

Factors Affecting Days Open among Smallholder Dairy Cattle in Uasin Gishu County, Kenya

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Abstract

The dairy industry in Uasin Gishu County (UGC) provides nutrition and employment among Smallholder dairy Farmers (SDF). The reproductive and productive potential of dairy cattle within the recommended range 85-110 days open (DO) ensures a calf per year. The study sought to determine factors influencing DO among SHF in UGC. 216 cows were purposively selected and artificially inseminated in the three agro-ecological zones (AEZ) of UGC. Further selection DO on 116 was determined. Focus group discussions (FGD) and interviews of key informants (KI) were held, in DO data. Data from the animals was subjected to t-tests to establish the differences within AEZ, breeds, farming systems, and conception status while Information from the FGDs was presented descriptively. Mean DO for AEZ 3 of 206 ± 20 days was significantly lower than those of AEZ 1, 303 ± 35 and AEZ 2, 281 ± 34 . Mean DO for Ayrshire, Friesian and Zebu cross of 264 ± 30 , 258 ± 28 and 244 ± 24 days respectively weren't significantly different as of 227 ± 34 for intensive farming systems and 260 ± 20 days for semi-intensive farming. DO for cows confirmed in-calf was 237 ± 21 and those that weren't, was 279 ± 27 days. The average DO (255 ± 17) was significantly longer than 85-110 days. High cost of feeds, poor record-keeping, and inadequate Veterinary services (VS) resulted from the FGDs and interviews of KI. Inadequate VS forced farmers to handle dystocias and other obstetrics complications resulting in post-parturient metritis and consequently, prolonged DO. Other factors included poor management of cows in the first 100 days in milk, poor record-keeping, irregular supplementation, and inadequate extension services. Good nutrition after pregnancy and veterinary and extension services are necessary for a calf-per-year-per cow.

Keywords: Days open, calving intervals, first days in milk

INTRODUCTION

Dairy farming is the single largest sub-sector of agriculture in Kenya, contributing 14% to the Agricultural Gross Domestic Product (GDP) and with an annual growth rate of 4.1%. (Odero-Waitituh, 2017; Kibiego *et al.*, 2015). Smallholder dairy production contributes up to 80% of total dairy cattle produce and accounts for 56% of the total milk produced in Kenya (Odero-Waitituh, 2017; Wambugu *et al.*, 2011). It also contributes significantly to the Big Four Agenda (Macharia, 2019) of the Government of Kenya, especially in the food and nutrition security, manufacturing, and health sectors. The dairy cows consist of exotic and local breeds together with their crosses, which are kept under extensive, semi-intensive, or intensive farming systems of production (Odero-Waitituh, 2017). The majority (70 %) of these dairy farmers in Uasin Gishu County are smallholder farmers who keep less than 10 cattle (Kios *et al.*, 2018). The main breeds for dairy production are generally Friesian, Guernsey, Ayrshire, Jersey, Zebu, and their crosses (Kibiego *et al.*, 2015) with Friesian, Ayrshire, or their crosses with Zebus being the most predominant (Mugambi *et al.*, 2015). The demand for dairy products continues to increase because of the growing human population. This is good for dairy farmers because it enhances farm income, food, and

nutritional security. It is therefore important that an appropriate breeding system be put in place that ensures that dairy cows reproduce optimally and produce milk maximally (Gicheha *et al.*, 2019). Calving intervals and days open are major indicators of dairy cattle reproduction rates and productivity.

Days open refers to the period between calving and conception while calving interval is the period from one calving to the next. Calving interval (CI) and days open (DO) influence the reproductive performance of dairy cattle (Muraya, *et al.*, 2018). Radostits, O. M. (2006) reported that even though CI was variable with small herd size, it remains the appropriate measure in contemporary reproductive performance. Days open could be related to the management of the individual farming system and the quality and quantity of feeds available (Melo *et al.*, 2012). Each farm differs in soil quality, management, workforce, and herds. In a study, Melo *et al.*, (2012) established that a significant difference in DO exists between farms. To obtain one calf per year per cow, the optimal CI should be 12-13 months and days open should be 85-110 days Radostits, O. M. (2006). The reproductive performance of dairy cows is greatly influenced by the management of periparturient conditions. A rapid increase in milk production over the last few years has resulted in a subsequent decrease in dairy cow fertility (Esposito *et al.*, 2014). There is, therefore, a need to enhance the proper management of dairy cows especially during the first 100 days in milk (DIM) which also helps in maintaining the reproductive performance of dairy cattle. Fertility is likely to be influenced by periparturient clinical and/or subclinical diseases and disorders. In some cases, culling is based on increased calving intervals, which emanated from decreased conception rate therefore automatically increased days open. Maizon *et al* (2004) found that periparturient conditions like dystocia, milk fever, retained foetal membranes (RFM), uterine prolapse, metritis, cystic ovarian disorders, and other diseases reduced the conception rate and increased the days open.

