

Prevalence of Repeat Breeding Syndrome in Dairy Cattle in Selected Regions of Kenya

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ABSTRACT

The optimum production in dairy cows aims at getting a calf per cow per year. This, however, is limited by repeat breeding syndrome (RBS), which has multiple etiologies that cause either fertilization failure or early embryonic death. This study objective was to determine the prevalence of repeat breeding syndrome in dairy cattle within the selected regions of Kenya. A cross-sectional study design was carried out in 205 smallholder dairy farms in Makueni, Kakamega and Nandi counties. A total of 553 cows/heifers were recruited and examined per rectal to determine their reproductive status. Information on the breeding history of the cow and heifer was acquired at the farm. The results revealed that cross bred cattle were most affected by RBS at 38.9% followed by Jersey, Guernsey Ayrshire and least in Frisians at 21.1, 16.7, 25 and 14%, respectively. The overall animal level prevalence of RBS in cattle in the three counties was at 18.4%, while the overall farm-level prevalence was 58.3%. However, per county prevalence's were different with animal level prevalence at 31.9, 20.9 and 12.5% in Makueni, Kakamega and Nandi, respectively. The farm-level prevalence's at the counties were 75.4, 58.3 and 48.4% in Makueni, Kakamega and Nandi counties, respectively. Cattle kept in the zero-grazing/intensive system had the highest level of RBS at 30.1% compared to semi-intensive and extensive farming systems. The prevalence of RBS was also higher in multipara at 76% in comparison to primipara cows. Finally cows over four years which were in third or more parities had the highest prevalence of RBS, accounting for 65% of the cases. In conclusion, the prevalence of RBS is significantly high in the Kenyan smallholder dairy farms. Further research should be undertaken to identify risk factors and appropriate intervention approaches for RBS to enhance its management.

Key words: Kenyan, Exotic, Cattle, Repeat-breeding, Prevalence.

INTRODUCTION

The smallholder dairy industry is a significant sector in Kenya as it contributes 3.5% of the Kenyan Gross Domestic Product (GDP), which accounts for 21% of the 40% from agricultural produce (Knechtges 2011). The smallholder dairy farming makes up 80% of the dairy population; therefore, a crucial driver for rural development, poverty reduction and food and nutrition security (Bingi and Tondel 2015; Olum et al. 2020). The dairy farming enterprise is, however, constrained by infertility-related factors, among them repeat breeding syndrome (RBS) (Mungube et al. 2019). Repeat breeding syndrome is a condition in which a clinically normal cow which is less than eight years old fails to conceive after three regularly spaced inseminations (Yusuf et al. 2010).

The RBS is shown to be a multi-etiological problem as described in (Pérez-Marín and Espana 2007). The standard index for services per conception is an average of 1.5 rounded off to the nearest whole number of 2 services per conception (Radostits et al. 2001). Repeat breeding syndrome contributes to sub-optimal production and economic loss in the dairy industry through; delayed conception, maintaining a low productive or non-productive state, increased number of services per conception, increased inter-calving interval and culling rate which reduces the number of calves per cow in a lifetime (Ahmadi and Dehghan 2007; Nishi et al. 2018). Although bovine RBS has been studied widely in other countries; the literature is limited in Kenya's smallholder dairy farms. The current study, therefore, aimed at estimating the prevalence of RBS in dairy cattle within the selected counties of Kenya.

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MATERIALS AND METHODS

Study Area and Approval

The study was conducted in 3 counties with different agro-ecological and social-economic activities, and a high presence of dairy breeds with a high level of artificial insemination (AI) uptake. These counties were; Nandi, Kakamega and Makueni, from which nine subcounties were purposively selected. The subcounties were Chesumei, Nandi Hills and Mosop in Nandi county; Lurambi, Mumias West and Likuyani in Kakamega county and; Makueni, Mbooni and Kaiti in Makueni county.

This study was approved by the Kenya Agricultural and Livestock Research Organization (KALRO), Veterinary Science Research Institute (VSRI) - Institutional Animal Care and Use Committee (IACUC) and assigned the approval number KALRO/VSRI/IACUC/2/20172019.

Study Design

This was a cross-sectional study in which farm visits and animal examinations were conducted once during the study period. The study was carried out between December 2018 and June 2019 during which 205 farms were visited, and 553 cattle examined.

Farm, Animal Selection and Sample Size

A list of smallholder farmers in the study area was obtained from existing dairy cooperative records. Computer-generated random numbers were used to identify the farms to participate in the study. Smallholder dairy farm was defined as that with 1–15 animals: the average herd size being 1–3 animals in rural areas and 7–8 dairy animals in urban and peri-urban areas (Njarui et al. 2011; SNV 2015).

