

## Major Reproductive Disorder and Performances of Small Holder Dairy Farms in and around Fitcha Town, North Shoa Zone of Oromia Regional State, Central Ethiopia

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**Abstract:** A study was conducted to identify and estimate the prevalence rate of reproductive disorder and to assess the possible risk factors and reproductive performances of dairy cattle small holders in and around Fitcha town from December 2013 to June 2014. Eighty one dairy farms (average herd size=4.8) were visited and collected data included reproductive performance indicator, cow attributes, type of mating, body condition score and general farm management. The overall mean value for calving to conception interval (CCI) (n=66) was 169 days and duration after last calving (DALC) (n=56) for pregnant and non-pregnant cattle was 264 days. The least squares mean CCI was higher (p<0.05) for cows in their first parity (primiparous) and lower for multiparous cows ( $\geq 4^{\text{th}}$  parity). Management system significantly influenced (p=0.001) the least squares mean DALC, where the non-pregnant cows in the semi-intensive management system had lower value. The overall mean value of age at first calving (AFC) (n=35) was 36 months. The overall average number of services per conception and the first service conception rate were 1.9 (n=66) and 28.4% (n=116) respectively. The prevalence of abortion, dystocia (assisted parturition), retained fetal membrane, vulval discharge/endometritis, repeat breeder and pre-weaning calf mortality were 8.4%, 9.6%, 12.6%, 5.4%, 14% and 13.6% respectively. The present estimates of extended CCI, DALC and reduced first service conception rate indicated poor reproductive performances of dairy cows belonged to small holders in the study area. Moreover, the pre-weaning calf mortality rate was significantly high. Accordingly, further detailed investigation is necessary to identify and quantify the specific disorders and associated interacting factors attributing to poor performance and to determine the causes and predisposing factors behind high calf mortality.

**Key words:** Dairy Farm Smallholders • Reproductive Performance • Fitcha • Reproductive Disorder

### INTRODUCTION

Cattle production is the main component of agricultural growth in many parts of sub-Saharan countries. In sub-Saharan countries, the overall cost of keeping cattle is associated with the health care, nutrition and reproduction management, either matched their contribution to the livelihood and economy of the people. please rephrase the highlighted sentence

As in many other countries, livestock particularly cattle play an important role in Ethiopia as being a source of milk, meat, hide, etc [1]. The low productivity of indigenous cattle breeds referred to diseases, parasites, nutrition, poor management systems and large

socioeconomic factors, resulting in poor reproductive performance and low milk production which in turn shortening the expected length of productive life. Reproductive problems are the most common which occur in lactating dairy cows and can dramatically affect reproductive potential of the dairy herd. Poor reproductive performance is a major cause of involuntary culling and therefore reduces the opportunity for voluntary culling and has a negative influence on the subsequent productivity of a dairy herd [2-4]. World-wide, poor reproductive performance of dairy herds has become a major concern, especially Holstein herds. Decline in conception rate and increase in calving interval over the last decades have been reported [5, 6].

Most of the available information pertaining to reproductive performance of dairy cattle in Ethiopia is based on research stations or institutional herds. The reproductive performance of crossbred cows and indigenous zebu cows in institutional herd kept under an intensive management system [7, 8], concluded that crossbred cattle have shown significantly better performance than indigenous zebu cattle for the major reproductive traits considered [7, 8]. In the Holeta and Selalle areas, part of the central highlands of Ethiopia, the significant differences in reproductive performance among crossbred cattle was related to different management system [9, 10].

The main indicators of reproductive efficiency in the female dairy cattle are calving interval, suckling status, age at first calving, days open (Calving to conception interval), calving to first service interval, number of services per conception, first conception rate and calving interval [10].

Generally, the causes of infertility in female cattle have been considered to be many and complex [11-13]. However, it is mainly exaggerated by various predisposing factors like management at calving, hygiene, parity number, nutrition, environment and stage of lactation [14]. Some of the major health problems commonly recorded in most dairy farms include abortion, infertility, sub fertility and cows usually require more than two services to conceive and some are remained sterile for years.

