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Prevalence of Abortion and Associated Risk Factor in Dairy Cattle of Jimma Horro District in Kellem Wollega Zone, Western Ethiopia

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Abstract

Abortion is one of the most important causes of economic losses in Ethiopian cattle industry. A cross sectional study was conducted between October 2016 and October 2017 to quantify the prevalence and associated risk factors of abortion in dairy cattle of Jimma Horro district of Kellem Wollega zone in western Ethiopia. A total of 384 dairy cattle were randomly selected from selected peasant associations of the district based on composition of cattle population. The overall prevalence of abortion was 2.9% (11/384) in the study area. This prevalence indicated that efforts should be made to taken measures to control and prevention of abortion in dairy cattle in study area. Multivariable logistic regression analysis identified that method of breeding (OR=7.4) and season of calving (OR=4.4) as a risk factor of abortion. However, there were no statistically significant differences observed between herd size, age group, parity, body condition, origin and dairy cattle that had previous history of abortion (P>0.05). Thus, there is a need to create awareness about impact of abortion on dairy cattle and appropriate control methods of abortion should be designed and implemented. Moreover, further investigation considering more causes should be carried out to identify the specific cause of abortion and the associated loss in the study area.

Keywords: Dairy cattle; Abortion; Risk factor; Prevalence; Jimma horro

Introduction

Ethiopia has the largest livestock population in Africa, with a total cattle population of 59.5 million. Out of this total cattle population, about 55.5% were female cattle [1]. The country has paid considerable attention to cattle productivity (meat and milk) through breeding and health interventions to increase the contribution of cattle to economic growth as well as to meet the increasing local demands [2]. In order to increase the milk production in the country, cattle cross breeding program have long been used as one of the main strategies and temperate breeds have been introduced in country [3]. On behalf of this, Ethiopia has given the priority on the development of dairying at farmer level to increase the supply of milk from smallholder dairy farms [4]. However, reproductive health problems are becoming the major hindering this development plan [5,6]. Among these, abortion is the main constraint in dairy sector development plan to achieve its goal. Abortion is one of the major problems that have direct impacts on reproductive performance of dairy cattle [7,8]. Abortion is defined as the premature expulsion of fetus between 42 days and approximately 260 days of gestation stage [9]. The diagnosis of abortions is a major challenge to the farmers and veterinarian especially during early stage. There is sudden and dramatic increase of abortion in herds over a long period of time is more commonly seen [10].

Cattle abortion is caused by infectious and non-infectious agents [11]. These causes are global in distribution and great concern to the dairy farms [12]. Infectious cause of abortion is an important reproductive disease of cattle, which may occur in sporadic as well as in epidemic form and is caused by a diverse types of agents. These agents associated with abortion in cattle include viruses, bacteria, protozoa and fungus [13]. These pathogens can result in substantial economic losses, indicating the need for control measures to prevent infection or disease [14]. Non-infectious factors such as genetic and non-genetic disorders have been reported in some investigations [15,16]. The probability of abortion may differ between herds, calving seasons, parity, pregnancy stage and milk yield. Moreover, occurrences of previous history of abortions may increase the risk of abortion in cattle [17].

Abortion in dairy cattle is an important fertility problem causing a serious economic hindrance due to direct losses of concepts and consequent impairment of fertility, this resulting in significant economic losses for the cattle industry. Abortions have a highly negative impact on reproductive efficiency of dairy cows [18,19]. Abortion is a major problem for dairy producers in Ethiopia, like in many other countries [20]. In addition to loss of fetus, abortion imposes rebreeding costs, veterinary care, decreased milk yield, and replacement costs to farmers [21]. Spontaneous abortion of dairy cows is most common problem that contributes substantially to low herd viability and decreasing production potential by reducing the number of potential female herd replacements and lifetime milk production, and by increasing costs associated with breeding and premature culling [22,23].

Several studies on major reproductive health problems have been conducted in local and crossbreed animals in different agro-ecological and production systems in Ethiopia, and the results indicated that cattle abortion is common and widespread reproductive health problem with different prevalence rate [24-26]. The highest prevalence of abortion (28.9%) was observed by Siyoum [27] in Adea Berga of west Shewa zone. In contrast Gizaw [28] reported a relatively lower prevalence (2.2%) in Nazareth town of central Ethiopia. Other study

indicated that incidence of abortion more than 2 to 5% should be viewed seriously, efforts should be made to determine the causes and measures should be taken to control it [29].