All mature female animals above two years of age that had been mated in the last one year were included in the study.

The prevalence of RBS in Kenya at the time of this study was unknown and therefore, calculation of sample size was done through an estimated prevalence of 50%, a precision of 5% and confidence level at 95% (Dohoo et al. 2009).

$$n = \frac{(1.96)^2 \times P^2}{L^2}$$

$$n = \frac{(1.96)^2 \times (0.5)^2}{(0.05)^2}$$

n = 385 cows.

n – being the minimum sample size for this study.

Methodology

The study subjects were rectally examined to confirm the reproductive status to help categorize the cow as a repeat or non-repeat breeder. The breeding records were scrutinized and where non available farmers recall was utilized to gather crucial data. The reproductive history was also acquired with emphasis to the number of services per conception. Subjects served three or more times with or without conception were defined as repeat breeders.

Data Management

The data collection which included all aspects of breeding management and history as well as animal level as well as farm level factors was conducted using epi-collect+ mobile application and then retrieved into Microsoft excel 2010 sheets. Data was thereafter scrutinized for accuracy and errors and then coded and finally imported to Stata® 15 software for analysis. Proportion of RBS at farm and animal-level was calculated to determine its prevalence. Additionally, the proportions were computed for different categories.

RESULTS

A significantly higher percentage (60%) of dairy cattle in this study was bred using Artificial insemination (AI) while 40% were bred using natural service. The regional variations in the breeding methods were as follows: In Makueni 87% of dairy cows was bred through strict AI while the rest 13% heavily relied on NS. In Kakamega County a significantly higher percentage (68%) of dairy cattle were bred through AI while the rest 32% used NS. In Nandi County the lowest percentage (25%) of dairy cows were bred using AI while the rest (75%) relied heavily on NS.

Repeat breeder syndrome was observed across the counties with an overall animal level prevalence of 18.44%. The overall farm level prevalence of RBS across the counties was significantly higher at 58.3%. Makueni County reported an animal level prevalence of 31.96% (22/69), followed by Kakamega at 20.85% (15/72) and Nandi 12.5% (8/64). The farm-level prevalence at the county was 75.4% (52/69), 58.3% (42/72) and 48.4% (31/64) in Makueni, Kakamega and Nandi counties respectively.

Repeat breeding syndrome prevalence was highest among the crossbred cow/heifers at 38.9% (14/36) followed by Jersey, Ayrshire, Guernsey and least in Friesians at 25% (2/8), 21.1% (43/204), 16.7% (2/12) and 14.0% (41/293) respectively. The type of production system affected RBS prevalence with the highest among the zero grazed animals at 30.1% (22/73) followed by semi-intensive and extensive grazing systems at 20% (14/70) and 14.5% (9/62) respectively.

The level of awareness of RBS within the smallholder dairy was high, with 64.39% (132/205) of farmers aware of the condition against 35.6% (73/205) of farmers who were unaware of RBS in dairy cows. The highest proportion of this condition was seen in farmers with a secondary level of education 40% (82/205) and least with those having tertiary education 20% (9/205).

Repeat breeding syndrome prevalence was highest in multipara cows at 76% (78/102) in comparison with heifers at 24% (24/102). Similarly, the prevalence of this syndrome was higher in older cows with cows at 4 years accounting for 20% (20/102) while cows over four years accounting for 65% (67/102) of RBS cases. There was an association between age at first service and repeat breeder syndrome, the cows with RBS had a slightly higher (27.37 months) age at first service as compared to the non-repeat breeder cows at 25.98 months. Furthermore, cows with RBS were served earlier at 3.5 months on average postpartum as compared to non-repeat breeder cows served at 3.58 months postpartum.