In Ethiopia, abortion and postpartum reproductive disorders such as dystocia, retained fetal membranes and subsequent endometritis have been reported to be some of the major problems that have greatly caused serious economic loss [9, 10]. Economically, abortion is of a great concern to the farmer because the fetus is lost, prolonged period of uterine disease and sterility may follow. Therefore, the objectives of this study were to identify and estimate the prevalence rate of major reproductive disorders and assess the possible risk factors and to assess reproductive performances of smallholder dairy cattle in the study area.

## **MATERIALS AND METHODS**

**Study Area:** The study was conducted from December 2013 to June 2014 in and around Fitch town, North Shoa Zone of Oromia region, in the central high land of Ethiopia. Fitch is the central town of North Shoa Zone as

well as Girar Jarso district. The total area of the GirarJarso district is 42, 400Km<sup>2</sup>. The climatic condition of the area includes Dega (52%), Woinadega (41%) and Kola (7%). The total area of the GirarJarso district is 42, 400Km<sup>2</sup>. The climatic condition of the area include Dega (52%), Woinadega (41%) and Kola (7%) [15]. The minimum and maximum temperature is 11.5°C and 35°C, respectively. It has a bimodal rainfall with minimum and maximum of 615 mm and 1115 mm, respectively. A short rainy season occurs from March to May followed by a long rainy season lasting from June to September [15]. Mixed crop and livestock production system are the main livelihood of the population.

**Study Animals and Study Protocols:** Eighty-one dairy farm smallholders (Comprising 167 cows) were randomly selected for the study. Questionnaire survey, regular follow up and clinical examination methods were used to collect the required data. Questionnaires survey was based on one time observation visit to the herds, interviewing farmers who came to the clinic either for treatment or for AI service, smallholder owners located in different Kebeles of the town and its surrounding village selected for investigation. An individual cow attributes such as parity number, breed suckling status and body condition score were recorded. Body condition was estimated and the cows were grouped in to 0, 1, 2, 3, 4 and 5 adapting the earlier description of Nicholson and Butterworth [16] and Edmonson *et al.* [17]. Rectal examination of individual cows was conducted to determine pregnancy status. The data obtained from reproductive, breeding and management histories of 81 herds (Comprising 167 cows) were used to determine variables such as age at first calving, calving to conception interval (CCI), duration after last calving (DALC), number of service per conception, first service conception rate, body condition score (BCS), prevalence of major reproductive disorders and pre-weaning calf mortality.

**Statistical Analysis:** The general Linear Model Procedure (SAS, 2001) was used to evaluate the fixed effects of management system, suckling status and parity number on dependent variables such as CCI, DALC and BCS. Chi-square test was used to assess the effect of management system, parity number and type of mating on the prevalence of pre-weaning calf mortality and major reproductive disorders.

## RESULTS

**Dairy Herds, Composition and Management:** Out of cross bred dairy cows examined, 66 (39.5%), 85 (50.9%) and 16 (9.6%) were pregnant, non-pregnant and uncertain pregnancy status, respectively, at the day of examination. Some of the farms in semi-intensive management system practiced semi-grazing, depending on the seasonal availability of native grazing pasture and the rest farms kept their cattle in door, feeding and watering took place in their house by cut and carry system. All the farms in the intensive management system kept their cattle in good housing and dairy cows got a good health care and farms mostly market oriented. In both management systems, breeding was practiced either by natural mating using a shared cross bred bull or by artificial insemination (AI). Detailed information regarding herd composition and type of breeding service used is presented in (Table 1).

### Overall Reproductive Performance

**Age at First Calving (AFC):** The overall mean of AFC was 36 months (n=35), which is equivalent to 3 years. The data on age at first calving was statistically tested and no significant difference was found for all factors considered in the present study.

