Original Article

Major Reproductive Health Problems in Small Holder Dairy Farms in and Around Durame Town, Southern Ethiopia

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Abstract

The present study was conducted in and around Durame Town from October 2017 to June 2018 with the objective of estimating the prevalence of reproductive health problems in dairy cattle. Cross-sectional study design was carried out to collect data from a total of 401 dairy cows which were selected by using systematic random sampling techniques. The overall prevalence of clinically observed major reproductive health problems was 61.35%. Body condition score of animals, management system, and age of animal showed statistically significant association with the occurrence of overall reproductive health problems (P< 0.05). The common specific reproductive health problems occurred at the study area were anoestrus (34.66%), repeat breeding syndrome (19.20%), dystocia (8.48%), retained fetal membrane (10.47%), metritis complex (4.24%), abortion (3.49%), uterine prolapse (2.49%) and stillbirth (1%). The study findings also revealed that the status of brucellosis among dairy cows of the study areas was very low and occurred with prevalence of 1.25% (0.82 -3.07%) at individual level. Extensive management system, use of communal water points and age of animal were found to be the risk factors for *Brucella* occurrence (P< 0.05). Other factors such as breed and breeding methods did not show significant association with *Brucella* seropositivity (P>0.05). Further statistical analysis made to know status of association between *Brucella* seropositivity and occurrence of reproductive health problems, showed that there was no statistically significant association among brucellosis and occurrence of reproductive health problems. This could be attributable to low level of *Brucella* prevalence and this may suggest that some other etiological agents are responsible as precipitating the reproductive disorders rather than brucellosis.

ABBREVIATIONS

RBS: Repeat Breeding Syndrome; AI: Artificial Insemination; RHP: Reproductive Health Problems; ZDA: Zonal Department of Agriculture; RFM: Retained Fetal Membrane; RBPT: Rose Bengal Plate Test; HC: Holstein Friesian Cross; JC: Jersey Cross

INTRODUCTION

One calf by a cow per a year is the general reproductive objective in a dairy cattle production. It means that cows must get pregnant after AI, maintain the pregnancy, have parturition approximately after 270 days, and wait for a period of 40-50 days to be successfully inseminated again [1]. This is not only to increase calf crop production but also to take the advantage of milk production peaks in each lactation, since pregnancy and parturition are prerequisite for the initiation and maintenance of lactation [2].

Nevertheless, this objective is not always attained and cows may not produce one calf crop annually due to presence of different factors interfering normal reproductive process and function of dairy cows [3]. Reproductive disorders are among different ranges of problems in dairy cows, can affect reproductive processes like the manifestation of oestrus, the production, transport and fertilization of ova and the transport, implantation and survival of the conceptus. This can lead to a reduced level of reproductive efficiency or sub-fertility through delay of conception and, in some cases, to total failure of reproduction, or infertility depending on the severity of the problems [4-6].

Economic losses due to these reproductive health problems are attributed to slower uterine involution, reduced reproductive rate, prolonged inter-conception period and calving interval, high cost of medication, drop in milk production, reduced calf-crop and early depreciation of potentially useful cows [7]. Frequently reported reproductive disorders of dairy cattle in Ethiopia are anoestrus, repeat breeding, metritis complex, abortion, retained fetal membrane, dystocia and uterine prolapse and were also reported with prevalence rate of 0.3-37.8%, 1.3-21.0%, 2-16.9%, 1-13.9%, 3.8-19.3%, 2.9-11.6% and 0.5-2.9% respectively in dairy cattle from different part of Ethiopia [8- 11].

According to different studies conducted in the country, due to occurrence of these reproductive health problems, reproductive performance of dairy cattle was highly affected. Conception rate to first inseminations in general were poor, ranging from 7.14 to 40.23% and a big challenge for genetic improvement [12]. Similarly study conducted in the Central Highlands of Ethiopia, indicated that conception rate in crossbred dairy cows without reproductive disorders was 51.7%; whereas conception rate in animals with RDs was reduced to 15.1% [13]. One study from Kembata Tembaro Zone, Ethiopia, also estimated about 50%-60% reduction of overall calf crop, milk production and

market price of animal itself as consequence of occurrence of reproductive disorders [14].

