



T.J.A.N.R.S

The Journal of Agriculture and Natural Resources Sciences

Journal homepage: <http://www.journals.wsrpublishing.com/index.php/tjanrs>

Online ISSN: 2383-238X

Print ISSN: 2423-4397



Original Article

Assessment of Hygienic Milk Production and Prevalence of Mastitis in Dairy Cows in Jikawo Woreda of Nuer Zone, Gambella Region, Ethiopia

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ARTICLE INFO

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How to Cite this Article:

Deng, Y., Tamir, B., and Asebe, G. (2015). Assessment of Hygienic Milk Production and Prevalence of Mastitis in Dairy Cows in Jikawo Woreda of Nuer Zone, Gambella Region, Ethiopia. *The Journal of Agriculture and Natural Resources Sciences*, 2(2), 480-486.

Article History:

Received: 17 March 2015
Revised: 19 April 2015
Accepted: 21 April 2015

ABSTRACT

A cross sectional study was conducted in Jikawo Woreda of Nuer Zone, Gambella Regional State in Southwest Ethiopia, with the objectives of assessing hygienic milk production practices, prevalence of mastitis and associated risk factors from December 2013 to April 2014. Data were collected through administering semi-structured questionnaire and conducting California Mastitis screening test across the randomly selected households of purposively selected kebeles in the Woreda. From 145 households respondents 95.17% (138) were not practicing in washing of udder while only 4.83% (7) practiced washing udder before milking only after the death of the calf. The California Mastitis Screening Test was performed on 121 lactating dairy cows, of these; about 60.33% (73) showed mastitis cases. The prevalence of clinical and subclinical mastitis was found to be 11.57% (14) and 48.76% (59), respectively. Test of quarter level prevalence of mastitis was done on 484 quarters and it was found that 9.32% (45) and 37.89% (183) of the quarters had clinical and subclinical cases, respectively. The quarter level prevalence of clinical and sub clinical mastitis from the highest to lowest rate of infection was left front teats (LF) 53.72% (65), right rear teats (RR) 50.00% (60), left rear teats (LR) 45.56% (55) and right front teats (RF) 39.65% (48). Those animals which were affected with tick infestation ($\chi^2 = 11.14$, $p < 0.003$), with teat injury ($\chi^2 = 7.14$, $P < 0.008$) and with history of mastitis ($\chi^2 = 8.62$, $P < 0.003$) were affected with mastitis compared to their counter parts. The occurrence of mastitis based on age, stage of lactation and parity was higher in adult cow (6-9yrs) ($\chi^2 = 7.87$, $P < 0.020$), in mid (5-7month) lactation ($\chi^2 = 6.41$, $P < 0.041$), and in cow with moderate (4-7) parity ($\chi^2 = 11.79$, $P < 0.003$) respectively. In conclusion, the hygienic milk production activity in the area as a whole requires an intervention. Mastitis has been found to be a serious disease in the area. This indicates proper mastitis control should be practiced by maintaining an appropriate cow's environment and udder health management program by the farmers including further investigation on the etiological agents associated with prevalence of mastitis to undertake measurable control options of mastitis in the area.

Keywords: Dairy cow, hygienic, milk, mastitis, prevalence, Jikawo, Nuer, Gambella, Ethiopia.

INTRODUCTION

There are several types of diseases which potentially infect and affect the wellbeing of livestock population among which mastitis is the common and costly disease of dairy cows, causing loss in milk yield and treatment cost for dairy farmers (Nibret *et al.*, 2012). It is a complex disease that generally involves interplay between management practices and infectious agents, having different degrees of intensity and variations in duration and residual effects. In Ethiopia, around urban and peri urban areas of Addis Ababa, the economic losses estimated from mastitis about 210.8 birr per cow per lactation (Mungube, 2001).

The disease, plays a high economic impact in the dairy sector yet it has been given little attention, especially the sub clinical form which is mainly caused by a bacterial agent called *Staphylococcus aureus* (*S. aureus*) (Abera *et al.*, 2013).