### Number of Services per Conception and First Service

**Conception Rate:** The overall average number of services per conception rate was 1.9 (n=66). The overall first service conception rate was 28.4% (n=116). The data on number of services per conception and first service conception rate were statistically tested and no significant difference was found for all factors in the present study.

**Calving to Conception Interval:** The overall mean (SE) CCI was 169 (12.5) days for pregnant cows (n=66). Parity number significantly (P<0.05) influenced the least-square mean CCI, where cows having  $\geq 4$  parities had the lowest least-square mean CCI. The effect of other factors considered, management system and suckling status on CCI and was not significant (P>0.05) (Table 2).

**Duration after Last Calving (DALC):** The overall mean (SE) DALC was 264 (21.1) days for non-pregnant cows (n=56). The difference in DALC for cows in the semi-intensive and intensive management systems was highly significant (P=0.001). Non-pregnant cows that were in the semi-intensive management system had higher DALC than cows that were in the intensive management system (Table 2). Suckling status and parity number had no significant (P>0.05) influence on the duration after last calving.

**Body Condition Score (BCS):** The overall mean (range) BCS was 3.3 (1-4). The effect of parity number and suckling status on BCS was not significant (P>0.05) (Table 2). Management system significantly influenced (P=0.001) body condition scores, where cows in the intensive management system had better body condition score than cows in semi-intensive management system.

### Prevalence of Abortion and Pre-weaning Calf Mortality:

Out of 167 cows examined 14 (8.4%) had abortion in their reproductive history. Of the 154 calves born alive, 21 (13.6%) died before weaning (Table 3). Management system had no significant influence (P>0.05) on abortion and pre-weaning calf mortality.

Table 1: Dairy herd composition and type of breeding service used in 81 randomly selected smallholder dairy farms in and around Fitcha town

Variable	Management system	
	Semi-intensive	Intensive
Average herd size per farm	5.5	4.3
Average number of cows per farm	3.6	3.2
Average number of heifers per farm	1.3	1.1
Average number of calves per farm	1.2	0.9
Average number of bulls/oxen per farm	0.8	0.2
Number of pregnant heifers	4	7
Number of non-pregnant heifers		
Growing	20	18
Breeding	22	26
Type of mating utilized (percent of farms)		
Only AI service	21	40.7
Only bull service	9.8	1.2
AI and/or bull service	14.8	12.3

Out of 81 farms included in the study, 35 (43.21%) and 46 (56.79%) were in semi-intensive and intensive management system, respectively. The overall average herd size was 4.8.

Table 2: The least-square mean (SE) of calving to conception interval (Days), duration after last calving (Days) and body condition score in smallholder dairy farms in and around Fitch town

Variable	PG cows (no)	CCI (SE)	NPG cows (no)	DALC (SE)	Cows (no)	BCS (SE)
Overall mean	66	169 (12.5)	56	264 (21.1)	167	3.3 (0.04)
P-value		P<0.01		P=0.001		P<0.01
Management system						
Semi-intensive	27	200 (19.5)	25	372 (31.3) <sup>a</sup>	74	3.1 (0.06) <sup>a</sup>
Intensive	39	160 (16.2)	31	188 (28.1) <sup>b</sup>	93	3.5 (0.05) <sup>b</sup>
P-value		P=0.12		P=0.001		P=0.001
Suckling status						
Suckling	29	184 (18.8)	25	237 (31.3)	74	3.3 (0.06)
Not-suckling	37	176 (16.6)	31	322 (28.1)	93	3.3 (0.05)
P-value		P=0.75		P=0.08		P=0.81
Parity number						
1	15	258 (26.1) <sup>a</sup>	12	314 (45.2) <sup>a</sup>	37	3.3 (0.09)
2	19	155 (23.2) <sup>b</sup>	9	322 (52.2) <sup>ab</sup>	39	3.4 (0.08)
3	8	173 (35.8) <sup>b</sup>	12	250 (45.2) <sup>ab</sup>	30	3.3 (0.1)
≥4	24	134 (20.7) <sup>b</sup>	23	236 (32.7) <sup>b</sup>	61	3.3 (0.07)
P-value		P<0.01		P=0.44		P=0.72

CCI, calving to conception interval; PG, pregnant; NPG, non-pregnant; BCS< body condition score; a, b, ab, within- variable means in the same column with different superscript differ significantly.

