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Prevalence of Major Reproductive Problem and Associated Risk Factor in Dairy Cattle of Jimma Horro District in Kelem Wollega Zone, Western Ethiopia

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Abstract **– Reproductive health problems are one of the major causes of economic losses in Ethiopian cattle industry. A cross sectional study was carried out to determine prevalence and its associated risk factors of major reproductive health problem in dairy cattle of Jimma Horro district from November 2016 to November 2017. From a total of 384 randomly selected dairy cattle 11.7% (45/384) of cattle were infected by at least with one of reproductive health problem in study area. This study shown that abortion (2.9%), dystocia (2.3%), retained fetal membrane (2.1%), uterine prolapse (1.3%), still birth (1.0%), Anestrous (0.7%), vaginal prolapse (0.7%) and repeat breeder (0.5%) were the major reproductive health problem in Jimma Horro district. Season of calving (OR = 2.3) and type of breeding (OR = 3.4) were identified as risk factors of reproductive health problem in study area. However, herd size, age group, parity, body condition, origin and previous history of reproductive problems of dairy cattle were not show statistically significant difference with prevalence of reproduction health problems (P > 0.05). The current study indicated that reproductive health problem is one of the cattle production losses in the district. Hence, there is a need to design and implemented appropriate control methods of reproduction health problem and further investigation should be carried out to isolate and characterize the causes of the reproductive health problems in the study area.**

Keywords **– Dairy Cattle, Jimma Horro, Risk Factor, Prevalence and Reproduction Problem.**

I. INTRODUCTION

Ethiopia has the largest livestock population in Africa, with a total cattle population of 59.5 million. Out of this total cattle population, the female cattle constitute about 55.5% and the remaining 44.5% were male cattle. At present, about 99% of Ethiopia's national herd is local breeds managed under extensive farming systems [13]. However, the rate of urbanization is high, which places challenges on farmers and government to meet the demand for food (red meat and dairy products) for an increasing population. To increase livestock productivity and satisfy the increasing demand for livestock products, the Ethiopia has prioritized breed improvement, pasture development and animal health [35]. 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 [52].

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 [50]. Cross breeding with improved exotic dairy breeds in wide scale has been introduced as an option some many years back for upgrading the genetic potential of the indigenous zebu cattle and subsequently to improve the dairy sector in Ethiopia [23]. The performances of animals depend not only on their genetic merit, but also on other factors like nutrition, management, health and environment. On the other hand, reproduction is a vital factor in determining the efficiency of cattle production [27]. Thus, the success of cross breeding programmed needs to be monitored regularly, by assessing the performances of crossbred cows under the existing management system. 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 [50].

However, reproductive health problems are becoming the major obstacles for this developmental plan [3. 9]. Reproductive health problems result in considerable economic losses to the dairy industry and are the main cause of poor productive performance of smallholder dairy farms. Among the major problems that have a direct impact on reproductive performance of dairy cows, retained fetal membrane, abortion, dystocia, vaginal prolapse, uterine prolapse, repeat breeder, endometritis and pyometra have been reported to be the most common reproductive health problems [27]. In Ethiopia, abortion and postpartum reproductive disorders such as dystocia, retained fetal membranes and subsequent endometritis have been greatly caused serious economic loss [32, 41]. These have been implicated to cause a considerable economic loss to the dairy industry due 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 [1, 11].

Several studies indicated that reproductive health problems is one of the most challenging in dairy cattle production in different parts of Ethiopia [9, 41]. It is very difficult to diagnose those problems by one particular disorder or symptom because there is interrelation between predisposing factors such as management at calving, hygiene and parity, stage of gestation, nutrition and environment [37]. In Ethiopia, even though dairy cattle are maintained under different production systems, the differences in management and environmental conditions under which cattle are maintained could greatly affect the occurrence of reproductive disorders [30].