The incidence and distribution of mastitis disease in Gambella Peoples National Regional State of Ethiopia has not been studied systematically and information relating to economic loss and the overall prevalence of the disease is not known (GBOA, 2010). Also, studies related to hygienic milk production in Gambella region was generally unknown. Among the different woredas in Gambella Regional State, Jikawo Woreda was

considered to be a potential area for dairy development. Accordingly, there was no information about the practice of hygienic milk production and prevalence of mastitis in the region in general and in the study woreda in particular. Therefore the current study was undertaken with the objectives of assessing *practices of hygienic milk production, determining the prevalence of dairy cow mastitis and identifying mastitis associated risk factors in Jikawo Woreda of Gambella Regional State, Ethiopia.*

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Jikawo Woreda of Nuer Zone in the Gambella People's National Regional State located in south-western part of Ethiopia (Fig. 1). The Woreda is located 120 km away from the regional town Gambella. It extends between 7°N to 8.17°N latitude and 33°E to 35.02°E longitude (GBOA, 2010) (Fig. 1). The altitude of the Woreda town called Nyinenyang is 410 meters above sea level. The study area receives average annual rainfall of 645.3 mm and annual temperature ranges from 33.71-40.32 C (GBOA, 2010).

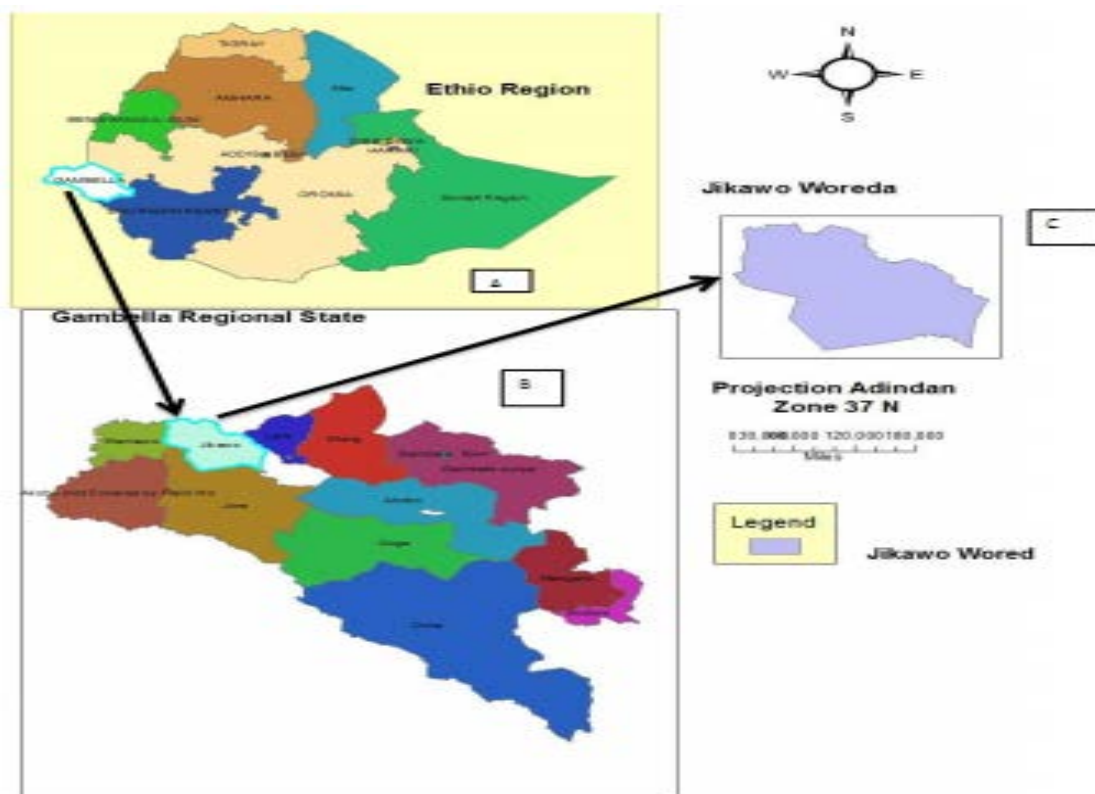


Figure 1: Map of the study area

Study Design

Sampling procedure and Sample size determination

The sampling procedure used here was purposive type by considering the population of cows, accessibility and security of the kebeles. Based on the obtained information from rapid exploratory field visit together with available secondary information, 3 kebeles (namely, Puokueth, Nyinenyang and Bildak) were purposively identified.