Thus, it makes sense that to optimize the profitability of any dairy farm, reproductive efficiency of a herd should be achieved through appropriate reproductive health care. Level and epidemiology of the problems and underlining possible causes and risk factors should be also identified to take appropriate and effective control and prevention measures timely. At present even though the occurrence of different life threatening diseases of animals at the study area is minimized through regular preventive vaccination, other complex diseases like mastitis and infertility due to reproductive problems are rising and incurring huge economic losses by resulting abortion, anoestrus, repeat breeding and stillbirth. This particular study is, therefore, carried out to determine the prevalence of reproductive health problems and assess possible risk factors that play a role in precipitating such problems in smallholder dairy farms in and around Durame town.

METHODOLOGY

Study area description

Durame town is capital of Kembata Tembaro zone, and located at 290 km away from Addis Ababa through in West-South direction. The average annual precipitation and average daily temperature ranges from 1100 to1400 mm and 7 to 25°C, respectively [15]. Production system is mixed with crop production and main feed source for animals are crop residues, enset (false banana), improved forages, wheat bran, concentrates and natural forages. Animals managed in semi-intensive system are milked three times a day whereas; those managed in extensive management systems are milked twice a day. Average milk production per cow per day at the study area is 9 and 2.4 liters for exotic breeds and local non-descriptive breeds respectively [14,16].

Study animals and sample size

The study animals were dairy cows which were selected from 8 vilages which are found in and around Durame town. These villages were selected purposively due to large dairy cattle population in the areas. A total of 401 dairy cows were included in the study by using systematic random sampling method.

Out of total animals, 234 (%) animals were from semi-intensive management system and the rest 167 (%) were sampled from extensive management system. Classification of management systems was based on the criteria adopted by Richard [17]. Accordingly, semi-intensive system included all animals that were kept in door and fed and watered in their house/shade by cut and carry system while extensive management system included all animals that were kept out-door during the day time and allowed to graze on a communal or private owned pasture land. Mean age of study animal is 7.8years and ranges from 3 to 16 years and categorized in to two (above and below the average).

Study design

Since the objective of the study was to determine the status/prevalence of reproductive health problems and in dairy cattle, a cross-section study design was applied.

Laboratory testing

To test for antibodies of *Brucella* species, 10 ml of blood sample was collected from jugular vein of each animal and labeled using codes describing each animal and herd. Collected blood samples were left for overnight at room temperature and serum was separated by using decantation tubes. Separated serum samples were transported to Wolaita Soddo Regional Veterinary Laboratory (WSRVL) in Ice box and stored at -20°C until processed.
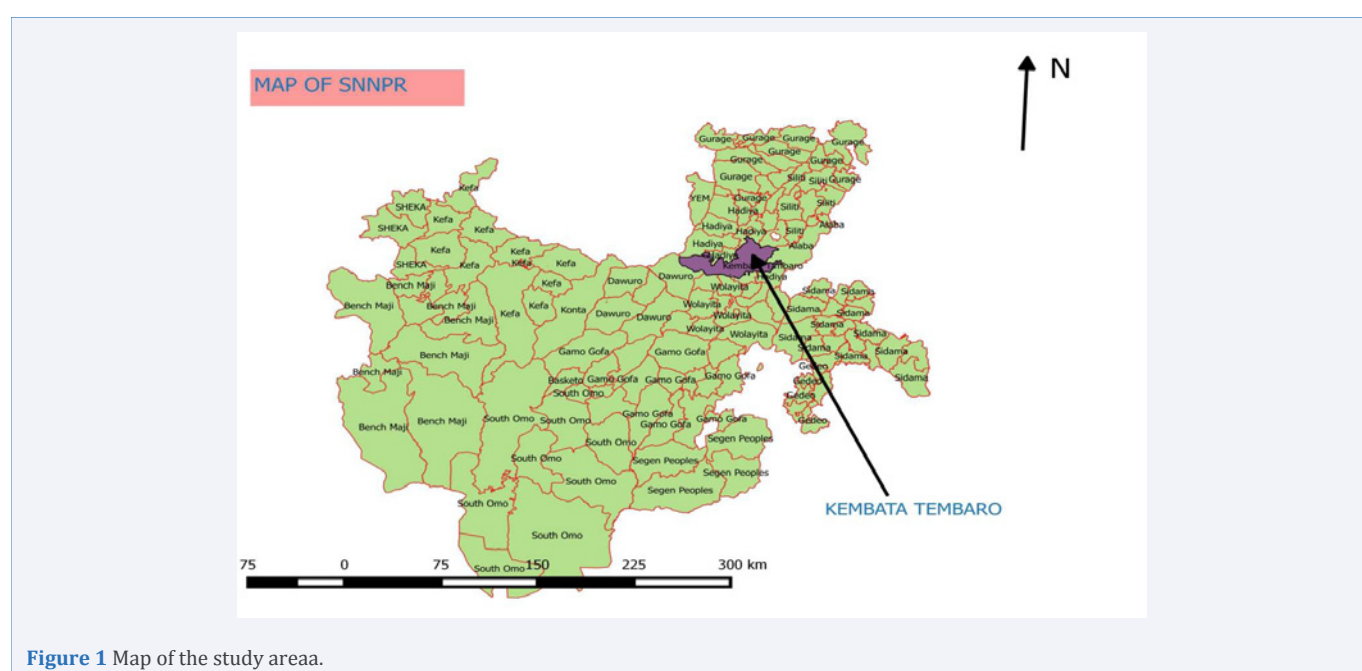
To conduct RBPT, plates with 12 wells, test sera, known

