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Research Article

Effect of Management Practices on Reproductive Performance of Smallholder Dairy Cattle

Ali T[1], Lemma A[2]* and Yilma T[2]

[1]Department of Animal Sciences, College of Veterinary Medicine, Samara University, Ethiopia

[2]Department of Clinical Studies, College of Veterinary Medicine and Agriculture, Addis Ababa University, Ethiopia

***Corresponding author:** Lemma A, Department of Clinical Studies, College of Veterinary Medicine and Agriculture, Addis Ababa University, Ethiopia

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Abstract

In smallholder dairy farms, reproductive performance has been described in relation to each cow's calving date. The objective of this research was to evaluate the reproductive performance based on the intervals from each cow's calving date and to assess effect of management practices involved thereof. A retrospective data of 529 farm characteristics and management practices, 722 cow reproductive histories and 700 inseminations results were recorded through records analysis and questionnaire. The mean (±SE) days from Calving to First Service Interval (CFSI) and Calving to Conception Interval (CCI) were 168.9±5.5 (n= 449) and 197.2±7.0 (n= 312), respectively. The mean (±SE) Days after Last Calving for non-pregnant cows (DALC) was 197.3±6.2 days. Number of Service per Conception (SPC) was 1.40± 0.04. First Service Conception Rate (FSCR) and Conception Rate (CR) were 40.6% and 73.4%, respectively. Dairy owner's practice of submission of non-pregnant animals to service was known to influence performance and pregnancy outcomes. Pregnancy by day 200 post calving (PREG-200) and Non-Pregnancy by day 300 post calving (NPREG-300) were used to evaluate the management on performance. The proportion of PREG-200 and NPREG-300 were 28.2% and 53.8%, respectively. Poor BCS and age of the cows, production system, educational status of dairy owners and problems related to AI had all significant effect on the reproductive performance of the dairy cows in the smallholder practice.

Keywords: Reproductive performance; PREG200; NPREG300; Smallholder dairy

Introduction

Ethiopian dairy production is generally characterized as a year round calving system with low nutritional input and limited use of mixed rations. The lifetime productivity of a dairy cow depends on the number of calves born and the amount of milk produced during its active reproductive phase [1]. Thus, reproductive performance and milk production are the major determinants of dairy cow profitability. Reproductive performance optimization requires measurement of current performance, assessment of areas in which performance is less than desirable and subsequent suitable interventions [2,3].

The outcomes of reproductive performance can be described by measuring the distribution of conceptions over time and/or conception efficiency. Within their limitations mean interval from Calving to First Service (CFSI) and/or Calving to Conception (CCI) are the two mainly used indices to measure reproductive outcomes. The distributions of CCI/CFSI are usually positively skewed and their mean values are affected by small numbers of extreme values (particularly in small herds) which are among the limitations. Furthermore, CFSI/CCI exclude non inseminated cows that exceed voluntary waiting period and CCI do not explain cows that fail to conceive after several inseminations [4]. Thus, measuring mean CCI as major reproductive outcomes may underestimate variation of reproductive performance between populations. The limitations of CCI can be addressed by evaluating proportion of cows pregnant and non pregnant by specified intervals after their calving date that are often influenced by reproductive management practices. Reproductive performance can also be described using proportions of cows pregnant by specified time periods after their calving date since various time periods have been used, including 80 days [5], 100 days [4], 115 days [6], 150 days [7,8], 210 days [6] and 320 days [8].

Dairy production systems vary internationally due to differences in management system, physical environment, social-economic status of producers, relative cost of labor, nutrition economics, available reproductive technologies and breeding costs, infrastructure availability and the regulatory environment with adaptability and genetic composition of cattle [9].

Major reproductive performance factors encompass both management factors (such as methods of husbandry, feeding, estrus detection, semen handling and transition cow management) and cow-level factors (such as age, BCS, post parturient problem, disease, milk yield, and genetics) [10,11]. Studies in tropical countries showed that performance of smallholder dairy cattle affected by various factors such as genotype, location (geographical location), and season of calving; suckling status, parity, and body condition score [12-15]. While it is debatable, social status of farm owners and attendants (such as education level of farmer owners and attendants, and years in farming) is a potential factor for poor reproductive performance of cows and hindrance in the effectiveness. Hence, performance needs to be assessed not only on an individual cow basis, but also at herd and general management level. The major objectives of this study were to describe the reproductive performance and to evaluate the effect of

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Table 1: Factor variables screened for further analysis using general liner model.