The sample size was determined based on the formula described in Thrusfield (2007). A total of 121 cows were taken for CMT test.

Accordingly, 50 households each from Puokueth and Nyinenyang kebeles, and 45 from Bildak kebele were selected and subjected for a semi-structured questionnaire, making a total of 145 households for the study woreda. Also, 121 lactating cows of which 41 cows from Puokueth, 40 from Nyinenyang and 40 from Bildak kebeles of the Jikawo Woreda were selected and tested for CMT method.

Methods of Data Collection

Both qualitative and quantitative data were collected by employing questionnaire survey and California mastitis test (CMT) methods

Statistical Analyses

The collected data were checked for any inconvenience and inconsistency and entered to Excel spread sheet, coded, and transferred to SPSS version 20. Both the questionnaire and CMT data were analyzed on the given statistical package software. For descriptive statistics presentation of categorical data, Chi-square was used to compare the different groups of age, sex, and various risk factors, with the outcome variable (mastitis). A p-value less than 0.05 were considered statistically significant.

RESULTS

Socio-economic characteristics of the respondents

From the total of 145 dairy farmers interviewed females comprised 75.2% (109) of the respondents while the remaining 24.8% (36) were males of different age and educational levels. The mean and the standard deviation of the family size in the study areas was 5.17 ± 0.154 . About 5.5% (8) of the elder people participated in some off farm activities such as black smith and weaving as an income source (Table 1).

Table 1: Socioeconomic profile of the respondents in Jikawo Woreda

Variables	Parameters	N	Proportion (%)			
			Puokueth	Nyinenyang	Bildak	Total
Sex	Male	36				24.8
	Female	109				75.2
Educational level	Illiterate	88				60.2
	Read and write	21				14.5
	Grade 1-5	11				7.6
	Above grade 6	15				17.2
Occupation	Mixed farming	129				89.0
	Livestock rearing only	8				5.5
	Off farm business	8				5.5
Age category	<20 years	23				15.9
	21-35years	65				44.8
	36-45years	48				33.1
	>46years	9				6.2
Family size by kebele	Mean \pm S.E					
		5.46 \pm 0.279	5.28 \pm 0.218	4.71 \pm 0.294	5.17 \pm 0.154	

N=number

Milk Hygienic Practices

Washing of udder before milking was not a common practice in the study area, as there is a belief that calve could wash it with saliva when they are allowed to have few suckling before and after milking while 28.6% (2), 28.6% (2) and 42.9% (3) of respondents in Puokueth, Nyinenyang and Bildak kebeles, respectively, practices washing of udder before milking and this happened only in the absence

(death) of calf with the intention of removing dirt from udder.

Sanitary practices of milk and milk products

Hygiene of milk handling equipment

Cleaning of milk handling equipments is common among most of the respondents. The farmers responded with 48.3% (70) 43.4% (63) and 8.3% (12) proportions as they used cold water, both cold and warm water and

warm water, respectively for cleaning milk handling equipment's (Table 2, 3).