Table 3: Prevalence of abortion and pre-weaning calf mortality in smallholder dairy farms in and around Fitch town

Variables	Cows examined (no)	Cows aborted [no (%)]	Cows gave Live calves (no)	Pre-weaning Calve mortality [no (%)]
Management system				
Semi-intensive	74	8 (10.8)	66	11 (16.7)
Intensive	93	6(6.5)	88	10 (11.4)
X <sup>2</sup>		0.94		0.90
p-value		P=0.33		P=0.345
DF		1		1
Total	167	14 (8.4)	154	21 (13.6)
Parity number				
1	37	4 (10.8)	33	5 (15.2)
2	38	5 (13.2)	36	5 (13.9)
3	31	2 (6.5)	27	3 (11.1)
≥4	67	3 (4.9)	58	8 (13.6)
Total	167	14 (8.4)	154	21 (13.6)
Type of mating				
AI	118	9 (7.6)	111	17 (15.3)
Bull	41	4 (9.8)	36	2 (5.6)
Both AI & bull	8	1 (12.5)	7	2 (28.6)
Total	167	14 (8.4)	154	21 (13.6)

DF, Degree of freedom

**Prevalence of Major Reproductive Disorder:** A total of 167 dairy cows from different management systems and type of services were examined and 42% (n=70) of them found to be affected either with one or more of the clinical reproductive disorders. Major clinical reproductive disorders encountered were vaginal discharge/ endometritis, retained fetal membranes (RFM), dystocia, abortion and repeat breeder (Table 3 and 4).

The prevalence of dystocia, RFM, vaginal discharge (Vaginitis), endometritis and repeat breeder were 9.6%, 12.6%, 5.4% and 14%, respectively (Table 4). The prevalence of abortion was 8.4% (Table 3). The variation in prevalence among the different management system, parity number and type of mating was not found statistically significant (P>0.05).

Table 4: Prevalence of major reproductive disorders in smallholder dairy farms in and around Fitche town

Variables	Cows Examined (no)	Cows affected [no(%)]	DT [no(%)]	RFM [no(%)]	VD/MT[no(%)]	RM [no(%)]
<b>Management system</b>						
Semi-intensive	74	28 (37.8)	4 (5.4)	9 (12.2)	4 (5.4)	11 (14)
Intensive	93	42 (45.2)	12 (13)	12 (13)	5 (5.4)	13 (14)
X <sup>2</sup>		0.65				
P-value		P=0.42				
DF		1				
Total	167	70 (42)	16 (9.6)	21 (12.6)	9 (5.4)	24 (14)
<b>Parity number</b>						
1	37	18 (48.6)	6 (16.2)	4 (11)	2 (5.4)	6 (16.2)
2	38	12 (31.6)	2 (5.4)	4 (10)	3 (7.9)	3 (8)
3	31	14 (45.2)	3 (10)	5 (16)	2 (6.5)	4 (13)
≥4	61	26 (42.6)	8 (8.2)	8 (13)	2 (3.3)	11 (18)
X <sup>2</sup>		2.5				
P-value		P=0.48				
DF		3				
Total	167	70 (42)	16 (9.6)	21 (12.6)	9 (5.4)	24 (14)
<b>Type of mating</b>						
AI	118	48 (40.7)	13 (11)	16 (13.6)	7 (6)	12 (10.2)
Bull	41	15 (36.6)	2 (4.9)	3 (4.9)	2 (4.9)	8 (19.5)
Both AI & bull	8	7 (87.5)	1 (12.5)	2 (25)	2 (25)	4 (50)
X <sup>2</sup>		0.21				
P-value		P=0.64				
DF		1				
Total	167	70 (42)	16 (9.6)	21 (12.6)	9 (5.4)	24 (14)

