Reproductive performance of dairy cows in a smallholder farm

M Yusuf and Sahiruddin

Laboratory of Animal Reproduction, Faculty of Animal Science, Hasanuddin University, Makassar, Indonesia

E-mail: myusuf@unhas.ac.id

Abstract. The aim of this study was to know the reproductive performance of dairy cows in a smallholder farm. The study was conducted in a dairy tie stall housing system farm with herd size of 30 dairy cattle in Enrekang Regency, Indonesia. A total of 25 dairy cows was observed during the study period. Reproductive parameters used in the present study were service per conception, interval from calving to conception, duration of pregnancy, and calving interval. The results of this study showed that out of 25 dairy cows observed, 20 of them become pregnant after one or more insemination. The average (± standard deviation; SD) duration of pregnancy was 273.40 ± 5.38 days after 1.55 ± 0.76 inseminations. After calving, 13 cows (65.0%) become pregnant after repeated inseminations (3.00 ± 2.24) with interval from calving to conception, duration of pregnancy, and calving interval were 254.31 ± 187.78 days, 275.54 ± 4.46 days, and 529.85 ± 189.32 days, respectively. For the third pregnancy, out of 13 dairy cows, only six cows (46%) become pregnant after repeated inseminations with service per conception was 2.00 ± 0.89 times. The interval from calving to conception, duration of pregnancy, and calving interval were 129.17 ± 46.24 days, 275.00 ± 4.98 days, and 404.17 ± 48.87 days, respectively. The overall service per conception times, interval from calving to conception, duration of pregnancy, and calving interval of dairy cows in a smallholder farm were 2.05 ± 1.49 times, 214.79 ± 166.35 days, 274.51 ± 5.10 days, and 490.16 ± 167.81 days, respectively. In conclusion, reproductive performance of dairy cows in a smallholder farm decreased after first calving as well as the number of cows become pregnant.

1. Introduction

For long time ago, it has been stated that one of the important factors determining profitability of dairy herds is reproductive performance [1]. Similarly, Wiltbank et al [2] also stated that profitability of livestock operations, including commercial dairy herds is affected by reproductive efficiency. This suggests that high rate of reproductive performance provides high rate of profitability, contrary, the low rate of reproductive performance reduces the profitability of dairy herds. There are many factors affecting the performance of dairy herds’ reproduction. One of them is the size of the herd and management applying in the herd. Each herd whether in modern or conventional dairy herds has a unique reproductive problem. For instance, in modern dairy herd, that are mainly in developed countries, one of the most reproductive problem is caused by high yielding of milk resulting in decrease of reproductive performance. This due to that during milk production, high yielding dairy cows require a lot of feed consumption resulting high blood flow in the digestive tract and finally high estrogen and progesterone metabolism cause low level of these two hormones in the circulation blood [2]. Decrease the estrogen and progesterone levels in the blood circulation will disturb the normal reproductive process physiologically.
On the other hand, in developing countries including Indonesia, mostly herds are raising in a small number of animals. Furthermore, the management applied in smallholder farms are still very simple and far away from sophisticated technology. Then it can be predicted that both calves and milk productions are in lower level. This suggests that there are some problems occur in small farms. Therefore, the characteristic of such condition are needed to be understood by the farmers, so that chances to improve and to produce more calves and milk are widely open.

The reproductive problems faced in smallholder farms are totally different to those in modern dairy farms. In small dairy farms, reproductive problems are not caused by high milk production as faces in modern dairy herds. This predictable because milk production in small farms are much lower than in modern dairy farms. Furthermore, the issues that not only causes of low reproductive performance are not clearly understood but how low the level of reproductive performance in smallholder farms are still questionable. Therefore, to improve the reproductive performance in smallholder farms, the first step that should be known is the real condition of the farms itself such as management related to all activities including housing management, feeding management, health management, reproductive management, and some other management. The next step is how the management applied; whether they are working well accordingly. Finally, the management applied in smallholder farms needs to be improved based on development of technology in order to increase production.

In this occasion, we hypothesized that the reproductive performance in dairy smallholder farms is lower than their potential, therefore, the aim of this study was to know the reproductive performance of dairy cows in a smallholder farm.

2. Materials and methods

2.1. Dairy farms and management
This study was conducted in a dairy small holder farm with herd size of 30 dairy cattle in Enrekang Regency, Indonesia. The dairy cattle were housed in tie-stall barn just under the house of the farmer. The cows were milked everyday once or twice in the morning and afternoon depending upon milk production of the lactating cows. For pregnant cows, they are stop to be milked two months before due date of calving. Mostly cows usually are milked once a day in the morning time just after cleaning the animals and housing from the feces and some other dirty compounds. The dairy cattle are fed twice a day just after milking in the morning and in the afternoon. The feedstuffs consisted of elephant grass or other natural grasses, rice bran, sometimes concentrates or by-product of tofu. In a certain condition, vitamins and/or minerals are administered to the animals.