Table 2: Hygienic and milk consumption practices followed by dairy farmers in Jikawo Woreda

Variables regarding hygienic practices	Kebele		
	Puokueth N (%)	Nyinenyang N (%)	Bildak N (%)
Producers followed during milking			
Washing udder before milking only	2 (4%)	3(6%)	2 (4.4%)
No washing at all	48(96%)	47(94%)	43(95.6%)
Total	50(100%)	50(100%)	45(100%)
Consumption of milk			
Raw only	9(18%)	16(32%)	18(40%)
By processing only	0(0%)	3(6%)	1(2.2%)
All	9(18%)	1(2%)	11(24.5%)
Raw and processing	32(64%)	30(60%)	15(33.5%)
Total	50(100%)	50(100%)	45(100%)

Table 3: Milk sanitary practices in Jikawo Woreda

Sanitary practices	Frequency	%
Cleaning frequency of milk handling containers		
Using cold water	70	48.3
Using both cold and warm water	63	43.4
After each usage using warm water	12	8.3
Materials used to wash milk handling equipment		
Sponge	27	18.62
Ashes	50	34.48
Grass leaves(any)	31	21.38
Other locally available materials	37	25.50
Sources of water for washing purpose		
Hand pump water	65	44.8
Hand dug well water	17	11.7
River water	63	43.4

Prevalence of Mastitis

Out of total examined cows, 60.33% (73) were found to be affected with clinical and subclinical mastitis. The study similarly showed, cows with CMT positive for the clinical and subclinical mastitis were found to be 11.57% (14) and 48.76% (59) respectively (Table 4).

Out of the 484 quarters examined only one teat was found to be blind. During the screening of quarters, 9.32% (45) and 37.89%

(183) were found to be both affected by clinical and subclinical mastitis respectively (Table 4). The quarter level prevalence of clinical and sub clinical mastitis from the highest to lowest rate of infection were left front teats (LF) 53.72% (65), right rear teats (RR) 50.00% (60), left rear teats (LR) 45.56% (55) and right front teats (RF) 39.65% (48) respectively (Table 5). The overall quarters prevalence of clinical and sub clinical mastitis was 47.21% (228) (Table 5).

Table 4: Prevalence of clinical and sub clinical mastitis at cow and quarter levels

Form of mastitis	Total examined (Cows)	Total No. affected N (%)	Total examined quarter	Total No. affected (%)
Clinical	121	14(11.57)	483	45 (9.32)
Subclinical	121	59(48.76)	483	183 (37.89)
Total		73(60.33)		228(47.21)

Table 5: Prevalence and distribution of udder infection across the four quarters in dairy cows based on their clinical stages

Variable	Total n°. of examined quarter	No. of quarters affected	Clinical mastitis	Subclinical mastitis
			Prevalence N (%)	Prevalence N (%)
LF	121	65(53.72)	12(26.67)	53(28.96)
LR	121	55(45.56)	8(17.78)	47(25.68)
RF	121	48(39.67)	11(24.44)	37(20.22)
RR	120	60(50.00)	14(31.11)	46(25.14)
Total	483	228(47.21)	45(100)	183(100)

Risk factors associated with dairy cow mastitis

Accordingly, the occurrence of mastitis based on age, stage of lactation and parity was significantly higher in adult cow (6-9yrs)

($\chi^2=7.87$, $P=0.020$), in mid (5-7m) lactation cows ($\chi^2 =6.41$, $P=0.041$), and in cow with moderate (4-7) parity ($\chi^2=11.79$, $P=0.003$) respectively (Table 6).

Table 6: The prevalence of dairy mastitis based on intrinsic risk factors

Risk factors	Total number of animal Examined	Number of animals Affected	Prevalence (%)	χ^2	P- value
Age					
Young adult(3-5)	22	9	40.91	7.87	0.020
Adult(6-9)	27	17	62.96		
Old(>9)	72	47	65.23		
Stage of lactation					
Early(<4m)	37	21	56.76	6.41	0.041
Mid(5-7m)	74	41	55.41		
Late(>7m)	10	8	80.00		
Parity					
Few(1-3)	23	13	56.52	11.79	0.003
Moderate(4-7)	51	33	64.71		
Many(>8)	47	27	57.45		

Table 7: The prevalence of bovine mastitis based on some of the extrinsic risk factors