Figure 1 Map of the study areaa.

positive and negative control sera, Rose-Bengal stained antigen (VLA Weybridge, UK), pipettes and applicator sticks were used. 30μl of RBPT antigen and 30μl of serum were placed on a plate and thoroughly mixed with applicator stick. After 4 minutes, mixed antigen and serum was checked for the presence of agglutination. Any degree of agglutination was taken as evidence for presence of antibody; whereas, if there was no agglutination, the test serum was considered as negative (sero-negative).

Assessment of reproductive disorders

From all the study animals, information concerning herd size, age, breed, parity, and history of reproductive disorders were recorded using the specific format prepared for the evaluation of reproductive health problems. Diagnosis of reproductive disorders including dystocia (difficult calving), abortion (expulsion of the fetus before the end of pregnancy), stillbirth(calf born dead at end of the term), retained fetal membrane(retained longer than 12 hours after calving), repeat breeding syndrome(cows requiring three or more service before conception), anoestrus (lack of expression of the oestrus at an expected time), prolapse and metritis complex [2, 6] was made based on history and observation of clinical sign of animals. Body condition score (BCS) of the animal was determined as 1,2,3,4 and 5 based on criteria adopted from Richard [17]. Based on body condition score, animals were categorized into three groups; poor (BCS=1-2), medium (BCS=3) and good (BCS=4-5).

Statistical analysis

Data collected were entered and stored into Microsoft Excel and summarized by descriptive statistics. Reproductive disorders and exposure to *Brucella* infection were recorded as binary variables (1= presence; 0= absence), screened for errors and was transferred to STATA Version 11 for statistical analyses (Stata Corp, College Station, Texas). The association of risk factors on some reproductive disorders and seropositivity for *Brucella* spp were analyzed by using Chi-square (X^2) test or fisher's exact test. The difference was considered statistically significant if the *P*-value was < 0.05.

RESULTS

As indicated in Table 1, reproductive health problems are highly prevalent at the study area since 246 (61.35%) of animals were affected at least by one or more types of reproductive disorders. There was high risk of occurrence of reproductive health problems in animals found in extensive management system (67.66%) if compared to animals managed under semi-intensive system (56.83%); and in older animals (69.56%) if compared to adult ones (54.37%). Moreover, higher proportions of reproductive health problems were also observed in animals with poor body condition if compared to animals with medium and good body condition (Table 2).

Anoestrus, repeat breeding syndromes, retained fetal membrane and dystocia were major reproductive health problems in the area accounting prevalence of 34.66%, 19.20%, 10.47% and 8.48% respectively; whereas abortion, metiritis, uterine prolapse, and stillbirth were relatively less frequently observed problems (Table 1).

Repeat breeding syndrome was the second most

Prevalent disorder reported at the study area next to anoestrus and occurred with the prevalence of 19.20%. Analysis of the problem to show association between breeding methods indicated that animals which were bred with artificial insemination had high risk of occurrence of repeat breeding syndrome if compared to animals bred with natural service (Table 4).

Prevalence of brucellosis at the study area, was estimated to be 1.25% (CI: 0.82 –3.07%) at individual animal level based on RBPT test (Table1).