There are wide spread cattle reproductive problems in J-

-imma Horro district that compromise health and production. These unusually high losses of cattle production represent a great economic loss to the nation and it is a significant blow to the livelihood of the people in the affected areas. Despite the continued and widespread occurrence of cattle reproduction health problems in the district, no any study has been conducted to quantify the magnitude and risk factors associated with this problem so that prevention and control mechanisms are devised. Therefore, the objective of this study was to determining the prevalence of major reproductive health problem of dairy cattle and possible risk factors that play a role in precipitating such problem in dairy farms of Jimma Horro district of Kellem Wollega zone in western part of Ethiopia.

II. Materials and Methods

2.1. *Study Area*

The Jimma Horro district is situated 665 kilometers from Addis Ababa. The district is located at an elevation of 1400-1830 meters above sea level. It is bounded by Begi district in North, Gawo Kebe district in East, Yamalogi Wolel district in South and Gidami district in West. The Landscape of this district is characterized by Forest of Wolel Mountain and Dati Wolel Park. There are three seasons district in Jimma Horro: long summer rainy season (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 1200mm and 15 to 25ºc, respectively. The agro-ecology of the district is characterized by 19.7% highland, 48.5% mid-highland and 31.8% lowland. Jimma Horro district has 68,500 cattle, 19,952 sheep and 13,575 goats. Mixing farming system (crop-livestock production) is practiced in study area [29] (Figure 1).

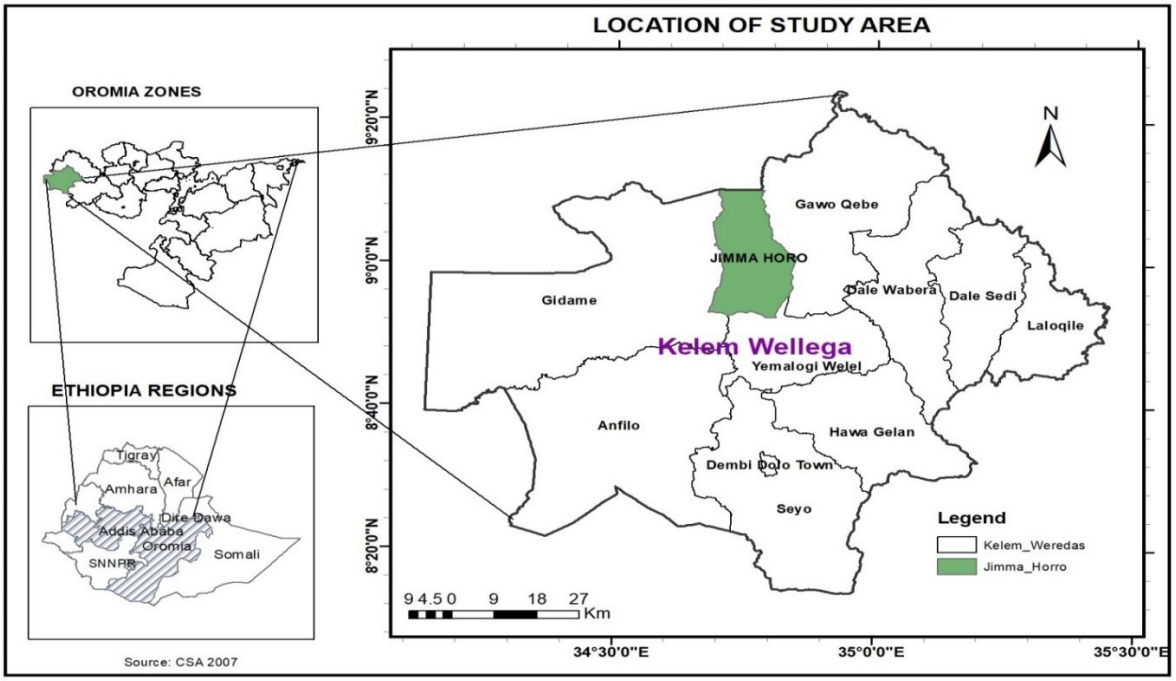

Fig. 1. Map of study area.