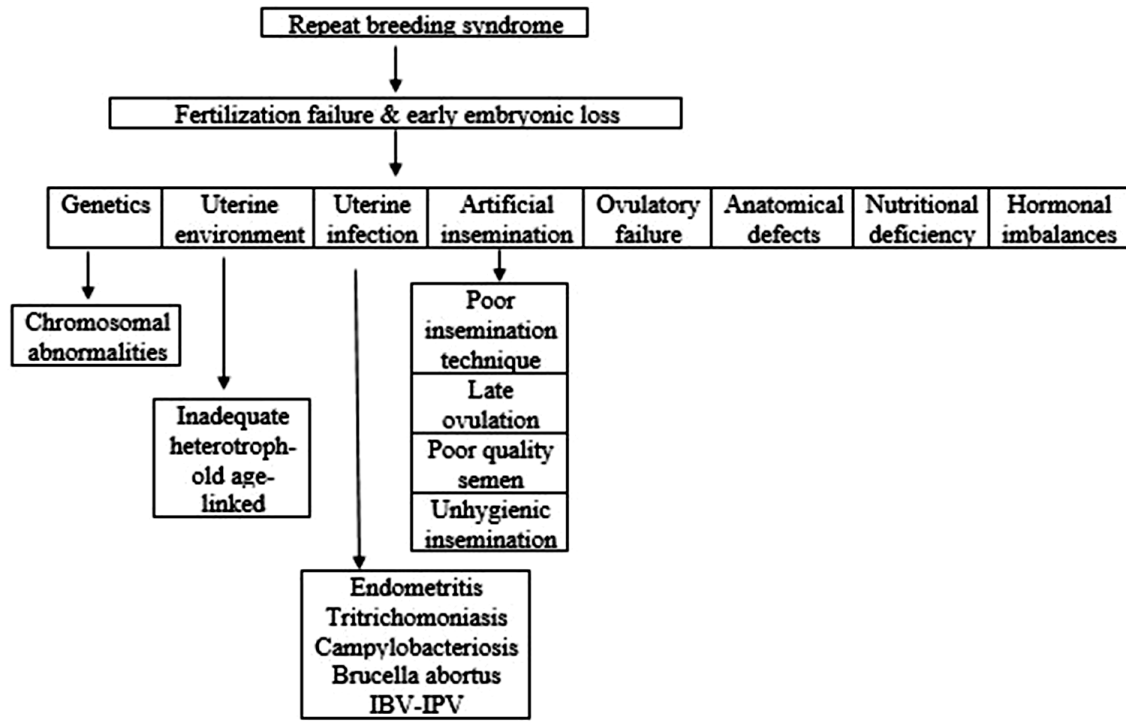


Fig. 1: Schematic etiological factors of repeat breeding syndrome (Rodriguez et al. 2000; Morrell 2006; Thakur et al. 2006; Pérez-Marín and Espana 2007; Bazer et al. 2009; Santos et al. 2009; Jaswal and Singh 2010).

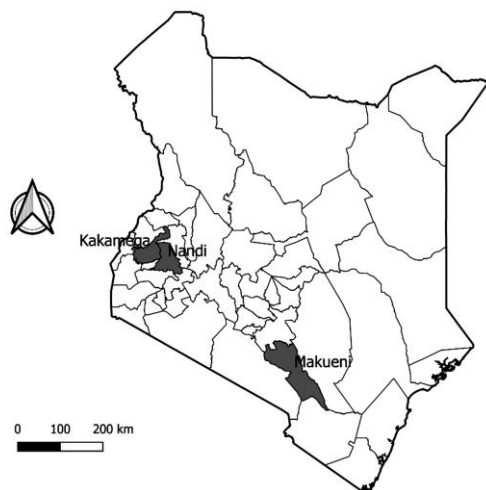


Fig. 2: Map of Kenya showing study counties.

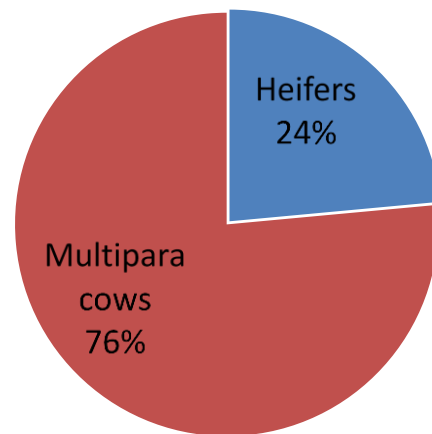


Fig. 4: Comparison of proportion of RBS in cows against heifers in the small-scale dairy farms in the counties of Makeni, Kakamega and Nandi during the study done between Dec 2018-Jun 2019.

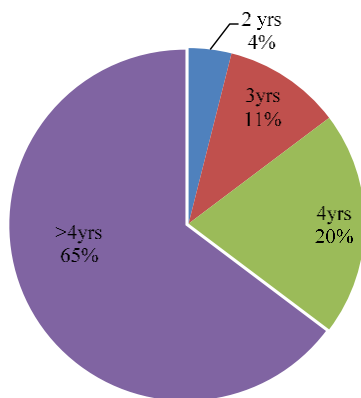


Fig. 3: Proportion of RBS within different age in cows/heifers in the small-scale dairy farms in the counties of Makeni, Kakamega and Nandi counties during the study between Dec 2018-Jun 2019.