DT, dystocia; RFM, retained fetal membrane; VD/MT, vaginal discharge/endometritis; RB, repeat breeder

## DISCUSSION

The mean AFC (36 months) found for crossbred cattle in the present study was higher than the 31.5 months reported for F1 crosses of Boran and Friesian cattle and 32.7 months reported for ¾ Friesian \* ¼ Boran crosses [7]. On the other hand, the finding of AFC in the present study was lower than 36.7 and 40.1 months estimated crossbred dairy heifers in smallholder dairy farms in Malawi [18] 58.3 and 36.8 months reported for crossbred dairy heifers at two locations in smallholder dairy farms in Zimbabwe [19] and 40.6 months for crossbred dairy heifers in different dairy production systems in central highlands of Ethiopia [9]. A number of previous works indicated that management factor especially nutrition determined prepubertal growth rates and reproductive development. The better managed and well-fed heifer grew faster, served earlier and resulted in more economic benefit in terms of sales of pregnant heifers and/or more milk and calves during the life time of the animal [8, 19].

The average number of services per conception (1.9%) could be considered satisfactory in view of the earlier estimates reported in Ethiopia, which ranged from 1.6 - 2.6% [10, 20, 21]. The conception rate at first service

(28.4%) was lower than other reports, which varied from 41% to 56% [9, 10, 21]. The variation in number of services per conception and first service conception rate among the finding of different investigations may be due to differences in the type and efficiency of services used, year of study, geographical location and other management factors. In general, the present finding of average number of services per conception and first service conception rate seem satisfactory, respectively when related to the previous reports.

Calving to conception interval (CCI) is considered an important index for evaluating cow reproductive efficiency and herd performance. This is mainly because CCI is the component that determines the length of calving interval. The other component of calving interval, gestation length, is more or less constant although varies slightly with breed, calf sex, litter size (Single Vs twin), dam age, year and month of calving and little can be done to significantly manipulate the duration of gestation [10, 21].

The mean CCI estimated of the present study (169 days) lied within the range 113-319 days that was reported for crossbred and local zebu cattle in different management systems in Ethiopia [9, 10, 20, 22]. Although the present estimate is within the range of the previous reports, it is an unfavorable estimate compared with the

optimum CCI recommended (80-85 days) to achieve the target 365 days of calving [23]. The current mean CCI estimate is also higher than the results of 93-120 days reported in Sweden [24] and 99 days [25] UK found in dairy cattle of improved breed and in improved management systems.

The least-squares mean indicated there was a trend of decrement in CCI From 258 to 134 days ( $p < 0.05$ ) with increasing parity number within the present study. The least-squares mean for the first parity was 258 days and for the second parity was 155 days. This finding was much longer than  $40.8 \pm 2.3$  days reported by McDowell *et al.* [26]. The two components of CCI, postpartum anoestrus interval and service period, are usually influenced by feeding and housing system, method and efficiency of heat detection, type and efficiency of breeding services used, efficiency of recording system and extra nutritional demands for lactation and/or growth of younger animals.

Although one literature reported the variable DALC in non-pregnant cows [10] it should be considered cross sectional studies, particularly at the smallholder dairy production level, where a recording system is incomplete and monitoring studies is difficult. The number of non-pregnant cows ( $n=56$ , Table 2) that had 60 days or more duration after last calving (DALC) at the time of examination was considerable 34% of the total number of cows examined compared to the estimate of mean CCI (169 days) for pregnant cows.