2.2. *Study Population*

Target population comprises were female cattle of Jimma Horro district and study population were breeding cows in selected peasant associations of the district which was kept under extensive production systems. Local breed female cattle three years and above were used for this study.

2.3. *Study Design*

A cross-sectional study design was conducted in Jimma Horro district from November 2016 to November 2017 to estimate prevalence and the potential risk factors of reproduction health problems in dairy cattle.

2.4. *Sampling Method and Sample Size determination*

The Jimma Horro district was selected purposively based on history of reproduction health problems reported. Four peasant associations were selected from this district by simple random sampling method. The sample size required for this study was computed according to the formula given by [47]. Hence, using 95% confidence interval, 5% precision and 50% expected prevalence of reproductive problems, the numbers of dairy cattle needed to demonstrate prevalence of reproductive problems in study areas were 384 dairy cattle. Individual dairy cattle were also selected by simple random sampling method based on number of cattle population.

2.5. Data Collection

A total of 384 dairy cattle's data were collected from different herds. Factors related to individual cow such as age, body condition, parity and previous history of reproductive problems were documented. In addition, managmental 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 [36] 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 [51]. 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 [6, 49]. Parity number was categorized as monoparous (parity one) and pluriparous (≥ two parities) [28, 33]. Those dairy cattle included in the study were judged as cows with and without reproductive health problems according to the following definitions.

Abortion**:** Is a loss of the fetus between the age of 42 days and approximately 260 days of gestation stage [39].

Dystocia: A condition in which the first or especially the second stage of parturition was prolonged markedly for more than 6 hours and the cow required assistance [45].

Retained Fetal Membranes (RFM): is the lack of expulsion of the fetal membranes within the first 24 hours after calving [12]

Uterine Prolapse: The coming out of uterus through the vulva commonly shortly after parturition and hanged out with the inner surface outer most [38].

Stillbirth: Defined as a calf loss from day 260 until the end of normal gestation period [40].

Vaginal Prolapse: The protrusion of the vagina and sometimes with the cervix through the vulva [43].

Anestrous: A state of complete sexual inactivity with no manifestation of estrus for more than two months [40].

Repeat Breeder: A cow that failed to conceive for three or more consecutive services is considered as repeat breeder [22].

2.6. *Data Management and Analysis*

Data obtained from this study was recorded, and stored in Excel for windows 2010 and transferred to SPSS version 20.0. Logistic regression model was used to investigate the associations between reproductive health problems and its associated risk factors for all units of analysis. The strength of the association between outcome and independents variable was assessed using adjusted odds ratios (OR). Risk factor associated with reproductive health problems was identified by using multivariable logistic regression model. Variables with a p-value ≤ 0.25 in univariable analysis were involved in multivariable logistic model. Further selection of variable was based on backward elimination procedure using a LR-test at 0.05 as cut point. Prior to building a final model, variable were tested for interaction effect using cross-product terms and for multiple-collinearity using the collineary matrix index [5]. The validity of the model to the observed data was assessed by computing the Hosmer-Lemeshow test. For all the analyses, confidence level (CL) is at 95% and P≤ 0.05 were set for significance.

III. RESULTS

In this study, a total of 384 dairy cattle were examined for reproduction health problem. Out of those, 11.7% (45/384) of them had at least one reproduction health problems. The major reproductive disorders found in this district were abortion (2.9%), dystocia (2.3%) and retained fetal membrane (2.1%). The other reproductive problems found with lower frequency were uterine prolapse (1.3%), still birth (1.0%), Anestrous (0.7), vaginal prolapse (0.7%) and repeat breeder (0.5) in selected peasant associations of Jimma Horro district (Table 1).