Risk factors	Total number of animal Examined	Number of animals Affected	Prevalence (%)	χ^2	P- value
Body condition					
Poor	85	40	47.06	6.69	0.010
Good	36	33	91.67		
Tick infestation					
Highly	14	10	71.43	11.41	0.003
Moderately	47	44	93.62		
Low	60	19	31.67		
Teat injury					
Present	65	45	69.23	7.14	0.008
Absent	56	28	50.00		
History of previous mastitis					
Yes	26	23	88.46	8.62	0.003
No	95	50	52.63		

The occurrence of mastitis based on body condition, tick infestation, teat injury and history of previous mastitis was significantly higher in cow with good body condition ($\chi^2=6.69$, $p<0.010$), in moderately tick infested cows ($\chi^2 =11.14$, $p< 0.003$), in cows with teat injury ($\chi^2 =7.14$, $P<0.008$) and in cows with previous mastitis history ($P<0.003$, $\chi^2=8.62$) respectively (Table 7).

DISCUSSION

Majority (75.2%) of respondents in the study area who were engaging in hygienic milk production were females than males which is similar with other findings (Bereda *et al.*, 2012; Asrat *et al.*, 2013) report, that dairying offers more opportunities for females to be closely involved in the daily management than males. Most of the

respondent's educational levels were found between illiterate and primary school which is in agreement with Bereda *et al.*, (2014). This indicates that more intervention is needed to aware farmers in order to improve their hygienic dairy production and husbandry practices. The study of Tesfay, G. (2014) showed variable usage of water sources in which a higher proportion of the respondents indicated that their major water source was pipe water followed by Borehole in the urban areas whereas, in the peri-urban areas it was pipe water followed by river water of Aksum and Adwa areas.

In the present study, the overall prevalence of mastitis in local Nuer breed cows was 60.33% and 47.21% at cow and quarter levels respectively. This result is in agreement with finding of Abera *et al.*, (2013), who reported that the overall mastitis prevalence in the farm

was 66.6% and 42% at cow and quarter level, respectively in Assella Dairy Farm in Oromia Region, Ethiopia. The present findings were found to be higher than previous findings in some parts of the country (Girma, 2010, Tigre, 2011; Abera, 2013), which could be due to lack of awareness, housing and milking practices they are accustomed.

In the present study from selected potential risk factors age ($P < 0.020$, $\chi^2 = 7.87$), stage of lactation ($P < 0.041$, $\chi^2 = 6.41$), and parity ($P < 0.003$, $\chi^2 = 11.79$) had statistically significant effect on the occurrence of mastitis which agree with the report by Zeryehun *et al.*, (2013).

The occurrence of mastitis based on these risk factors like body condition, tick infestation, teat injury and history of previous mastitis showed statistically significant effect with the occurrence of mastitis. This was also reported by several investigators to have association with the occurrence of mastitis (Biffa *et al.*, 2005; Mekibib, 2010; Benta, 2011; Nibret, 2012).

CONCLUSION

In the study area, majority of farmers who were participating in hygienic milk practices was females. There are various factors that were observed to affect practices of hygienic milk production such as herd management, milking practices and diseases like mastitis and its associated risk factors. The presence of poor milk handling practices and absence of hygienic milk processing system was a common problem observed in the study area. The unhygienic conditions of milking, unclean milk handling equipment and the use of contaminated cleaning water were among the important determinant factors of milk contamination in the study area. Udder washing in the presence of calf is not practiced, which indicates a poor milk hygienic practice. The California mastitis test (CMT) method also indicated that mastitis of both clinical and subclinical types were major health problems of the dairy cows, which cause huge loss of milk production that assure serious attention in creating awareness and prevention strategy. The study also showed various environmental risk factors such as tick infestations, teat injury and previous history of mastitis which are statistically significant and required intervention. Awareness about the importance of hygienic milk production and hygienic milk handling practices, external

parasites especially tick prevention program should be applied as well as keeping the hygiene of the cow and housing area are important to ensure reduced exposure to mastitis pathogens.

ACKNOWLEDGMENTS

The present study was supported by grants from Addis Ababa University. Authors would like to thankful for funding this study. This study would not be accomplished without the close assistance of the local community, the district agricultural offices and development agents.

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