There are wide spread cattle abortion in Jimma Horro district that compromise health and production. These unusually high losses of pregnancies represent a great economic loss to the nation and it is a significant blow to the livelihood of the people in the affected area. Despite the continued and widespread occurrence of cattle abortion in the district, there were no any reports are available that estimate prevalence and associated risk factors of abortion in study areas. This study is therefore required to provide evidence on the importance of risk factors and magnitude of abortion to the dairy industry in the area. The evidence can inform policy and interventions aimed at reducing the impacts of the abortion. Hence, the present study was designed to investigate the prevalence and associated risk factors of cattle abortion in Jimma Horro district among dairy production area in Kellem Wollega zone in western part of Ethiopia.

Materials and Methods

Description of study area

The study was conducted from October 2016 and October 2017 in four selected peasant associations (Une, Ilu Kitaye, Makanisa and Abono) of Jimma Horro district, Kellem Wollega zone in western Ethiopia. This district is bounded by Begi district in North, Gawo Kebe district in East, Yamalogi Wolel district in South and Gidami district in West. The area is located at about 665 km west of Addis Ababa. The area is located at an elevation of 1400-1830 meters above sea level. The Topography of this district is characterized by forest of Wolel Mountain and Dati Wolel Park. The main river in this district is Supe, Burar and Kumbabe. The climatic condition alternates with long summer rain fall (June to September), short rainy season (March to May) and winter dry season (December to February) The minimum and maximum annual rain fall and daily temperature range from 800 to 1200 mm and 15 to 25°C, respectively. Jimma Horro district is characterized by Dega (19.7%), Woyna dega (48.5%) and Kola (31.8%). Livestock population in area is estimated to be about 68,500 heads of cattle, 19,952 sheep and 13,575 goats. The farmers in the area practice mixed (crop-livestock) farming system [30] (Figure 1).

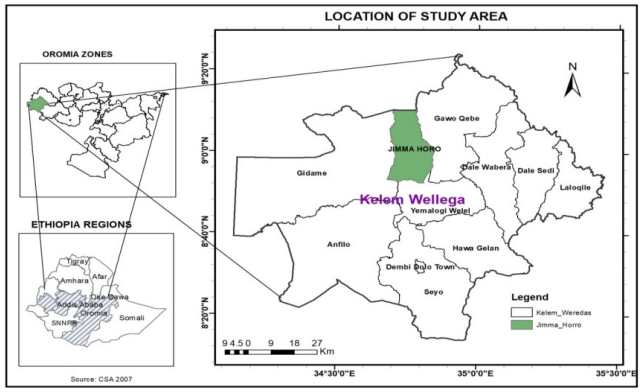

Figure 1: Map of study area.

Study population

Target populations were female cattle in Jimma Horro district of Kellem Wollega zone in western Ethiopia whereas study population were breeding cows in selected peasant associations of the study district. Cows and heifers above three years were study animals in this study.

Study design

Cross-sectional study was undertaken from October 2016 until October 2017 in selected peasant associations of Jimma Horro district of Kellem Wollega zone in western Ethiopia. This study was carried out to estimate prevalence and the potential risk factors of abortion in dairy cattle.

Sampling procedure and sample size determination

The study district was selected purposively based on history of abortion reports. Simple random sampling technique was used to select four peasant associations from Jimma Horro district. The sample size required for this study was determined depending on the expected prevalence of abortion and the desired absolute precision by the formula given by Thrusfield [31]. Hence, using 95% confidence interval, 5% precision and 50% expected prevalence of abortion, the numbers of dairy cattle needed to demonstrate prevalence of abortion in study areas were 384 dairy cattle. Simple random sampling method was also used to selected individual animals from selected peasant associations based on number of cattle population.

Data collection

A total of 384 pregnant cows' data were collected from different herds. Factors related to individual cow such as age, body condition, parity and previous history of abortion were documented. In addition, manage mental and environmental related factors such as herd size, type of breeding used, calving season and origin of animals were also recorded. Body condition score was based on the criteria adopted by Moran [32] and for all cows under the study their body condition grouped into three groups (poor, medium and good). Age of animals were categorized into <3, 3-6 and >6 years and groups were chosen because optimal age at first calving cattle reared under tropical conditions were estimated to be 24-36 months [33]. Herd size was categorized into small (5-10 heads of cattle) and large (>10 heads of cattle). Those cattle that housed in same barns were grouped together and considered as one herd [3,34]. Parity number was categorized as monoparous (parity one) and pluriparous (≥ two parities) [35,36].