Table 1. The major reproduction health problems in dairy cattle of Jimma Horro district

Reproductive health problems	Number of cow affected	Prevalence (%)	95% CI
Abortion	11	2.9	1.20-4.53
Dystocia	9	2.3	0.83-3.86
Retained fetal membrane	8	2.1	0.65-3.51
Uterine prolapse	6	1.3	0.32-2.80
Still birth	4	1.0	0.28-2.65
Vaginal prolapse	3	0.7	0.16-2.27
Anestrous	3	0.7	0.16-2.27
Repeat breeder	2	0.5	0.14-1.88

CI: Confidence Interval

The highest (45.8%) prevalence of reproductive health problem was recorded in dairy cattle from Abono peasant association with lowest prevalence (9.4%) in Nunu Inaro peasant association, but no statistical significant difference (P>0.05) was observed between reproductive health problems and origin of dairy cattle. Similarly, there was no statistically significant different (P>0.05) between prevalence of reproduction health problem and age category with higher (18.7%) prevalence was recorded in >6 years age category than in 3-6 years age category (11.1%) of the dairy cattle. Though, the highest prevalence of reproductive health problem was recorded in cattle with poor body condition (15.4%), variation in prevalence of reproductive health problem among body condition was not statistically significant (P>0.05). Concerning the breeding system of cows, prevalence of reproductive health problem was higher in cows (11.9%) bred by natural service than those bred by artificial insemination (AI) (7.1%). Cows bred by natural service were almost five times more likely to be infected by reproductive health problem than those bred by AI (OR = 4.6; P<0.05). With regard to season, the highest (27.8%) and least (5.8%) reproductive health problem was recorded in winter and spring, respectively. The difference in reproductive health problem among the seasons was statistically significant (P<0.05). The prevalence of reproductive health problem in monoparous cows (13.3%) was higher than that of pluriparous cows (8.3%), however, the variation was not statistically significant (P>0.05). The cows which had previous history of reproductive problem had higher prevalence of reproductive health problem (19.1%) than those that did not have previous history of reproductive problem (10.7%). However, there was no statistically significant difference (P>0.05) between prevalence of reproductive health problem and previous history of reproductive problem of dairy cattle. Higher (12.6 %) prevalence of reproductive health problem was recorded in cattle from large herd size than that of small herd size (11.1%). No statistically significant variation

(P>0.05) in prevalence of reproduction health problem between cattle from different herd sizes was observed. The variables with p-value ≤ 0.25 in univariable analysis with no multicollinearity were entered into multivariable logistic regression model. The final multivariable logistic regression model showed that dairy cattle calving in spring season were more likely (OR = 2.3, P<0.05) to be infected by reproductive health problem than those calving in winter season. Similarly, dairy cattle bred by natural service were more likely (OR = 3.4, P<0.05) to had reproductive health problem than those bred by AI. There were no significant interaction between variable were detected. The Hosmer-Lemeshow goodness - of - fit test showed that the model fitted the data well (P = 0.95) (Table 2).

Table 2. The effect of some potential risk factors of reproductive health problems of dairy cattle in Jimma Horro district.