Cow level factors	Management level factors
Breed	Sex of the farm owner
Zebu	Male
Zebu*Holstein Friesian cross	Female
Age	**Farm attendant**
≤ 4 years	Owner
4< X ≤ 6 years	Family member
6< X≤ 8 years	Employed laborer
>8 years	
Parity (1, 2, 3, ≥4)	Farm attendant educational status (educated, uneducated)
BCS on 1-5 scale (≤2, 2<X≤3, >3)	Years involved in dairy farming (≤5, 5<X≤10, >10 years)
	Years in using AI breeding(≤5, 5<X≤10, >10 years
	Availability of bull in the farm (Yes/No)
	Production system (Intensive/Extensive)
	Feed sufficiency in the view of the farm attendant (Yes/No)
	Regularity of AI service (Yes/No)
	Pregnancy diagnosis for inseminated cows (Yes/No)
	Problems related to AI other than regularity (Yes/No)

reproductive management factors on the reproductive performance of smallholder dairy cows under AI in selected sites of Ethiopia.

Materials and Methods

A retrospective data analysis was conducted in smallholder dairy farms. Since smallholder dairy systems vary substantially by geographic location, 5 districts were selected based on coverage of AI technology and agro-ecological constitution from four regions (Amhara, Oromia and South Nation and Nationality People Region). The study enrolled only AI breeding farms and their cows with ≥60 days postpartum. Data for 529 farms were recorded on farm characteristics and their management strategies through record analysis and questionnaire. Data on reproductive history from 722 cows and 700 inseminations were also collected. Reproductive tracts of cows were palpated per rectum at Day >60 post AI to determine pregnancy. Cows were classified as non pregnant only after a negative pregnancy diagnosis, and return to estrus within 56 days post AI.

Data was entered into a Microsoft Excel 2007 data sheet and analyzed using SPSS 15 for Windows (SPSS 2006, LEAD Technologies Inc). Data was described; with additional summarization of results by graphs and plots to describe pregnancy success. The fixed effects of independent variable that were screened for significant effect (cow level factors and management factor, (Table 1) by univariate model were later analyzed using generalized linear models. PREG200 and NPREG300 were taken as dependent variables. Conception rates were described for first inseminations and all AI.

Results

The mean (±SE) for CFSI was 168.9± 5.5 days (range = 33–583 days) and CCI was 197.2± 7.0 days (range = 40–587 days). The mean (±SE) for DALC for non-pregnant cows were 197.3± 6.2 days (range = 62–698 days). Mean (±SE) SPC for cows/heifers were 1.44± 0.04 (range = 1–5) and the CR and FSCR were 73.8% and 40.9%, respectively. Pregnancy result was known to be a function of days post last calving (Figure 1) although a significant difference was observed in PREG200 and NPREG300 between farm locations. Cows in Bishoftu had the highest PREG200 than cows in Guangua (OR= 2.79) and cows in Aletawendo had the lowest PREG200 (OR= 0.616). The percentage of cows those were pregnant by day 200 post calving were 28.2% while non-pregnant cows by day 300 post calving were 53.8%.

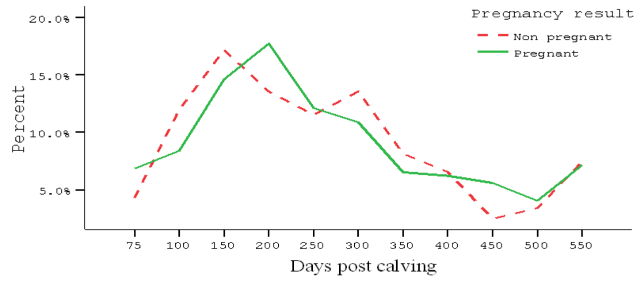

Figure 1: Pregnant and non-pregnant cows by days post calving.

The selected factors for modeling of PREG200 and subsequent result are presented in (Table 2). PREG200 was strongly associated with location, BCS, age of the cow and production system. Dairy cows kept in Bishoftu site had better reproductive performance in PREG200 than kept in Guangua which was the reference category (OR= 2.2.79). Cows with very poor condition (BCS ≤2, OR= 0.257) and cows with moderate condition (BCS= 3, OR= 0.527) were less likely to be pregnant by Day 200 post AI compared to those with relatively good condition (BCS >3). PREG200 was significantly better for cows in intensive production system than those in extensive system (P<0.05; OR= 1.844).

The descriptive statistics and odds ratio for factors affecting NPREG300 is shown in (Table 3). NPREG300 was strongly associated with location, BCS, age of the cow, years involved in dairy farming and educational status of farm attendant. Dairy cows kept in Aletawendo had the highest number of non-pregnant cows by 300 after calving (OR= 1.637).