Data analysis in this study indicated that use of communal water points for animals and extensive management system were risk factors for *Brucella* seropositivity at the study area. However history of occurrence of reproductive health problems did not show any statistically significant difference in the occurrence of brucellosis if compared to animals without history of reproductive health problems (Table 5).

These findings indicated that even though, brucellosis was responsible cause of many reproductive disorders as established in many literatures, it may not be true at the present study area. This demanded further investigation of other etiological agents rather than brucellosis, which were precipitating the occurrence of reproductive health problems at the study area.

Table 1: Occurrence of major clinically manifested reproductive health problems (RHP) and brucellosis in dairy cows with respect to breeds (n=401).

Reproductive problems	Total Cases	Prevalence	95%CI	Breed			X^2	P-Value
				HC (n=170)	JC (n=103)	Local (n=128)		
Dystocia	34	8.48	6.02- 12.80	19(11.17)	11(10.67)	4(3.12)	6.96	0.031
Abortion	14	3.49	2.23 - 5.21	7(4.11)	6(5.82)	1(0.78)	4.65	0.098
Stillbirth	4	1	0.25 - 1.66	1(0.58)	3(2.91)	0(0.0)	5.40	0.067
Retained placenta	42	10.47	7.44 - 12.48	20(11.76)	14(13.59)	8(6.25)	3.81	0.149
Prolapse	10	2.49	1.02 - 2.98	5(2.94)	3(2.91)	2(1.56)	0.67	0.715
Metritis complex	17	4.24	3.23 - 6.32	11(6.47)	2(1.94)	4(3.12)	3.81	0.148
Anoestrus	139	34.66	30.80 - 37.69	55(32.35)	32(31.06)	52(40.62)	2.99	0.223
Repeat breeder	77	19.20	16.89 - 22.67	37(21.76)	23(22.33)	17(13.28)	4.28	0.119
Over all RHP	246	61.35	57.85 -64.92	112(65.88)	62(60.19)	72(56.25)	2.93	0.231
Brucellosis(RBPT)	5	1.25	0.82-3.07	3(2.5)	1(1.1)	1(2.1)	0.659	0.719

DISCUSSIONS

The present study documented the common reproductive disorders encountered under smallholder's dairy production system at the study area. Results showed that higher proportion of the studied cows (61.35%) had at least one type of the reproductive health problems, which is comparable to a report from Kembata Tembaro Zone, southern Ethiopia which is reported with prevalence of 61.40% [14]. The prevalence of major reproductive disorders reported by this study was higher

Table 2: Overall reproductive disorders in relation to different risk factors.

Risk factors	No. examined	RDs cases (%)	X^2	P-Value
Management				
Semi-intensive	234	133(56.83)	4.82	0.028
Extensive	167	113(67.66)		
Breed				
J.C	103	62(60.19)	2.93	0.231
H.C	170	112(65.88)		
Local	128	72(56.25)		
BCS				
poor	136	101(74.26)	9.68	0.008
medium	58	37(63.79)		
good	207	108(52.17)		
Age(years)				
<=8 Years	217	118(54.37)	9.68	0.002
>8 years	184	128(69.56)		
Brucella exposure (RBPT)				
Absent	396	242(61.11)	0.74	0.389
Present	5	4(80.00)		

BCS= body condition score: <=2(poor), =3(medium), >=4(good)

Table 3: Risk factors of anoestrus.

Variable	No. examined	Anoestrus cases (%)	X^2	P-Value
Parity				
Primiparous	98	24(24.48)	5.92	0.015
Multiparous	303	115(37.95)		
Management				
Semi intensive	234	65(27.77)	11.76	0.001
Extensive	167	74(44.31)		
BCS				
poor	136	64(47.05)	11.76	0.001
medium	58	12(20.68)		
good	207	63(30.43.)		
Age				
<= 8 years	217	58(26.72)	13.14	0.000
>8 years	184	81(44.02)		

Table 4: Risk factors of repeat breeding syndrome (RBS).

Variable	No. examined	RBS cases (%)	X^2	P-Value
Parity				
Primiparous	98	26(26.53)	4.49	0.034
Multiparous	303	51(16.83)		
Management				
Semi intensive	234	49(20.94)	1.09	0.296
Extensive	167	28(16.76)		
Breeding method				
AI	135	43(31.85)	20.99	0.000
NS	266	34(12.78)		
Dystocia				
No	367	65(17.71)	6.20	0.013
Yes	34	12(35.29)		
Metritis complex				
No	384	67(17.44)	17.96	0.000
Yes	17	10(58.82)		

Table 5: Risk factors of brucellosis at individual animal level based on RBPT.