Other abnormal conditions during calving like dystocia, abortion, stillbirth, and occasionally twin calving are thought to have a negative effect on the number of days open. Bell & Roberts (2007) found on the survey that an increased number of days open was associated with the calving assistance technique. Dystocia increases days open by almost two times and to conception by more than eight on average (Fourichon *et al.*, 2000). Fertility is also affected negatively by twin calving as shown by Berry *et al* (2007). Abortion and Stillbirth negatively influences fertility by increasing days open, subsequently, it may reduce the conception rate (Inchaisri *et al.*, 2010). Uterine disorders such as retained foetal membrane (RFM), cystic ovarian disorders, endometritis, uterine prolapse, and metritis are the most common uterine disorders which mostly cause abnormalities of the reproductive tract during involution and may influence the days open (Buják *et al.*, 2018). RFM, which usually occurs with an average frequency of 11%, increases the risk of other reproductive disorders Buják *et al.*, (2018) and is associated with increased days open by almost 20 days. Disruption of normal ovarian function or delayed regeneration of the endometrium may result in uterine infections in the reproductive system (Földi *et al.*, 2006). The fertility of dairy cows is negatively affected by the presence of Puerperal metritis which not only increases days open but also reduces the conception rate (Földi *et al.*, 2006; Buják *et al.*, 2018). Rufino *et al* (2009), reported that in central highland-Kenya, unsupplemented diets prolonged calving intervals and therefore, reduced lifetime productivity since the energy deficit during the rest of the lactation resulted in less cumulative milk production, more bodyweight loss, and poor body condition, which had a negative impact on the calving rates.

MATERIALS AND METHODS

Area of study

The study was carried out in Uasin Gishu County, Kenya. The County has three main distinct Agro-ecological zones (AEZs) namely; lower highlands (LH) ranging from LH2 to LH4 (AEZ 1), upper midlands (UM3) (AEZ 2), and upper highlands (UH) representing UH1 and UH2 (AEZ 3) (Jaetzold *et al.*, 2010). The study was carried out across the three Agro-ecological zones in Uasin Gishu County among the predominant improved breeds of zebu crosses, Friesian and Ayrshire (Mabonga & Ogallo, 2018).

Study Design

In each of the three AEZs, the first 24 each of Friesian, Ayrshire or their crosses to come on heat were purposively selected and artificially inseminated (AI) with either Conventional Imported Semen (CIS), conventional Kenyan genetic semen from Kenya Animal Genetics Resources Centre (KAGRC) or imported sex-sorted semen (SSS). This gave a total of 216 animals. The target animals were from smallholder dairy farms with 1-10 cattle in which there were no mature breeding bulls, and which supplied milk to one of the six selected dairy cooperative organizations. Ear tags were used for identification. Data on various on-farm parameters such as age, parity, milk yield of the cattle inseminated, body condition scores (BCS) and types of production systems was obtained. The respective ages of the selected animals was obtained either from farm records, farmer interviews, or by dentition (Torell *et al.*, 2003), while parity was obtained from farm records. Body condition scores were determined through palpation of specific animals' body parts and visual assessment using a scale of 0 to 5 (Bewley *et al.*, 2008). The study relied on real, on-farm situations and hence, animal feeding, housing management system and semen selection were not altered in the selected farms.

To get indebt information and verification of some finding on productivity and reproductivity in the county, six focus group discussions were held, two in each of the three AEZs. The discussion format used was adapted from Krueger and Casey, (2015). Key informants, who included Veterinary personnel employed in the six dairy cooperative societies selected in the study area, were also interviewed.