Variables	Category	Total cattle tested	Total cattle positive (%)	Univariate		Multivariate	
				OR (CI; 95%)	P-value	OR (CI; 95%)	P-value
Origin					0.74		
	Abono	96	14 (45.8)	1.3 (0.57-3.07)	0.52		
	Makanisa	96	11 (11.6)	1 (0.41-2.43)	0.90		
	Nunu Inaro	96	9 (9.4)	0.8 (0.32-2.03)	0.64		
	Une (Ref)	96	11(11.6)	-	-		
Age					0.91		
	>6 years	75	14 (18.7)	1.4 (0.63-3.19)	0.40		
	3-6 years	198	22 (11.1)	2.6 (1.06-6.37)	0.036		
	<3 years (Ref)	111	9 (8.1)	-	-		
BCS					0.26		
	Poor	123	19 (15.4)	1.9 (0.86-4.36)	0.11		
	Medium	145	16 (11.0)	1.3 (0.57-3.02)	0.52		
	Good (Ref)	116	10 (8.6)	-	-		
Season					0.011		0.033
	Autumn	121	15 (12.4)	0.4 (0.15-0.91)	0.031	0.9 (0.39-1.98)	0.705
	Summer	124	14 (11.3)	0.3 (0.13-0.83)	0.018	0.4 (0.16-1.16)	0.097
	Spring	103	6 (5.8)	0.2 (0.05-0.48)	0.001	2.3 (1.61-5.82)	0.004
	Winter (Ref)	36	10 (27.8)	-	-	-	-
Parity							
	Monoparous	263	35 (13.3)	1.7 (0.81-3.57)	0.157		
	Pluriparous (Ref)	121	10 (8.3)	-	-		
Herd size							
	large	159	20 (12.6)	1.2 (0.62-2.15)	0.660		
	Small (Ref)	225	25 (11.1)	-	-		
Type of breeding							
	Natural	370	44 (11.9)	4.6(1.46-14.35)	0.009	3.4 (1.02-11.39)	0.044
	AI (Ref)	14	1 (7.1)	-	-	-	-
Previous history of reproductive problems							
	Yes	47	9 (19.1)	2.0 (0.89-4.43)	0.10		
	No (Ref)	337	36 (10.7)	-	-		

OR: Odds Ratio; CI: Confidence Interval, Ref: Reference

IV. Discussion

An overall 11.7% prevalence of reproductive health problem was recorded in study area. This result is in line with report of [15] and [18], who reported prevalence of 18.3% and 19.8% in central and southern Ethiopia, respectively. The prevalence of reproductive health problem reported in the current study was lower than the values reported by [48] 39.8% in northeast Ethiopia, [7] 61.9% in northwest Ethiopia and [2] 30.1% in central Ethiopia. This difference in the results could be related to production system, breed type and environmental factors that might be appeared in the different study areas.

The prevalence of abortion (2.9%) recorded in the present study is consistent with the reports of [7, 21, 26] who reported 2.2%, 2.6% and 2.7% of abortion prevalence, respectively in different part of Ethiopia. On the other hand, [9], [15] and [9] reported 13.9%, 14.6% and 12.2%, respectively which are higher than the current finding. However, compared with the finding of [19] who reported 1% prevalence of abortion, the present finding is higher. 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 prevalence of dystocia 2.3% was recorded in this study is agrees with that of [23] and [17], who reported prevalence of 2.9% and 3.3% respectively in dairy cattle in central Ethiopia. However, the current finding is lower than the reports of [46] and [7], who reported 7.8% and 6.0% prevalence of dystocia, respectively. This variation may be due to different in size of bull used, fetus and birth canal of dairy cattle in different study areas.

The prevalence of retained fetal membrane (2.1%) found in this finding is higher than the report of [17] who reported that prevalence of 0.8% in central Ethiopia. However, this result is lower than reports of [19, 21, 25] who reported

prevalence of retained fetal membrane of 12.9%, 17% and 19.2%, respectively in different part of Ethiopia. Similarly, [14] also reported higher prevalence of retained fetal membrane (18.3%) than current result in Arsi zone. The variation in the prevalence of retained fetal membrane may be attributed to the difference in breed, environmental factors, management factors and cause of retained fetal membrane is varies in different study areas.

The prevalence of uterine prolapse recorded in this study (1.3) is consistent with the previous reports by [9, 26, 46], who reported that 0.76%, 0.65% and 0.43% of prevalence of uterine prolapse, respectively. This finding is also in line with report of [19], who reported 0.5% prevalence of uterine prolapse in Jimma town, southwestern Ethiopia. However, this study is relatively lower than the study of [9], who reported the prevalence of 2.7% in indigenous Borena breed cows in Borena zone in southern Ethiopia.

The prevalence of stillbirth (1.0%) observed in this study is in line with the findings of [34] who reported 1.0% prevalence of stillbirth in Boloso Sore, southern Ethiopia. However, the present finding is lower than that of [46], who reported 3.0% prevalence of stillbirth in Kombolcha, Northeast Ethiopia. Still births can occur due to forceful fetal extraction, hypocalcaemia and various pathogens.

