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Risk Factors Related to Infertility in Dairy Cows in and Around Gondar, North West Ethiopia

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Abstract: The aim of this study was to determine the risk factors for infertility problems in dairy cows.Regular follow up were conducted to determine the infertility problems of dairy cows and to identify associated risk factors in smallholder, medium and large scale dairy farms in and around Gondar, North Western Ethiopia from January 2012 to September 2013. The study populations comprised of 266 indigenous and 384 crossbred cows, randomly selected from 138, 98 and 7 smallholder; medium and large scale managed dairy farms, respectively. A total of 650 cows were examined of which 352 (54.15%) had at least one of the infertility problems.The association of infertility with the risk factors was investigated using univariate and multiple logistic regressions.

Key words: Dairy cows · Infertility · Risk factors · Univariate,multiple logistic regressions

INTRODUCTION

The cause of infertility in cows is multifactorial involving inadequate nutrition, poor reproductive management, an increased incidence of disease and overall poor cow welfare [1]. High fertility efficiency is necessary for efficient milk production and it, therefore, has an important influence on herd profitability [2]. Low fertility efficiency decreases herd profitability by: (i) prolonging the calving interval, which results in less milk produced per cow and fewer calves born per year; (ii) increasing culling due to infertility and therefore, increased replacement costs; (iii) increased labor, semen costs and veterinary bills; (iv) an extended low production or dry period can result in over conditioned cows calving in too high a BCS (>3) which results in a subsequent prolonged period of negative energy balance (NEB) and low fertility efficiency. High Fertility efficiency is dependent on obtaining normal uterine involution, early resumption of ovulation, high efficiency of estrous detection and high conception rates per service [3].

Fertility is one of the key determinants of the lifetime performance of a cow. For dairy cows, it is necessary for a calf to be produced every 365 days. Regular breeding depends upon the normal function of the reproductive system. When the function of the reproductive system is impaired, cows fail to produce a calf regularly [4].

A well-managed dairy herd should have 65 to 70 percent of the cows conceive on first service with an average of 1.3 to 1.7 services per conception. There should be less than 10 percent of the cow with reproductive “problems” and the calving interval from one calving to the next calving should be between 12 to 13 months [5]. Reproductive failure (infertility) leads to low productivity in dairy cows. Infertility leads to a loss of milk production, a loss of income from calf sale and an increase in the replacement of sate of cow with first calving heifers [6].

Accordingly, there is a scarcity of reliable information regarding infertility problems of dairy cows in and around Gondar. Information pertaining to infertility and interacting factors is of paramount importance to livestock owners and as well as to extension agents, veterinarians and researchers. Moreover, it can assist in the development of strategies and prioritization of possible intervention options for fertility improvement. Therefore, this study was designed to investigate the magnitude of major infertility problems and interacting factors that influence fertility efficiency under large, medium and small scale dairy production system. To compare their relative importance, to collect base line data for future study in the area and to forward possible recommendations for the prevention and control approaches. Therefore, the objective of this study was toidentify major infertility

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problems and risk factors in indigenous and crossbred dairy cows in and around Gondar and to forward possible recommendations for the prevention and control approaches.

MATERIALS AND METHODES

Study area:The study was conducted in urban and peri urban areas of Gondar towndairy farms which are located North West part of Ethiopia in Amhara regional state.Gondar town is found about 727 km from the capital cityAddis Ababa.It islocated at latitude, longitude, altitude of 12.3-13.8°N, 35.3-35.7°E and 2200m.s.l, respectively.The annual mean minimum and maximum temperature of the area vary between 12-17°C and 22-30 °C, respectively.The area is located under woynadega, agro-climatic zone and receives a bimodal rainfall the average annual precipitation rate being 1000 mm that comes from the long and short rainy seasons. The short rainy season occur during the months of March, April and May while the long ones extend from June through September [7].

Sample size:A sampling frame i.e. the list of the dairy farms was acquired from the urban agricultural development office at the beginning of the study. Dairy farms / cows were selected from this list using a stratified sampling procedure to ensure the selection of proportional and representative sampling of dairy farms and cows. Sampling stratification was done based on number of cows as described by ILRI [8]. Farms owning (n=1-2), (n= 3-10) and (n= 11 and above) cows were taken as to small, medium and large dairy farms, respectively.

The total number of animals sampled from the study area was determined by using the appropriate formula for proportional sample size determination in proportional stratified random sampling; the size of each stratum was proportionate to the population size of the strata across the entire population. This means that each stratum had the same sampling fraction. A sampling fraction of ½ (50%) randomly sampled. Three strata with dairy farms 138, 98 and 7 dairy farms subjected from each stratum respectively [9].

Urban and peri-urban dairy farm scale: The dairy farms considered for this study were categorized into defined strata based on cow herd size; these were small scale dairy farm (SSDF), medium scale dairy farm (MSDF) and large scale dairy farm (LSDF) having 1or 2, 3 to 10 and 11 to above as described by ILRI [8] respectively.

Follow-up study: The longitudinal study involved repeated visits and monitoring of dairy farms selected for follow up. The dairy farms registered for follow-up were classified as small (n =1-2), medium (n=3-10) and large (n= 11 and above) sized dairy farms based on the number of adult cows and pregnant heifers.

About 362 pregnant cows were selected in and around Gondar that were expected to give birth within the study period and 288 lactating and dry non pregnant cows were subjected to different clinical and gynaecological examinations including rectal examinationat monthly intervals and findings were recorded accordingly.