Cows with poor condition (BCS ≤2, OR= 2.706) were highly likely to be non pregnant by day 300 after calving compared with those with relatively good condition (BCS>3). Uneducated farm owners/attendants were less likely to submit their animals at the right time and hence were more likely to be non pregnant by Day 300 post AI (OR= 1.629). Similarly, the NPREG300 was lower for intensive farms (OR= 0.586). NPREG300 was also influenced by location of the farms.

Discussion

Location differences in reproductive performance are often results of difference in feed and feeding, microclimatic conditions including temperature and humidity, and management practices. The relatively better reproductive performance of dairy cows at Bishoftu is associated with the conditions of better feed availability, better AI services in bigger towns, and educational status and farming experience of dairy owners. As reported by Obese et al. [16], and Domecq et al. [17], lack

Table 2: Cow and management factors screened for their effect on PREG200.

Cow Variables	N	Proportion [%]	P-value	External Variables	N	Proportion [%]	P-value
Age of the cow (Year)				**Gender of the farm owner**			
<4	134	0.37	0.005	Female	122	0.39	0.004
4<X<6	176	0.21		Male	435	0.25	
6<X <8	152	0.32		**Production system**			
>8	95	0.10		Intensive	361	0.35	0.000
BCS				Extensive	196	0.16	
≤2	62	0.10	0.000	**Access to regular AI service**			
2X≤3	287	0.25		No	423	0.24	0.001
>3	208	0.39		Yes	134	0.40	
Breed				**Breeding site**			
Cross	515	0.29	0.037	On farm	241	0.36	0.001
Zebu	42	0.14		AI center	316	0.28	
				Location			
				Aletawendo	134	0.20	0.037
				Bishoftu	110	0.51	
				Dale	99	0.29	
				Fogera	113	0.25	
				Guangua	101	0.17	

Table 3: Descriptive statistics and odds of factors affecting NPREG300.

Variable	**N**	**Proportion of non pregnant by day 300 post AI**	**Odds ratio (95% CI)**	**P-value**
Location				
Aletawendo	98	0.60	2.169 (1.059-4.441)	0.014
Bishoftu	102	0.35	0.853 (0.410-1.774)	
Dale	82	0.39	0.881 (0.418-1.857)	
Fogera	94	0.57	1.294 (0.622-2.507)	
Guangua	70	0.54		
BCS				
≤2	42	0.69	2.706 (1.167-6.274)	0.046
2<X≤3	223	0.52	1.447 (0.914-2.290)	
>3	181	0.41		
Production system				
Intensive	298	0.43	0.586 (0.364-0.943)	0.027
Extensive	1488	0.62		
Educational status of farm attendant				
Uneducated	270	0.44	1.629 (1.079-2.458)	0.020
Educated	176	0.56		

of supplementary feeding in extensively grazed dairy cows affect their reproductive performance. Estrus activities are also suppressed due to heat stress [18-20]. Besides the nutritional deficiency, parasitic loads, and suckling, as is a common practice in extensive management systems, interfere with ovarian function, thereby prolonging the days open [21]. The effect of low level of nutrition on extended postpartum period due to weight loss was also noted by Gebreegziabher et al. [22]. Cows reared under very limited resources and unfavorable climate of extensive management systems may fail to become pregnant [21]. Such cows lose another year before being capable of conceiving and two-years CI are not uncommon, especially in the semi-arid tropics. Similar finding differences in performance found between cows under intensive and extensive system was also reported in previous study [23] with higher pregnancy rate for intensive farms compared to extensive farms.

PREG200 and NPREG300 were strongly associated to BCS. Cow's good condition is twice as likely to be pregnant compared to those with poor condition. This finding agrees with the that of Buckley et al.

[24] and Roche et al. [25] who reported odds of successful pregnancy by 6-week in-calf rate were reduced by 1.28 times and 1.62 times with each 0.5-unit decrease in BCS. Besides Roche et al. [25] also reported that the odds for successful pregnancy at 12 wk were 1.7 times lower in cows that had 0.5 BCS units lower. Cows losing over 10% of body weight loss also have prolonged CCI [26]. Cows that lost 0.3 BCS unit (5-point scale) are 1.17 times less likely to conceive than cows that did not lose condition after calving [25]. Cows in low BCS (less than 2) in early lactation are known to have delayed intervals to conception [27].