Variable	No. of animals tested	No. positive	P-value
Management			
Extensive	167	51.64%)	0.008
Semi-intensive	234	0(0%)	
Age (year)			
<=8	217	1(0.37%)	0.015
>8	184	4(2.17%)	
Breeding method			
NS	266	5(1.87%)	0.109
AI	135	0(0%)	
watering points			
Communal	211	5(2.36%)	0.033
Individual	190	0(0%)	
RHP			
No	155	1(0.64%)	0.389
Yes	246	4(1.62%)	

than that of [9,11,18] who reported an overall prevalence of 44.3%, 26.5% and 33.85% respectively.

Management system, body condition of animals, and age of animals were significantly associated with the occurrence of reproductive health problems (P <0.05); whereas *Brucella* seropositivity and breed of animals did not show significant association with the occurrence of reproductive health problems (P> 0.05) at the study area. However, the problem is higher in Holstein Friesian Cross (65.88%) and in Jersy Cross (60.19%) than in local cows(56.25%). Previously conducted studies in Kembata Tembaro Zone, Addis Ababa milk shed and East Shewa also reported similar findings [14,19,20]. Studies conducted at Jimma town also indicated that breed of animals had no statistically

significant association whereas; body condition of animal had strong association with the occurrence of reproductive disorders in dairy cattle [10].

An increased rate of reproductive health problems with increased age of cows in present study may be due to increased frequency of exposure to reproductive health problems and decreased defense mechanism and lack of uterine tone as age of animal is increased.

Anoestrus was prevalent reproductive problem of dairy cattle in the study area which was occurred with the prevalence of 34.66%. Slightly similar findings were reported from northern India and northern Ethiopia (Tigray) with prevalence of 31.79% and 37.8% respectively in dairy cattle [8,18]. Finding of the present study was much higher than findings from Borena breeds and crossbred cows which are reported with prevalence of 10.10% and 10.30% respectively [20,21]. However, the present finding was far lower than the study result from India which was reported with prevalence of 67.68% in dairy cattle [22]. The variation among different study results may be due to differences in feeding, management system, animal record, status of infectious and non infectious diseases which cause reproductive health problems and climatic conditions in which the study animals were found.

Higher prevalence of anoestrus was observed in animals with poor body condition (47.05%) if compared to medium (20.68%) and good (30.43%) body condition animals (P< 0.05). The reason why anoestrus was more common in poor body condition animals is that in poor body conditioned animals the available energy will be redistributed to sustain only vital priority like basal metabolism, activity and growth. With this prioritized use of available dietary nutrients, re-initiation of the oestrus cycle and all associated components (gonadotropin secretion, ovarian follicular development and ovulation) occurs only after priority needs (maintenance, growth, lactation and minimal energy reserve) are met [23]. Similarly some studies conducted in Nigeria, demonstrated that the incidences of cycling and pregnant animals were correlated positively with BCS; whereas incidences of anoestrus and abnormal ovarian cyclicity were correlated negatively with BCS [24]. In agreement to the present findings, one study also documented that better feeding and adequate management to increase BCS of animals are key tools to increase reproductive efficiency of dairy cows [25].

Repeat breeding syndrome was the second most prevalent disorder reported at the study area next to anoestrus and occurred with the prevalence of 19.20%. The present findings seem to be higher than the findings of previous works [21, 26] who reported with prevalence rate of 10.30% and 3.50% respectively; but fairly similar to the present findings were reported from various parts of the country [8,14,19].

The current findings indicated that repeat breeding syndrome was more common in animals which were bred with artificial insemination if compared to animals bred with natural service (P< 0.05). In agreement to this finding, different researchers in the country as well as from abroad reported higher prevalence of repeat breeding syndrome in dairy herds which bred using artificial insemination rather than natural service [27,28]. Higher

prevalence rate of RBS in artificially inseminated animals may be associated with improper semen and liquid nitrogen handling, poor semen quality, poor heat detection, walking of animals to long distance to be inseminated.

