(12.9%)	65.579
						0.000

Key: CE = Clinical endometritis; SCE = Sub-Clinical endometritis; RAB=Retained after Birth

Table 3. Reproductive performance of dairy cattle in Central Uganda

	Animal health status			Total
	Normal	CE	SCE	
Number of animals	109	5	26	140
Conception rate at first AI service (%)	31.2	20.0	3.8	25.7
Conception rate at first service by Bull (%)	33.9	40.0	11.5	30.0
Conception rate at ≥ 2 AI services (%)	2.8	-	7.7	3.6
Conception rate at ≥ 2 services by Bull (%)	4.6	-	3.8	4.3
Infertility rate (%)	12.8	20.0	65.5	22.8
Culling rate (%)	14.7	20.0	7.7	13.6
Calving to first AI interval (mean ± SD)	133.3±82.5	306±90.6	137.6±91.5	139.4±88.1
Calving to conception interval (mean ± SD)	138.7±79.5	306±90.6	143.3±88.3	144.7±85.1

Key:CE; Clinical Endometritis, SCE; Subclinical Endometritis, AI; Artificial Insemination

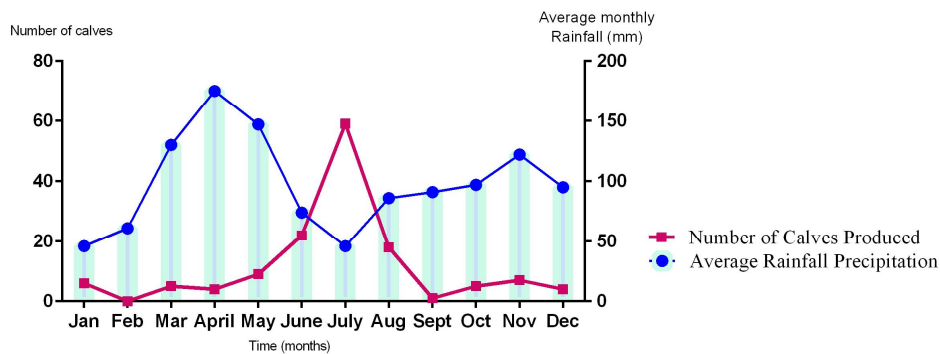


Fig. 1. Distribution of the calvings per month in relation to rainfall pattern (world weather online/Kampala-weather-averages, data set from 2000-2012)

4. CONCLUSION

The prevalence of CE and SCE was established at 3.6% and 18.6% respectively and the major risk factors associated with the high SCE burden were dystocia, RAB and abortion. Having more than 2 calves was also associated with a high disease burden, which is thought to be due to the management practices of the herds in the study area. Endometritis status observed in this study is reflects on the need to for farmers support bodies like NAADS and extension service providers like to concentrate on providing knowledge on management and awareness of production constraining diseases with a subclinical nature such as Endometritis and among others Mastitis. The liberal nature of the drug Industry in Uganda has cultivated a habit of self-reliance of farmers at handling disease without help from professional because they can access any type of drug over the counter and care much less about prescription and proper application in terms of dosage and dosage rate, this has elevated the prevalence of such disease as in discussion because the farmers attempt to assist delivery thus causing dystocia and

contamination majority of the times thus the high prevalence of SCE.

A multifactorial disease like Endometritis needs a multidisciplinary approach, thus farmers should be sensitized on proper feeding with high roughage feed (hay), corn (*Zea mays*) silage and supplementation with mineral and salt leaks would help to boost immunity and reduce cases of dystocia and RAB contrary to feeding animals with Elephant / Napier grass (*Pennisetum purpureum*) and peelings from bananas (*Musa acuminata*). Subsequent studies should be carried out to explore fully major limiting factors in relation to SCE in the study area. Abortion was among strongly associated with burden of CE and SCE, all the animals that aborted suffered from either of the two yet no data is substantial data is available on the causes of brucellosis in Uganda over the past seven (7) Years.

This study shows that there is no significant difference in the success when one uses AI or natural service, however it is highly suggested that more farmers adopt the use of AI for its economic and health soundness.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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