The mean DALC estimated in the present study (264 days) was higher than Lobago *et al.* [10]. This estimate of DALC in non-pregnant cows is an unfavorable estimate since it is even higher than the mean CCI estimate (169 days) of pregnant cows under similar management. The estimated mean DALC indicates clearly that the estimate of CCI of those non-pregnant cows after their conception would be higher than 264 days. The extended mean DALC observed in this study may be partly attributed to the presence of non-pregnant cows with fertility problems (As could be assumed from the positively skewed values, which ranged from 69 to 1095 days). The mean DALC in the semi-intensive management system was significantly ( $p=0.001$ ) higher than in the intensive management system. This may be due to poor body condition, which resulted from unsatisfactory management system and inadequate estrus detection in the semi-intensive management system.

The overall mean body condition score was 3.3 and since the score was performed at a particular point time, the current estimate may not be adequate to compare with other works and draw conclusions from. However, it does

indicate the nutritional status of cows at least at the time of examination. The better ( $P=0.001$ ) body condition of cows in the intensive management system than in the semi-intensive management system may be attributed to a better and more consistent concentrate supplementation of cows in the intensive management system [10]. This difference of the BCS of cows between the two systems might have partly contributed to the observed significant variation in reproductive performance. Inadequate intake of nutrition or inadequate body reserves need to meet production requirements after calving result in suppressed reproductive performance in cycle [27].

The overall pre-weaning calf mortality rate (14.6%) of the present study is considerably high compared to the average annual calf mortality of 7.8% (Ranging from 1% to 20% per herd) reported in 90 Holstein Friesian dairy herds (Average size 152 cows) in the UK [28]. And also still higher than the earlier finding of pre-weaning calf mortality rates of 3.4% in Boran and their Friesian crossbred animals in the Abernossa Ranch in Ethiopia [7] and 5% in Boran and Sahiwal breeds of cattle in Kenya [29]. Managerial problems such as inadequate nutrition and lack of supervision at calving and within the first 24 hours can increase calf mortality [28]. As well as, the extended time of weaning in suckling cows, which is commonly practiced in the traditional dairy production system [21] increased calf mortality.

The prevalence rate of dystocia, retained fetal membrane (RFM), vaginal discharge/endometritis, repeat breeder and abortion in the present study were 9.6%, 12.6%, 5.4%, 14% and 8.4%, respectively. In dairy herds in the UK, some annual incidences of dystocia, RFM, vulval discharge/endometritis and abortion were 9%, 3.6%, 15-22% and 1.5% [25, 28] were lower than that reported in the current study that was conducted for 6 months only. The high prevalence rate of dystocia (9.6%) and abortion (8.4%) were some of the predisposing factors for RFM. The prevalence rate of RFM varies depending on a number of factors such as dystocia, abortion, nutritional deficiency, management system and seasons of the year and geography of the area. The prevalence rate of 5% to 15% in range of repeat breeder was reported [30]. Repeat breeder can be caused by a number of factors, including sub-fertile bulls, endocrine imbalance, malnutrition, reproductive tract infection and poor management practice such as wrong time of insemination or heat detection, problem in semen handling and insemination technique [31]. The high prevalence rate of repeat breeder in the current work was because some of the farms practiced natural service using sub-fertile bulls.

## CONCLUSION

In conclusion, the present estimates of extended calving to conception interval in pregnant cows, duration after last calving in non-pregnant cows on smallholder dairy farms in and around Fitcha town. The pre-weaning calf mortality rate found in the present study is high. The result of the present study suggests that repeat breeder, abortion, dystocia, retained fetal membrane and vaginal discharge/endometritis are the common reproductive disorders of dairy cows in the study area. In addition to the common reproductive disorders, there are many factors such as managerial, environmental and nutritional problems, which collectively interact and exert adverse influences on reproduction. The causes and predisposing factors to such high prevalence of the various reproductive disorders and the poor reproductive performance, the causes and predisposing factors for such high calf mortality call further detailed investigation.

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