Data Analysis

After purging out nulliparous and other ineligible cows, data of days open (days from calving to first artificial insemination) was obtained from 116 cows. Data generated from the animals was entered into a Microsoft Excel worksheet and analysed. The data was subjected to independent two-sample t-tests to establish significant differences within variable categories. Zone, breed, farm system, and current conception status were also assessed. Information from the focus group discussions was analysed and presented descriptively

RESULTS

The days open ranged from 44 to 768 with a mean of 255 ± 17 days across all the animals in the study area. However, they were 303 ± 35 days for AEZ 1, 281 ± 34 days for AEZ 2, and 206 ± 20 days for AEZ 3. The mean OD for AEZ 3 was significantly lower ($p < 0.05$) than those for AEZ 1 and 2. With breed as the variable, the mean days open for Ayrshire was 264 ± 30 days, Friesian was 258 ± 28 days and for zebu crossbreed was 244 ± 24 days but there was no significant difference ($p > 0.05$) among them. Under farming systems, the mean days open were 227 ± 34 days for Intensive farming was not significantly different ($p > 0.05$) from the average of 260 ± 20 days in Semi-intensive farming. The mean days open for cows whose conception status had

been confirmed (in-calf) was 237 ± 21 days and this was not significantly different ($p>0.05$) from those which had not conceived with the mean open days of 279 ± 27 days (Table 1).

Table 1: Mean values of days open for zone, breed, farming system, and conception outcomes and contrasts between categories

Variable	Category	N	Mean	SE	Comparison	t-statistic	Df	Significance
Zone	1	37	303	35	1 v 2	0.453	64	0.652
	2	29	281	34	1 v 3	2.434	59	0.018
	3	50	206	20	2 v 3	2.033	77	0.045
	Overall	116	255	17				
Breed	A	38	264	30	A v F	0.147	76	0.884
	F	40	258	28	A v C	0.478	74	0.634
	C	38	244	30	F v C	0.346	76	0.730
Farm System	Int	28	227	34	Int v Semi-int	0.821	108	0.414
	Semi-int	82	260	20				
Conception	Y=0	51	279	27	0 v 1	1.269	114	0.207
	Y=1	65	237	21				

Key:

- Zone (Agro-Ecological Zone AEZ), 1= AEZ 1. 2=AEZ 2. 3= AEZ 3
- Breed: A=Ayrshire, F=Friesian, C=Crossbreed. Semen type: 1=Import Ayrshire, 2= Import Friesian, 3=KAGRC Ayrshire, 4= KAGRC Friesian
- Farming System: Semi-Int= Semi-intensive, Int= Intensive Y = Conception status: 1= conceived 0= not conceived.

A total of 42 participants from the six dairy cooperatives societies were engaged in the Focus group discussions, with majority being male participants even though invitations were made equally to both males and females. Most of the farm labour (61%) was carried out by the farmers themselves while the rest (39%) was by hired or employed personnel. Most of the farmhands were women and very few youths showed interest in farming according to the FGDs. Only about 20% of animal handlers had at least basic formal education or skills in animal husbandry. From the discussion groups, it was evident that many high producing cows suffered severe bodyweight loss shortly after calving down. In some cases, this led to recumbency, which was more frequent in younger cows with low parity. It was also noted that in subsequent lactations, the incidences of retained foetal membrane (RFM) and poor appetite was higher in the younger and higher producing cows. The key informants agreed with these observations and attributed the bodyweight loss to high negative net energy balance that results from low dry matter intake associated with poor appetite brought about by post parturient disorders often experienced in the first 100 days especially where good dairy management practice was not observed.

One of the major factors affecting days open and calving intervals was poor access to veterinary services. This was attributed to the low number of veterinary personnel available. It was unanimous amongst the Focus Group Discussions that the high cost of animal feed, especially the concentrates and mineral supplements, and low price offered for the milk produced were the greatest disincentives to the smallholder dairy farmers (Figure 1).