Data management and analysis

Data obtained from cross-sectional study was recorded, and stored in Microsoft® Excel for Windows 2010 and transferred to Statistical Package for the Social Sciences (SPSS) version 20.0. The prevalence of abortion as percentage was calculated as number of animals aborted divided by the total number of pregnant cows available during the period. Associations between outcome (reproductive problems) and explanatory variables (risk factors) for all units of analysis were investigated by using logistic regression model. The strength of the association between outcome and explanatory variables was assessed using the adjusted odds ratios (OR). The explanatory variables ($P \leq 0.25$) were further checked for multicollinearity using the variance inflation factor (VIF) and tolerance factor (TF) before multivariable

logistic regression analysis. Variance inflation factor values of greater than 3 or tolerance less than 0.1 were considered the cut-off points [2] for the collinearity diagnostics. Variables were also tested for interaction effects using cross-product terms. The backward elimination procedure was used to eliminate the factors that were not significant at P<0.05 in the overall model. Factors that were significant (P ≤ 0.05) were retained in the final model and model fit was observed using the Hosmer-Lemeshow test. In the analysis, a covariate was considered confounder and included in the model if its inclusion altered the OR of the estimated risk by more than 20% [37]. For all the analyses, confidence level (CL) is at 95% and P ≤ 0.05 were set for significance.

Results

In this study, a total of 384 pregnant cows were examined for abortion problem. Out of those, 11 (2.9%) of them had abortion problem. The highest (6.3%) and lowest (1.0%) prevalence of abortion was recorded in Nunu Inaro and Une peasant associations respectively in Jimma Horro district (Table 1).

Peasant associations	Total cows examined	Total cows aborted	Prevalence (%) (95%CI)
Abono	96	2	2.1 (0.57-7.28)
Makanisa	96	2	2.1 (0.57-7.28)
Nunu Inaro	96	6	6.3 (2.90-12.97)
Une	96	1	1.0 (0.18-5.67)
Total	384	11	2.9 (1.61-5.06)

Table 1: Distribution of prevalence of abortion in dairy cattle of Jimma Horro district.

The prevalence of abortion was higher in cows with >6 years age group (5.3%) than those <3 years age group (1.8%). However, there was no statistically significant variation (P>0.05) in prevalence of abortion between age groups. The prevalence of abortion in pluriparous cows (3.4%) was higher than that of monoparous cows (1.7%); the variation was not statistically significant (P>0.05). The cows which had previous history of abortion had higher prevalence of abortion (8.5%) than those that did not previous history of abortion (2.1%). Cows that had previous history of abortion were almost four times (OR=4.4; P<0.05) more likely to be affected by abortion than those did not experience abortion. Concerning the breeding system of cows, prevalence of abortion was higher in cows (21.4%) bred by artificial insemination (AI) than those bred by natural service (2.2%). Cows bred by natural service were almost five times more likely to face abortion than those bred by AI (OR=4.6; P<0.05). With regard to season, the highest (13.9%) and least (1.0%) prevalence of abortion was recoded in winter and spring, respectively. The difference in prevalence of abortion among the seasons was statistically significant (P<0.05). However, the association between abortion and independent variables like herd size, body condition and origin of cattle were not statistically significant. Variable with p-value<0.25 in the univariable with no multicollinearity were entered into multivariable logistic regression model. No significant interactions between variables were detected. The Hosmer-Lemeshow goodness-of-fit test showed that the model fitted the data well (P=0.20). The final multivariable logistic regression model showed seasons and types of breeding used were independently associated with abortion (Table 2).

Discussion

The prevalence of abortion recorded in study area was 2.9%. This finding is in line with reports of Ayisheshim et al. [28,38,39] who reported 2.2%, 2.6% and 2.7% of abortion prevalence in central, southern and northern Ethiopia, respectively. On the other hand, the prevalence of abortion reported in the current study is higher than the values reported by Gashaw [40] 1% in Jimma town, southwest Ethiopia. However, this result is lower than the values (13.9%) reported by Bitew [41] in Bedele; 12.2% in Borena zone [6] and 14.6% reported by Dinka [19] in Assella. This result is also lower than values (19.7%) reported from Gondar [42]. This variation in prevalence of abortion might be due to differences in environmental factors, breed of cattle, management system and level of veterinary service. The present result indicated that season was significantly associated (P<0.05) with abortion in cows. Cows were almost four times more likely (OR=4.4) to abort in winter season (December, January and February) compared to autumn season (September, October and November). This may be due to seasonal changes may reflect changing exposure to infectious disease agents, a changing pattern of endocrine function, the presence of a seasonal vector, or various seasonal feeding regimens [43,44]. The association between season and prevalence of abortion is in agreement with many reports from other countries [17,45-47]. This result differs from the finding of Gadicke et al. [48-51] in Korea, Iran and Chile who reported that season of calving had no significant effect on the prevalence of abortion. This variation may be due to differences in environmental condition, breed of animals and management system.