Statistical methods:The association of each individual risk factor with the infertility problem of cows was first screened by univariate logistic regression. A multivariate logistic model was built from those factors that showed significant association in the univairate analysis.After building the model using by backward step-down selection.

RESULTS

The effect of 11 potential risk factors on the incidence of infertility problems was analyzed by using logistic regression. The association of each individual risk factor with the infertility problem of cows was first screened by univariate logistic regression. From the total of 11 risk factors, 8 of them (breed, age, parity, herd composition, farm scale, cleanliness of the farm, heat detection and recording) showed an association with infertility problem with P- value of less or equal to 0.2 (Table 1).

A multivariate logistic model was built from those factors that showed significant association in the univairate analysis. After building the model using by backward step-down selection, from the 8 risk factors that were considered in the multivariate model only two factors: age and method of heat detection were found significantly associated ($P< 0.05$) with the infertility problem of cows (Table 2).

The model showed, keeping the effect other potential risk factors constant, the risk of infertility problem in older cows 44%were more likely affected thanyounger cows (RR: 0.442;95% CI: 0.284- 0.687). Similarly keeping the effect of other potential risk factors constant, the risk of using visual observation methodof heat detection for infertility problem was only about 30% of that of using no follow up methodof heat detection (RR: 0.297; 95%; CI: 0.114- 0.777) (Table 2).

Table 1: The results of univariate logistic regression

		95.0% C.I.for RR		
Risk factors	RR	Lower	Upper	P-value
Breed	0.764	0.553	1.054	0.101
Age				0.000
Parity	0.586	0.424	0.810	0.001
Herd composition				0.000
Farm scale				0.000
Feeding practice				0.916
Cleanliness of the farm				0.078
Heat detection				0.005
Recording	0.377	0.175	0.814	0.013
Method of service				0.899
Body condition score				0.969

Table 2: The final multivariate model in the backward step-down selection procedures

		95.0% C.I.for RR		
Risk factors	Relative risk	Lower	Upper	P-value
Breed	0.881	0.614	1.266	0.494
Age	0.442	0.284	0.687	0.000
Herd composition	1.501	0.781	2.886	0.223
Farm scale	1.288	0.646	2.569	0.472
Heat detection	0.297	0.114	0.777	0.013

DISCUSSION

The incidence of infertility problems related to specific risk factors was determined as the proportion of affected cows out of the total examined.The association of each individual risk factor with the infertility problem of cows was first screened by univariate logistic regression. From the total of the 11 risk factors 8 of them (breed, age, parity, herd composition, farm scale and cleanliness of the farm, heat detection) showed an association with infertility problem with P- value of less or equal to 0.2. Five variables were considered as potential risk factors for the occurrence of infertility problems in cows in this study. These risk factors were (breed, age, herd category, farm scale and heat detection). The association of infertility with the risk factors was investigated using univariate and multiple logistic regressions.

A process of examination and reduction using stepwise logistic regression was used to produce a final model. The final model consisted of five variables breed, age, herd category, farm scale and heat detection. A stepwise procedure, used to obtain the appropriate model with α=0.05 revealed that age and heat detection were the important risk factors for infertility problems.

Risk factors for infertility problems vary among different regions or countries because of differences in general management, environment and herd health control conditions. The effects of different causes on infertility of cows have varied in previous studies; calving condition, postpartum diseases, cow parity or BCS and calving season in dairy herds were identified factors by [10].

Risk factors such as dystocia and retained placenta may lead to chronic infection of the uterus which may happendue to uterine inertia and impairment of neutrophil function. According to the results of present study, abnormal parturition, postpartum uterine infections and retained placenta (indirectly) were associated with an increase in prevalence of SE. In this regard, there are several studies that resemble present findings. Beardan and Fuquay [11] reported that the main predisposing factors related to an incidence of uterine infections were calving assistance, twin births, malpresented calves and retained placenta.

It was reported that dystocia was one of the risk factors for repeat breeder syndrome.Pryce*et al*. [12] reported that retained fetal membranes, assisted calving, twin births and abortion were some of the risk factors for postpartum clinical endometritis. Moreover, Gebremariam [13] reported that 25.3% of cows had postpartum endometritis(clinical or subclinical).

In contrast, Gilbert *et al*. [14] reported much higher prevalence rates of dystocia 58% and retained foetal membrane 17% in smallholder crossbred dairy cows in Tanzania. Similarly, in dairy herds in the UK, 9, 3.6, 15-22 and 1.5% annual incidences of dystocia, retained foetal membrane, vulval discharge/endometritis and abortion, respectively, have been reported. Several factors, such as herd size, production level and incidence of various diseases, genetics, housing and management could influence the rates of occurrence of the various infertility problems, which on contributed to variations among the different reports.

Possible risk factors responsible for the occurrence of infertility problems included crossbreeding, parity and production system. Hence, improvements in management systems (such as housing, feeding and health care), timely heat detection and proper selection of bulls for breeding taking into account the size of cows could help in minimizing infertility problems andimprove the fertility efficiency of dairy cows in the study area.

CONCLUSIONS

Management decisions of dairy producers, as well as their knowledge and skills, have profoundimpact on the fertility of cows. Differences in management systems account for the differences in fertility rate. The further availability of feed resources and efficient nutritional and herd health management are identified in the principal constraints on dairy production in all dairy farm scales. Extension services such as AI and veterinary services are not available in and around Gondar town. Furthermore, most farmers focus on crop production and spend littletime and effort on oestrus detection and calf rearing or the other factors which also contribute tofertility rate.

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