2.2. Reproductive management of the herd
Basically, the farmer has no special recording and planning for reproductive management. The recording was only consisted of date of estrus, date of AI, and date of calving. However, estrous detection are mainly conducted by the farmer. If the cows are detected in estrus, the farmer informed to the AI technician (inseminator) to conduct AI. AM/PM rule are also applied in this herd; cow(s) detected in estrus in the morning is usually inseminated in the afternoon and vice versa.

There is no synchronization of estrus or induction of estrus applied in the herd, except if there is a program from livestock services or research project that usually conducted by university staffs or research agency staffs. In this herd, mating methods are mainly using AI without natural mating or clean-up using bull for repeat breeding cows. Pregnancy diagnosis of the dairy cows by palpation of rectum are usually conducted a few months after AI by AI technician on requested of the farmer.

2.3. Data collection
All data were collected from the recording book of the farmer that included date of estrus, date of AI, and date of calving. A deep interview to the farmer was also conducted, regarding all management applied in the farm, included raising, feed, reproductive, and milking management. A total of 25 dairy cattle was noted and observed during the study period. Reproductive examination was also conducted by the team during the study period, including pregnancy diagnosis by palpation per rectum. This examination was performed on the requested of the farmer regarding the problem of dairy cows especially those cows that did not become pregnant for long period. Reproductive problems that occur during examination such as pyometra, metritis, inactive ovary(es), and the other problems were noted and treated immediately.
2.4. Parameters of the study
Reproductive parameters measured in the present study were service per conception, calving to conception interval, duration of pregnancy, and calving interval. Service per conception was calculated as the number of artificial insemination (AI) conducted every conception. Calving to conception interval was number of days from calving to conception. Duration of pregnancy was calculated as the number of days from AI to calving, and calving interval was the interval for two consecutive calving.

2.5. Data analysis
All collected data in this study were tabulated and analyzed using Microsoft Excel program. The differences in the number of services per conception for the first, second, and third pregnancy, interval from calving to conception, duration of pregnancy, and calving interval were compared using ANOVA. Figures to distinguish the parameters were also drawn using Microsoft Excel program.

3. Results and discussion
In the present study, out of 30 dairy cattle observed in a smallholder farm, it was only 20 (80%) female dairy cattle getting pregnant and get calving in the first time. The remaining 5 (20%) did not become pregnant for various reasons. This indicated that not all dairy heifers in the farm be able to conceive or maintaining pregnancy after one or more inseminations. This might be due to that some of the dairy heifers do not fertile, and it will become more expenditure by the producer for feeding and raising replacement heifers [3]. Likewise, study of Losinger and Heinrichs [4] found that recommended target of ≤24 months age at calving dairy farms in the United States was only about 2.7%, resulting in economic losses. Therefore, one methods to accelerate the heifers to become pregnant is to introduce the heifers for reproductive protocols [5,6]. This protocols are intended to achieve the goal of management program in dairy heifers to have a low cost of economic and environmental for future lactation [7].

![Figure 1. Subsequent pregnancy of dairy cows in a smallholder farm](image)

The fate of 20 dairy cows that able to get pregnant in the first time for subsequently pregnancy are shown in figure 1. It may be noted that out of 20 dairy cows that got pregnant in the first pregnancy, it was only 65% (13/20) of them be able to get pregnant in the second time. Furthermore, only 6 (46%) of 13 dairy cows be able to get pregnant for the third time. This suggests that not all parity 1 dairy cows be able to become pregnant for the second time. Similarly parity 2 dairy cows had a difficulty to become pregnant for the third time. Study of Yusuf et al [8] stated that parity 1 dairy cows had greater percentage for repeat breeding than those in parity 2 and 3, suggested that dairy cows in parity 1 had longer interval from calving to conception.

3.1. Service per conception
Of the 37 pregnancies observed in a smallholder farm in the present study, the overall services per conception (± SD) was 2.05 ± 1.49 times. Detailed services per conception of dairy cows at different pregnancy are shown in Figure 2. In maiden dairy heifers at first pregnancy, the number of services per conception was 1.55 ± 0.76 times; significantly (P <0.05) lower than those in the second and the third pregnancies (3.00 ± 2.24 and 2.00 ± 0.89).
Likewise, number of services per conception between the second and the third pregnancies differed significantly (P <0.05).

The number of pregnancy of dairy cows in a smallholder farm at different services per conception are shown in figure 3. Out of 37 pregnancies, there was 46% of dairy cattle inseminated only once, 27% inseminated twice, 19% inseminated thrice, and the remaining 8% inseminated more than three times. High number of services per conception increases the interval from calving to pregnancy subsequently prolonged calving interval [9]. Likewise, most probably that high number of services per conception for the dairy cows for the second pregnancy might be caused by late embryonic loss after AI. This in line with the study of Rodriguez et al. [10] that the odds for late embryonic loss increased with parity number.