Variable	Category	Total cattle examined	Total cattle positive (%)	Univariate		Multivariate	
				OR (CI; 95%)	P-value	OR (CI; 95%)	P-value
Origin					0.19		
	Abono	96	2 (2.1)	2.0 (0.18-12.67)	0.57		
	Makanisa	96	2 (2.1)	2.0 (0.18-12.67)	0.57		
	Nunu Inaro	96	6 (6.3)	6.3 (0.75-13.64)	0.09		
	Une (Ref)	96	1(1.0)	-	-		
Age					0.36		

	>6 years	75	4 (5.3)	1.4 (0.27-7.40)	0.68		
	3-6 years	198	5 (2.5)	2.6 (1.06-6.37)	0.20		
	<3 years (Ref)	111	2 (1.8)	-	-		
BCS					0.95		
	Poor	123	3 (2.4)	0.8 (0.21-3.45)	0.81		
	Medium	145	4 (2.8)	0.8 (0.17-3.61)	0.76		
	Good (Ref)	116	4 (3.4)	-	-		
Season					0.01		0.042
	Summer	124	2 (1.6)	0.4 (0.04-3.77)	0.41	0.6 (0.09-3.54)	0.403
	Spring	103	1 (1.0)	0.6 (0.11-3.93)	0.63	0.4 (0.04-3.71)	0.004
	Winter	36	5 (13.9)	6.3 (1.44-8.01)	0.02	4.4 (1.91-11.04)	0.032
	Autumn (Ref)	121	3 (2.5)	-	-	-	-
Parity	Pluriparous	121	2 (1.7)	2.1 (0.45-9.91)	0.35		
	Monoparous(Ref)	263	9 (3.4)	-	-		
Herd size	large	159	9 (5.7)	3.3 (0.70-15.35)	0.13		
	Small (Ref)	225	2 (0.9)	-	-		
Type of breeding	Natural	370	8 (2.2)	4.6 (1.46-14.35)	0.01	7.4(1.47-16.88)	0.015
	AI (Ref)	14	3 (21.4)	-	-	-	-
Previous history abortion	Yes	47	4 (8.5)	4.4 (1.23-15.60)	0.02		
	No (Ref)	337	7 (2.1)	-	-	-	-

Table 2: The effect of some potential risk factors of abortion in dairy cattle of Jimma Horro district in Kellem Wollega zone.

The present study also showed that type of breeding used was significantly associated with prevalence of abortion (P<0.05) and cow bred by natural service was seven times (OR=7.4) more likely to face abortion compared to those bred by artificial insemination (AI). This may due to transmission of disease during service from infected bull to female is more common in natural mating than AI. Similar to this finding, previous report has indicated that higher prevalence of abortion in cows that bred by natural service than those bred by AI in northern Ethiopia [20].

The higher prevalence of abortion was found in large herd size (5.7%) than small herd size (0.9%). However, no statistically significant variation was observed in prevalence of abortion between herd sizes. This study finding is in line with that of Haile [52] who reported that significant association between prevalence of abortion and herd size in Addis Ababa, Ethiopia. Similarly Baranski et al. [24] also reported herd size was not risk factor for occurrence of abortion in Korea and Poland, respectively. However in contrary to this Keshavarzi et al. [17,46] who reported that significant association between prevalence of abortion and herd size in Iran. This variation might be due to differences in environmental factors, breeds of animals and management system.

Similarly, statistically significant difference in prevalence of abortion (P>0.05) was not observed in dairy cattle between parity. The prevalence of abortion was also no statistical significant difference (P>0.05) among peasant associations. In addition, there is also no statistical significant difference observed among age groups, body condition and cattle that had previous history of abortion. This may be due to similar management system, breed of cattle, equal chance of exposures of cattle to causes of abortion and even distribution of the cause of abortion in study area.

Conclusion and Recommendations

The information generated in this study provides some important insights about abortion with regard to its prevalence and potential risk factors. The prevalence of abortion was high indicating that it is abortion was one of the significant causes of cattle production loss in study area. The study indicated that abortion in cattle depends on breeding methods and seasons. Hence, there is a need to create awareness about impact of abortion on dairy cattle production and appropriate control methods of abortion should be designed and implemented. Moreover, further investigation should be carried out to isolate and characterize the causes of abortion in different study area.

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