The findings of the present study also indicated that the occurrence of other reproductive health problems like dystocia and metritis significantly associated with the occurrence of repeat breeding syndrome. Similarly, it is documented that physical damage to the dam resulting from dystocia can have a serious effect on future reproductive performance and it can lead to other problems such as RFM, endometritis vulval discharge and mastitis [6]. This indicated that most reproductive disorders are interrelated and occurred in mixed form rather than individually, and appropriate therapeutic and management measures undertaken to prevent one problem, do have also controlling and preventive effect on the other ones. Therefore, if dystocia in dairy cattle at the study area is minimized by taking appropriate measure like controlling body condition of cows to be moderate during parturition, early correction of abnormal presentation and position of fetus; RFM, uterine prolapse and metritis complex can be minimized and consequently prevalence of RBS and anoestrus will be lowered.

Sero-Prevalence of brucellosis in dairy cattle at the study area was 1.25% (CI: 0.82-3.07%) at individual animal level based on RBPT test. Fairly similar results to the present study were documented in different parts of the country like Kembata Tembaro Zone (0.82%), Debre-Birhan(0.2%), Arsi Zone (0.5%) and North Shewa(0.78%) [14,29-31]. However, one study which was extensively covering most parts of the country reported 1.9% of animal level prevalence on exotic and crossbred cattle, slightly higher than the present result [32]. The variation in sero-positivity among different studies may be attributed to farming practice, livestock management, herd size, climatic condition, sample size and techniques of sampling.

In the present study *Brucella* sero-prevalence was more common in animals which were kept under extensive management system and using communal water points (ponds, rivers) (P< 0.05). This is because using communal water sources, managing animals under extensive management system, and leaving animals in communal grazing area will increase probability of contact among individual animals, farms and herds which favour direct transmission of brucellosis. As some researchers indicated that dogs, birds and wild canids can spread brucellosis mechanically by dragging and carrying of dead/aborted calves, infected tissues and afterbirth (placenta) [33-35]; thus unprotected communal watering and grazing areas have high risk of being contaminated and animals sharing these areas in common will be also at high risk of acquiring the infection. However, breed and breeding methods did not show difference in seropositivity and this agree with findings from Uganda and Pakistan [36,37].

Further analysis in the present study showed that *Brucella* sero-positivity in dairy cows did not show statistically significant association with the occurrence of reproductive health problemss (P> 0.05). This result indicated that the role of *Brucella* as cause of reproductive disorders in dairy cattle at the study area is insignificant and may be due to low prevalence of brucellosis

occurrence or as a result of high prevalence (status) of occurrence of other pathogens which affect reproductive organs of cattle. Recently conducted study in Ethiopia also indicated that relative importance of other etiological agents like *Neospora caninum* were emerging as cause of reproductive health problems in dairy cattle rather than brucellosis [38].

Similarly lower prevalence status of *Brucella* occurrence, higher prevalence of reproductive disorders and lack of statistically significant association between occurrence of reproductive health problems and sero-prevalence of *Brucella* in dairy cattle at the present study suggested that *Brucella* may not be the main cause of reproductive disorders of dairy cattle at the study areas. Thus to control and prevent the occurrence of reproductive disorders in dairy cattle at the study area, other etiological agents should be identified and targeted rather than brucellosis.

CONCLUSION

The findings of the present study revealed that approximately two cows out of every three cows were suffering from at least one type of clinical reproductive health problems indicating the widespread occurrence of the problems among dairy cows at the study area. The most common types of reproductive health problems observed at the study area were, anoestrus, repeat breeding, dystocia, retained fetal membrane, metritis complex, abortion, uterine prolapse and stillbirth. Analysis of plausible risk factors showed that management, BCS of animal, and age, have association with the occurrence of reproductive disorders on dairy cattle at study area. Though brucellosis had been hypothesized as risk factor of reproductive health problems in this study, the disease was found to occur with low prevalence and did not show statistically significant association with occurrence of reproductive health problems. The occurrence of one type of reproductive health problem has also association with occurrence of others. Therefore, to improve reproductive efficiency early detection and treatment of the problem, improving of herd management (good nutrition, heat detection, general health care, care during insemination and semen handling and etc.) should be considered. Finally since brucellosis seropositivity did not show association with reproductive disorders occurred at the study area, and thus investigation of other causes of reproductive health problems like Neospora, BVD, trichomonosis and others are highly recommended.

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