3.2. Calving to conception interval
The interval from calving to conception of dairy cows in a smallholder farm at different parities are shown in figure 4. Parity 1 dairy cows had significantly (P <0.01) longer the interval from calving to conception compared to dairy cows in parity 2 (254.31 ± 187.78 vs. 129.17 ± 46.24 days). Longer calving to conception interval resulted in longer calving interval, subsequently reduces reproductive performance in the herd level. Cows in longer interval from calving to conception affecting the individual cow’s productivity both calf and milk production. In the district of Enrekang, South Sulawesi, cows that conceived within 150 d after calving was only 32% [11].
To achieve high rate of reproductive performance, interval from calving to conception is better within 100 days postpartum or 85 days in average. This intended that dairy cows achieve this interval would be able to have high rate of reproductive performance.

3.3. Duration of pregnancy
Duration of pregnancy of the dairy cows in a smallholder farm during the study period are shown in figure 5. The average (±SD) duration of pregnancy was 274.51 ± 5.10 days for all pregnancies. There was no significant different (P >0.05) the duration of pregnancy between the first, second, and third pregnancies. However, the first pregnancy had likely to shorter than the second and third pregnancies (273.40 ± 5.38 vs. 275.54 ± 4.46 and 275.00 ± 4.98 days. The shorter duration of pregnancy in maiden dairy heifers might be caused by first experience of pregnancy in relation to the first function of uterine.

3.4. Calving interval
Calving interval of the dairy cows in a smallholder farm in the present study are shown in figure 6. The overall interval from calving to calving both parities 1 and 2 for their subsequently calving was 490.16 ± 167.81 days in average (±SD). This study showed that the dairy cows in parity 1 for the second calving had significantly (P <0.01) longer calving interval in comparison to those dairy cows in parity 2 for their third calving (529.85 ± 189.32 vs. 404.17 ± 48.87 days). Longer calving interval in first parity cows might be caused by stress during first experience of pregnancy and calving that affect reproductive organ such as ovarian to actively resume.
Figure 6. Calving interval of dairy cows in a smallholder farm at different parity

4. Conclusion
In conclusion, reproductive performance of dairy cows in a smallholder farm decreased after first calving as well as the number of cows become pregnant. Efforts to improve the reproductive performance of dairy cows in smallholder farms especially for the parity 1 dairy cows are needed.

Acknowledgment
The authors are thanks to the Ministry of Research, Technology, and Higher Education of Indonesia through Directorate of Research and Community Services and The Centre of Research and Community Services, Hasanuddin University for funding this study through Excellent Research of Higher Education 2019.

References
[1] Bulman D C and Lamming G E 1978 Milk progesterone levels in relation to conception, repeat breeding and factors influencing acyclicity in dairy cows J Reprod. Fertil. 54 447-58
[2] Wiltbank M C, Lopez H, Sartori R, Sangsritavong S and Gumen A 2006 Changes in reproductive physiology of lactating dairy cows due to elevated steroid metabolism Theriogenology 65 17-29
[3] Gabler M T, Tozer P R and Heinrichs A J 2000 Development of a cost analysis spreadsheet for calculating the costs to raise a replacement dairy heifer J. Dairy Sci. 83 1104–09
[4] Losinger W C and Heinrichs A J 1997 An analysis of age and body weight at first calving for Holstein in the United States Prev. Vet. Med. 32 193–205
[5] Stevens J L, Rodrigues J A, Braga F A, Bitente S, Dalton J C, Santos J E P and Chebel R C 2008 Effect of breeding protocols and reproductive tract score on reproductive performance of dairy heifers and economic outcome of breeding programs J. Dairy Sci. 91 3424–38
[6] Masello M, Perez M M, Granados G E, Stangaferro M L, Ceglowski B, Thomas M J and Giordano O 2019 Reproductive performance of replacement dairy heifers submitted to first service with programs that favor insemination at detected estrus, timed artificial insemination, or a combination of both J. Dairy Sci. 102 1671-81
[7] Esser N M, Hoffman P C, Coblenz W K, Orth M W and Weigel K A 2009 The effect of dietary phosphorus on bone development in dairy heifers J. Dairy Sci. 92 1741–49
[8] Yusuf M, Nakao T, Ranasinghe R M S B K, Gautam G, Long S T, Yoshida C, Koike K and Hayashi A. 2010. Reproductive performance of repeat breeders in dairy herds Theriogenology 73 1220–29
[9] Akbarabadi M A, Shahankareh H K, Abdolmohammadi A and Shahsavari M H 2014 Effect of PGF2α and GnRH on the reproductive performance of postpartum dairy cows subjected to synchronization of ovulation and timed artificial insemination during the warm or cold periods of the year Theriogenology 82 509-16
[10] Rodríguez L E Q, Rearte R, Domínguez G, de la Sota R L, Madoz L V and Giuliodori M J 2019 Late embryonic losses in supplemented grazing lactating dairy cows: Risk factors and reproductive performance. *J. Dairy Sci.* 102 9481-87

[11] Yusuf Y, Toleng A L and Syafar M F 2012 Distribution of cows by days in milk (DIM) at first AI and calving to conception interval in dairy cows *Media Peternaka* 35 185-89