DISCUSSION

This study documents the existence of RBS within the smallholder dairy farms of Makeni, Kakamega and Nandi counties of Kenya and the situation could be similar in a majority of smallholder farms in Kenya.

In the current study, the smallholder dairy farmers had a preference for Friesians, Ayrshires and their crosses over other breeds of cattle. The findings of this study are similar to the findings of Mugambi et al. (2015).

The overall prevalence of RBS was 18.44% and 58.13% in animal and farm level prevalence, respectively, which is higher than what was reported by Ayalon (1984). Other studies have shown a lower or higher prevalence in comparison to the findings of this study (Bage et al. 2002; Boettcher and Parera 2007; Asaduzzaman et al. 2016).

Table 1: Proportion of RBS against various factors of study

Variable	Category	Distribution	Proportion with RBS (%)
Animal level RBS	Repeat breeder	102	102 (18.44)
	Non repeat breeder	451	451(81.56)
Farm level RBS	Repeat breeder	119	119 (58.3)
	Non repeat breeder	86	86 (41.95)
Breed	Friesian	293	41 (14.0)
	Guernsey	12	2 (16.7)
	Ayrshire	204	43 (21.1)
	Jersey	8	2(25)
	Crosses	36	14 (38.9)
Pregnancy status	Non gravid	381	88(23.1)
	Gravid	172	14(8.1)
Level of education	Primary	78	15 (19.2)
	Secondary	82	21 (25.6)
	Tertiary	45	9 (20.0)
Type of grazing system	Zero grazing	73	22 (30.1)
	Semi-intensive	70	14 (20.0)
	Extensive	62	9 (14.5)
Awareness of RBS	Aware	132	35 (26.5)
	Unaware	73	10 (13.7)

The variations in these results may be due to geographical location, agro-climatic zones, parameters used to define RBS and the prevailing aetiologies (Ali et al. 2006). In this study the possible causes of RBS could be due to fertilization failures due to flaws in AI as RBS prevalence was higher in region using AI in comparison with NS.

There was variation in the prevalence of RBS within the different study regions, with the highest prevalence (31.96 and 75.71% for the animal and farm-level, respectively) noted in Makueni along with the highest strict adoption of AI (87%). Kakamega county had the second-highest prevalence (20.8 and 58.11% for animal and farm level respectively) along with the second-highest artificial insemination (AI) adoption rate at 68%. The lowest prevalence of RBS (12.5 and 48.75% for animal and farm level, respectively) was noted in Nandi county, which also had the lowest adoption of AI (25%). These findings indicate an association between AI as a breeding method and RBS. Notably, farms using natural service as opposed to farms using AI had lower incidences of RBS; this is similar to reports by Jainudeen and Hafez (2000). Additionally, when AI is used, the wrong timing of insemination may lead to an increased proportion of RBS (Shamsuddin et al. 2001).

This study noted out that the majority (65%) of RBS was common in cows greater than four years of age which were cow in third or more parity. According to Gustafsson and Emmulson (2002), RBS was more common in cows > 7 years which is higher than that observed, the difference in findings could be due to the difference in the agro-ecological zones and management at the farms where the studies were conducted. However, Sarder et al. (2010) reported lower RBS in cows <4 years of age, which is in agreement with the findings of this study. Therefore, older cows are more prone to RBS to a higher degree than younger cows.

Majority of cattle (76%) with RBS were multipara with only 24% of them being heifers. This report is in agreement with an earlier report by Mandefro and Negash (2014) who found out that 22.64% of heifers had RBS. The same report by Mandefro and Negash (2014) also found that the highest (22.22%) RBS cases among cows in third calving while the lowest (7.24%) at first calving. This is consistent with the study findings. The overall

result is in agreement with the wide documentation of the negative effect of age on fertility (Hodel et al. 1995). The lower fertility with old age could be due to variation in the pituitary or hypothalamic hormone levels or the different ability of ovarian response in the different ages of the cows.

Conclusion

This study documents the presence of RBS within the small-scale dairy farms of Kenya. As such, this study has shown that RBS is a major hindrance to the optimization of dairy production in the small-scale dairy farms of Kenya. Further research should be undertaken to identify risk factors and appropriate intervention approaches for RBS to enhance its management.

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Author's contribution

All authors equally contributed to this study.

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