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Major Reproductive Disorder and Performances of Small Holder Dairy Farms in and around Fitche 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 smallholder dairy cattle in and around Fitche town from December 2013 to June 2014. Eighty one dairy farms (average herd size=4.8) were visited and data on reproductive performance indicator, cow attributes, type of mating, body condition score and general farm management were collected. The overall mean value for Calving to Conception Interval (CCI) (n=66) and Duration After Last Calving (DALC) (n=56) for pregnant and non-pregnant cattle were 169 and 264 days respectively. The least squares mean CCI was higher ($p<0.05$) in parity number 1 and lower in parity number 4 and above. Management system significantly influenced ($p=0.00$) 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 estimate of extended CCI, DALC and reduced first service conception rate indicates poor reproductive performances of smallholder dairy cows in the study area. Moreover, the pre-weaning calf mortality rate is highly significant. 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.

Keywords: Smallholder Dairy Farms; Reproductive Performance; Fitche; Reproductive Disorder

Introduction

Cattle production is the main component of agricultural growth in many parts of sub- Saharan countries. The overall cost of keeping cattle is associated with the health care, nutrition and reproduction management, however, has not matched to their contribution to the livelihood and economy of the people in sub-Saharan countries. As in many other countries, livestock, particularly cattle play an important role in Ethiopia as being a source of milk, meat, hide, etc [1]. However, the productivity of indigenous cattle breeds is low due to many constraints Including diseases and parasites, nutrition, poor management systems, poor reproductive performance and large socioeconomic factors by decreasing reproductive efficiency, shortening the expected length of productive life and By lowering milk production. 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, the poor reproductive performance of dairy herds has become a major concern, especially in Holstein herds. Decline in conception rate and increase in calving interval over the last decades have been confirmed by several studies [5,6].

Most of the available information pertaining to reproductive performance of dairy cattle in Ethiopia is based on research stations or institutional herds. For example, attempts have been made to investigate retrospectively the reproductive performance of crossbred cows and indigenous zebu cows in institutional herd kept under an intensive management system [7,8]. Most of these study confirmed that the crossbreed cattle have shown significantly better performance than indigenous zebu cattle for the major reproductive traits considered. Another study conducted in the Holeta and Sellable areas, part of the central highlands of Ethiopia, disclosed the existence of significant differences in reproductive performance among crossbred cattle kept under different management system [9,10].

According to various authors, main indicators of reproductive efficiency in the female animals 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 duration after last calving [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 placenta membrane 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 [15]. 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 Fitche town, North Shoa Zone of Oromia region, in the central highland of Ethiopia. Fitche is the central town of North Shoa Zone as well as Girar Jarso district and it is located 112Km and 90o00 100o44' North latitude and 37°5 '-39°33' East longitude [16]. The total area of the Girar Jarso district is 42,400Km2. The climatic condition of the area includes Dega (52%), Woinadeg (41%) and Kola (7%). The total area of the Girar Jarso district is 42,400Km2. The climatic condition of the area include Dega (52%), Woinadega (41%) and Kola (7%) [16].The minimum and maximum temperature is 11.5oc and 35oc, 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 bay long rainy season lasting from June to September [16]. Mixed crop and livestock production system is the main livelihood of the population.

Study Animals and Study Protocols

Eighty-one smallholder dairy farms (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 [17] and [18]. 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 [19] 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 preweaning 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 pregnancy uncertain, 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).

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

Table1: Dairy herd composition and type of breeding service used in 81 randomly selected smallholder dairy farms in and around Fitche town.

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.

Overall Reproductive Performance

Age at First Calving (AFC)

The overall mean of AFC was 36 moths (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 4 and above parity had the lowest least-square mean CCI. The effect of other factors considered, management system and suckling status, on CCI was no significant (P>0.05) (Table 2).

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)
Probability		P<0.01		P=0.00		P<0.01
Management system						
Semi-intensive	27	200 (19.5)	25	372 (31.3)a	74	3.1 (0.06)a
Intensive	39	160 (16.2)	31	188 (28.1)b	93	3.5 (0.05)b
Probability		P=0.12		P=0.00		P=0.00
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)
Probability		P=0.75		P=0.08		P=0.81
Parity number						
1	15	258 (26.1)a	12	314 (45.2)a	37	3.3 (0.09)
2	19	155 (23.2)b	9	322 (52.2)ab	39	3.4 (0.08)
3	8	173 (35.8)b	12	250 (45.2)ab	30	3.3 (0.1)
4 and above	24	134 (20.7)b	23	236 (32.7)b	61	3.3 (0.07)
Probability		P<0.01		P=0.44		P=0.72

Table2: 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 Fitche town.