In the present study, the likelihood of NPREG300 for cows with poor condition (BCS of 2 or less) was 2.706 times higher than cows with BCS 3 or above. This result coincides that of Buckley et al. [24] who reported similar finding. This may be attributed to delay for first service (prolonged CFSI), delayed onset of cycling postpartum and embryo and fetal loss [28-33].

The proportion of NPREG300 were higher for cows managed by uneducated than educated attendants or owners (44% *vs.* 56%). As also evidenced by the difference in SPC (1.36 for cows managed by uneducated attendants versus 1.58 for educated) was mostly associated with heat detection efficiency and understanding reproductive events such as estrus, services, pregnancies and calving. Success of AI has been associated with knowledge and farming skill of dairy farm attendants or owners [15,23,34].

Conclusion

Improving reproductive performance of dairy cows' requires understanding of current performance, identifying challenges and opportunities with the causal factors, and subsequently creating sustainable options for overcoming the problems. Management practices were known to affect pregnancy success and reproductive performance of smallholder dairy cows. In the present finding, the CFSI, CCI and DALC are longer than the optimal values further complicated by the influence of location of the farms, nutritional status of the cows, and management which in turn is influenced by educational level of the farm attendants and production system type. Apart from the conventional methods of evaluating reproductive performance, the introduction of evaluation parameters such as submission to service at the right time post partum, pregnancy by day 200 and non pregnancy by day 300 provide which are directly influenced by the management practices provide a useful evaluation alternative. The extended CCI, lower PREG200 and higher NPREG300 in the current finding indicate that the management practice in smallholder dairy farms is poor or inefficient.

References

1. de Varies A. Economic value of pregnancy in dairy cattle. Journal of Dairy Science. 2006; 89: 3876-3885.
2. Hare E, Norman HD, and Wright JR. Trends in calving ages and calving intervals for dairy cattle breeds in the United States. Journal of Dairy Science. 2006; 89: 365-370.
3. Swai ES, Kyakaisho P, and Ole-Kawanara MS. Studies on the reproductive performance of crossbred dairy cows raised on smallholder farms in eastern Usambara Mountains, Tanzania. Livestock Research for Rural Development. 2007; 19.
4. Morton JM. Interrelationships between herd-level reproductive performance measures based on intervals from initiation of the breeding program in year-round and seasonal calving dairy herds. Journal of Dairy Science. 2011; 93: 901-910.
5. Uchida K, Mandebvu P, Ballard CS, Sniffen CJ, and Carter MP. Effect of feeding a combination of zinc, manganese and copper amino acid complexes, and cobalt glucoheptonate on performance of early lactation high producing dairy cows. Animal Feed Science and Technology. 2001; 93: 193-203.
6. Ferguson JD. Diet, production and reproduction in dairy cows. Animal Feed Science and Technology. 1996; 59: 173-184.
7. Mandebvu P, Uchida KC, Sniffen CJ, Ballard CS, Carter MP. Effect of feeding complexed zinc methionine, manganese methionine, copper lysine, and cobalt glucoheptonate on lactation and reproductive performances by lactating Holstein cows. Journal of Dairy Science. 2000; 83: 303-304.
8. Raizman EA, Santos JEP. The effect of left displacement of abomasum corrected by toggle-pin suture on lactation, reproduction, and health of Holstein dairy cows. Journal of Dairy Science. 2002; 85: 1157-1164.
9. Thatcher WW, Silvestre FT, Santos JEP, Ribeiro ES, Staples CR, Risco C, et al. Interactions between nutrition, heat stress and reproduction in cattle within tropical/subtropical environments. Odongo NE, Garcia M, Viljoen GJ, editors. Sustainable improvement of animal production and health. Food and Agriculture Organization of the United Nations. Rome. 2010.
10. Lucy MC. Reproductive loss in high-producing dairy cattle: Where will it end? Journal of Dairy Science. 2001; 84: 1277-1293.
11. Hudson CD, Bradley AJ, Breen JE, Green MJ. Associations between udder health and reproductive performance in United Kingdom dairy cows. Journal of Dairy Science. 2102; 95: 3683-3697.
12. Masama E, Kusina KT, Sibanda S, Majoni C. Reproduction and lactation performance of cattle in a smallholder dairy system in Zimbabwe. Tropical Animal Health and Production, 2003; 35: 117-129.
13. Msanga YN, Bryant MJ. Effect of restricted suckling of calves on the productivity of crossbred dairy cattle. Tropical Animal Health and Production. 2003; 35: 69-78.
14. Msangi BSJ, Bryant MJ, Thorne PJ. Some factors affecting variation in milk yield in crossbred dairy cows on smallholder farms in North-east Tanzania. Tropical Animal Health and Production. 2005; 37: 403-412.
15. Lobago F, Bekana M, Gustafsson H, Kindahl H. Longitudinal observation on reproductive and lactation performances of smallholder crossbred dairy cattle in Fitche, Oromia region, central Ethiopia. Tropical Animal Health and Production. 2007; 39: 395-403.
16. Obese FY, Okantah SA, Oddoye EOK. Postpartum reproductive performance of sanga cattle in smallholder peri-urban dairy herds in the Accra Plains of Ghana. Tropical Animal Health and Production. 1999; 31: 181-190.
17. Domecq JJ, Skidmore AL, Lloyd JW, Kaneene JB. Relationship between body condition scores and conception at first artificial insemination in a large dairy herd of high yielding Holstein cows. Journal of Dairy Science. 1997; 80: 113-120.
18. Jordan ER. Effects of heat stress on reproduction. Journal of Dairy Science. 2003; 86: E104-E114.
19. Rensis H, Fabio D, Rex JS. Heat stress and seasonal effects on reproduction in the dairy cow- a review. Theriogenology. 2003; 60: 1139-1151.
20. Windig JJ, Calus MPL, Veerkamp RF. Influence of herd environment on health and fertility and their relationship with milk production. Journal of Dairy Science. 2005; 88: 335-347.
21. Ball PJH, Peters AR. Reproduction in Cattle. Third Edition, Blackwell Publishing Ltd, Oxford, UK. 2004.
22. Gebreegziabher G, Tegegne A, Diedhion ML, Hegde BP. Days to first service, conception rate and service period of indigenous and crossbred cows in relation to postpartum body weight change at Bako, Ethiopia. Ethiopian Journal of Animal Production. 2005; 5: 83-90.
23. Woldu T, Giorgis YT, Haile A. Factors affecting conception rate in artificially inseminated cattle under farmers condition in Ethiopia. Journal of Cell and Animal Biology. 2011; 5: 334-338.