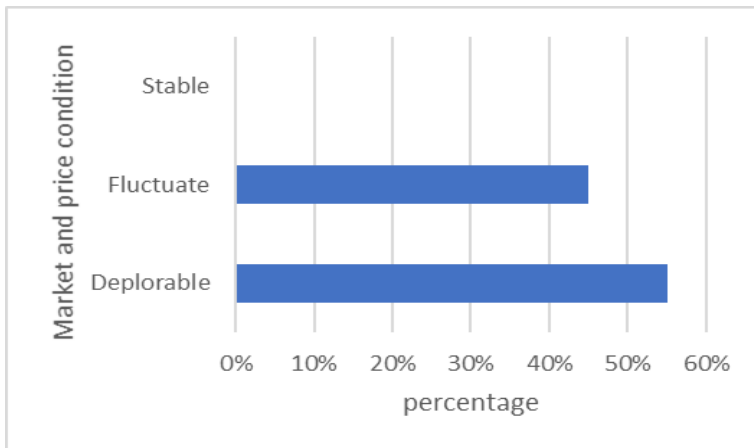


Figure 1: Opinion of farmers on status of market and price of milk

The focus groups and key informants agreed that there were poor extension services in the area under study and this resulted in poor health and high prevalence of diseases among the dairy animals. East Coast Fever was identified as the most important tick-borne disease while Foot and Mouth Disease was the most prevalent viral disease. Other diseases of concern included anaplasmosis, pneumonia and Lumpy skin Disease (Figure 2).

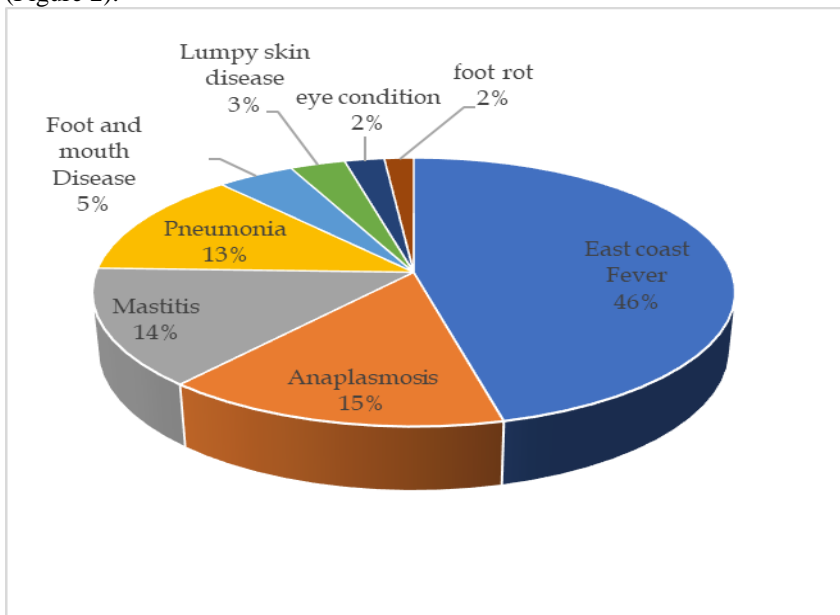


Figure 2: Important diseases in dairy cattle among smallholder dairy farmers in Uasin Gishu County

It was estimated that over 80% of cattle in the smallholder dairy farms had calving intervals of more than one year (Figure 3). Which was a confirmation that the majority of SDF was not able to get a calf a year from their cows.

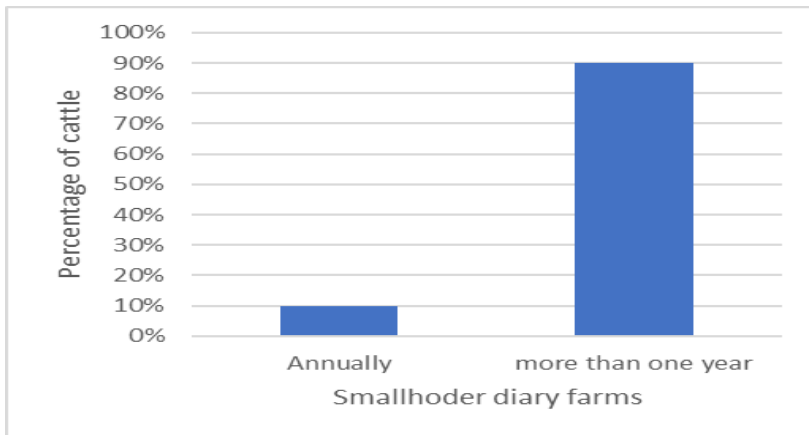


Figure 3: Calving intervals in Smallholder dairy farms in Uasin Gishu County

DISCUSSION

Only 116 out of the initial 216 selected cattle were used to obtain the days open data. The failure of smallholder farmers to keep records contributed to this discrepancy because some of the animals purged were those that had been recently acquired through purchase, gifts or dowry with no accompanying records. Without records on parity, last served or last gave birth, determination of days open or calving interval becomes difficult.