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.

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=0.00). 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=0.00) the 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 abortions 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.

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 Membrane (RFM), dystocia, abortion and repeat breeder (Table 3 and 4).

The prevalence of dystocia, RFM, vaginal discharge/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).

Variable	Cows examined (no)	Cows aborted [no (%)]	Cows gave Live calves (no)	Pre-weaning Calve mortality [no (%)]
Management system	74			
Semi-intensive	93	8 (10.8	66	11 (16.7)
Intensive		6(6.5)	88	10 (11.4)
X^2		0.94		0.90
Probability		P=0.33		P=0.345
DF	167	1		1
Total		14 (8.4)	154	21 (13.6
Parity number	37			
1	38	4 (10.8)	33	5 (15.2)
2	31	5 (13.2)	36	5 (13.9)
3	67	2 (6.5)	27	3 (11.1)
≥4	167	3 (4.9)	58	8 (13.6)
Total		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)

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

DF, Degree of freedom

Variable	Cows Examined (no)	Cows affected [No (%)]	DT [No (%)]	RFM [No (%)]	VD/MT [No (%)]	RM [No (%)]
Management system						
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^2		0.65				
Probability		P=0.42				
DF		1				
Total	167	70 (42)	16 (9.6)	21 (12.6)	9 (5.4)	24 (14)
Parity number						
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)
X2		2.5				
Probability		P=0.48				
DF		3				
Total	167	70 (42)	16 (9.6)	21 (12.6)	9 (5.4)	24 (14)
Type of mating						
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^2		0.21				
Probability		P=0.64				
DF		1				
Total	167	70 (42)	16 (9.6)	21 (12.6)	9 (5.4)	24 (14)

Table4: Prevalence of major reproductive disorders in smallholder dairy farms in and around Fitche town.

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 Boron and Friesian cattle and 32.7 months reported for ¾ Friesian and ¼ Boron 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 [20], 58.3 and 36.8 months reported for crossbred dairy heifers at two locations in smallholder dairy farms in Zimbabwe [21] 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 determines pre pubertal 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, 21].

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, 22, 23]. The conception rate at first service (28.4%) was lower than in other reports, which varied from 41% to 56% [9, 10, 23]. 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 an important index of 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 [10,23].

The mean CCI estimated in the present study (169 days) is within the range 113-319 days reported for crossbred and local zebu cattle in different management systems in Ethiopia [9,10,22,24]. 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 interval [25]. The current mean CCI estimate is also higher than the results (93-120 days [26] and 99 days- [27] from Sweden and UK, respectively) 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 in 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±2.3 days reported by [28]. 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 there is only one literature report of 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 the previous report [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 ($p=0.00$) 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 ($P=0.00$) 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 in 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 meat production requirements after calving result in suppressed reproductive performance in cycle [29].

The overall pre-weaning calf mortality rate (14.6%) found in the present study is considerable. An average annual calf mortality of 7.8% (ranging from 1% to 20% per herd) was reported in 90 Holstein Friesian dairy herds (average size 152 cows) in the UK [30]. In view of 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 Boron and Sahiwal breeds of cattle in Kenya [30], the current estimate is very high. The absence of calf rearing unit (result not shown in this report), lack of adequate knowledge and skill in handling calves and culling of male calves (mostly in intensive management system) contributed to the occurrence of such high calf mortality. Managerial problems such as inadequate nutrition and luck of supervision at calving and within the first 24 hours can increase calf mortality [31]. The extended time of weaning in suckling cows, which is commonly practiced in the traditional dairy production system [23], might have contributed as well.

The prevalence rate of dystocia, 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, annual incidences of 9%, 3.6%, 15-22% and 1.5% for dystocia, RFM, vulval discharge/endometritis and abortion, respectively have been reported [27,30]. 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 depend-

ing 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 [32]. 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 [33]. The high prevalence rate of repeat breeder in the current work was because some of the farms practiced natural service using subfertile bulls.

Conclusion and Recommendations

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 Fitche 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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