24. Buckley F, Sullivan KO, Mee JF, Evans RD, Dillon P. Relationships among milk yield, body condition, cow weight, and reproduction in spring-calved Holstein-Friesians. Journal of Dairy Science. 2003; 86: 2308-2319.

25. Roche JR, Macdonald KA, Burke CR, Lee JM, Berry DP. Associations among body condition score, body weight, and reproductive performance in seasonal-calving dairy cattle. Journal of Dairy Science, 2007; 90: 376-391.

26. Heinonen K, Ettala E, Alanko M. Effect of postpartum live weight loss on reproductive functions in dairy cows. Acta Veterinaria Scandinavica. 1988; 29: 249-254.

27. Suriyasathaporn W, Nielen M, Dieleman SJ, Brand A, Noordhuizen-Stassen EN, Schukken YH, et al. Use of Cox proportional-hazards model with time-dependent covariates to evaluate the relationship between body-condition score and the risks of first insemination and pregnancy in a high-producing dairy herd. Preventive Veterinary Medicine. 1998; 37: 159-172.

28. Cartmill JA, El Zarkouny SZ, Hensley BA, Lamb GC, Stevenson JS. Stage of cycle, incidence, and timing of ovulation, and pregnancy rates in dairy cattle after three timed breeding protocols. Journal of Dairy Science. 2001; 84: 1051-1059.

29. Moreira F, Orlandi C, Risco CA, Mattos R, Lopes F, Thatcher WW. Effects of Presynchronization and bovine somatotropin on pregnancy rates to a timed artificial insemination protocol in lactating dairy cows. Journal of Dairy Science. 2001; 84: 1646-1659.

30. Stevenson JS. Reproductive management of dairy cows in high milk-producing herds. Journal of Dairy Science. 2001; 84: 128-143.

31. Gumen A, Guenther JN, Wiltbank MC. Follicular size and response to Ovsynch versus detection of estrus in anovular and ovular lactating dairy cows. Journal of Dairy Science. 2003; 86: 3184-3194.

32. Lopez-Gatius F, Yaniz J, Madriles-Helm D. Effects of body condition score and score change on the reproductive performance of dairy cows: A meta-analysis. Theriogenology. 2003; 59: 801-812.

33. Starbuck MJ, Dailey RA, Inskeep EK. Factors affecting retention of early pregnancy in dairy cattle. Animal Reproduction Science. 2004; 84: 27-39.

34. Lemma A, Kebede S. The effect of mating system and herd size on reproductive performance of dairy cows in market oriented urban dairy farms in and around Addis Ababa. Revue Med Vet. 2011; 162: 526-530.

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