The mean days open for AEZ 3 was significantly lower ($p < 0.05$) than those for AEZ 1 and 2. This was attributed to availability of sufficient feeds and other amenities in AEZ 3, the highest potential zone in Uasin Gishu County. There was no significant difference amongst the mean days open of Friesian, Ayrshire and zebu cross breeds. This implies that despite the fact the cross breeds had the lowest days open amongst the three breeds, breed did not affect the days open. The same applied to production systems where there was no difference in days open in animals from intensive and semi-intensive systems.

The wide range of 44 and 768 days open in this study is a probable indication of interaction of various factors for which further studies are required. Further, an overall mean day open of 255 ± 17 days obtained in this study is much higher than the generally recommended value of 85-110 days (Radostits, O. M. 2006). The long open days determined in this study also imply long calving intervals. This results in poor reproductive performance and milk production. With this prolonged period of days open, the smallholder farmer loses much because the animals are fed for more than 200 extra unproductive days.

Due to prolonged days open, the productive potential of the cattle could not be realized, meaning that farmers were unable to produce enough replacement stock. This would force them to buy replacement stock at exorbitant prices. With most smallholder farmers being peasants they would not afford the high pedigree replacement stock and would instead go for culled cattle which would be either too old, diseased or having deformities (Bebe *et al* 2003; Muraya *et al* 2018). Purchase of animals as replacement stock may compromise biosafety in the farm as it may be the conduit for the introduction of disease-causing pathogens for instance bovine paratuberculosis (Omega

et al, 2019) which may prove difficult to eliminate once introduced to the farm. It may also be a source of introduction of undesirable genetic traits.

Most smallholder dairy farmers worked on the farms by themselves, probably in order to reduce input costs. Of the farmhands, majority had little or no formal education or skills in animal husbandry. The negative effects of this were that farm records on animals were not kept well, detection of critical signs of heat or sickness, proper feeding and general management of animals was poor. Although women played a major role in the rearing and managing of dairy animals in smallholder farms, they participated little in decision-making. This was evidenced by the fact that women were poorly represented in the FGDs and in a few of them, they were totally absent. The net outcome of all this is that animals are not well observed or attended to and this results in long days open and calving intervals, low milk production and high incidence of diseases. Indeed, the FDG participants and key informants averred that many high yielder cows suffered severe body weight loss, leading in some cases to recumbency. Younger cows suffered more from high net energy balance (NEB) due to greater energy needs for both growth and production during the first 100 days in milk. At this same stage in life of the young cows, there is shedding of milk teeth resulting in wounds in the mouth that negatively affect feeding. They also suffer from periparturient disorders which result low appetite and subsequently, poor feed intake (Walsh *et al.*, 2011). Esposito *et al* (2014) found that proper management of dairy cows especially during the first 100 days in milk (DIM) helped in maintaining the reproductive performance of the dairy, but in the present study, this is likely not to have been emphasized, leading to periparturient clinical and/or subclinical diseases and disorders which influenced fertility.

From the study, the lactation cycle of a dairy cow with prolonged days open was not optimized and this reduced the potential for productivity and reproduction. Many smallholders' dairy farmers did not get a calf per cow in the recommended 12-13 months cycle and may have been tempted to sell away cows that took too long to conceive since they were unproductive (Inchaisri *et al.*, 2010). Such cows would be sold away to butcher men for slaughter at a low price of between Ksh 15,000 (US\$ 139) and Ksh 50,000 (US\$463) per cow, instead of market price based on a dairy characteristic or live weight which could fetch the better price of between Ksh 70,000 (US\$648) to Ksh150,000 (US\$1389).

CONCLUSION AND RECOMMENDATIONS

Open days in dairy cattle of small holder farmers in Uasin Gishu County are about 255 days. This is much longer than the recommended 85-110 days. This is in part as a result of poor management of cattle in the first 100 days after giving birth, poor record-keeping and feeding, and inadequate veterinary and extension services. Veterinary and extension services, together with the best animals farming and feeding practices should be optimized to obtain an a-calf-a-year per cow. More women in the households should be trained in basic animal husbandry and record keeping since they are the ones who were always close to dairy animals.

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