The prevalence of vaginal prolapse recorded in the present study was 0.7%. This finding is in line with report of [23] and [9], who reported 0.7% prevalence of vaginal prolapse in central and southwest Ethiopia, respectively. Similarly, [46] reported 1.2% of prevalence of vaginal prolapse in northeast Ethiopia. On the other hand, the prevalence of vaginal prolapse reported in the current study is lower than the values reported by [26] 3.4% in Hosanna, southern Ethiopia and [8] 1.8% in Gondar in northern Ethiopia. This variation could be due to inter relationship between of reproductive problems as predisposing factors for each other.

The prevalence of anestrous (0.7%) observed in this study is lower than the report of [3], who reported 10.26% prevalence of anestrous in southern Ethiopia. This prevalence is also lower than the prevalence indicated by [4] who reported a prevalence of 37.8% in dairy cattle in Tigray northern Ethiopia. This variation might be due to the breed type, environment and management system differences.

The prevalence of repeat breeding (0.5%) found in this study is agrees with the values reported by [46], who reported 1.3% prevalence of repeat breeding in northeast Ethiopia. However, this result is lower than the finding of [15], [17] and [26], who reported prevalence of 26.8%, 15.9% and 13.8%, respectively in different part of Ethiopia. This variation may be due to environmental factors, reproductive tract infections, communal use of bull for natural service and managerial factors.

The present result indicated that season was statistically significantly associated ($P<0.05$) with reproductive health problems in dairy cattle. Cows were almost two times more likely (OR = 2.3) to had reproductive health problems in spring season (March, April and May) compared to winter season (December, January and February). 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 [20, 24]. The association between season and reproductive health problems is in agreement with report of [31] and [44]. The variation may be due to differences in environmental condition, breed of cattle and management system.

The current study also showed that type of breeding used was statistically significantly associated with prevalence of reproductive health problem ($P<0.05$) and cow bred by natural service was almost three times (OR = 3.4) more likely to face reproductive health problem 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. This result is in line with that of [8] and [7], who reported that statistically significant association between prevalence of reproductive health problem and type of breeding used. However, in contrary to this [34] reported that the risk of reproductive health problem was independent of type of breeding used in dairy cattle in Boloso Sore, southern Ethiopia. Similarly, previous report also has indicated that higher prevalence of reproductive health problem in cows that bred by natural service than those bred by AI in northern Ethiopia [41].

The higher prevalence of reproductive health problem was found in large herd size (12.6%) than small herd size (11.1%). However, no statistically significant variation was observed in prevalence of reproductive health problem between herd sizes. In addition, statistically significant difference in prevalence of reproductive health problem ($P>0.05$) was not observed in cattle between parity. The prevalence of reproductive health problem was also no statistically significant difference ($P>0.05$) observed among peasant associations. Similarly, there is no statistically significant difference observed among age groups, body condition and previous history of reproductive problems. This may be due to similar management system, breed of cattle, equal chance of exposure of cattle to causes of reproductive health problem and even distribution of the cause of reproductive problems in study area.

V. Conclusion and Recommendations

The current study revealed that the high prevalence of reproductive health problem in district. The prevalence of reproductive health problem was high indicating that it is reproductive health problem was one of the significant causes of cattle production loss in study areas. Reproductive health problem like abortion, dystocia and retained fetal member are the most important reproductive disorder in this study area. This study indicated that reproductive health problem in dairy cattle depends on breeding methods and seasons. This showed that reproductive health problem is one of the cattle production losses in Jimma Horro district. Hence, there is a need to created awareness about impact of reproductive health problem on dairy cattle production and appropriate control method of reproductive health problem should be designed and implemented. Moreover, further investigation should be carried out to isolate and

characterize the causes of the reproductive problems in different study area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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