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Research Article

Prevalence and analysis of risk factors of udder and teat health disorders in free-grazing and zero-grazing small holder dairy cows in south wollo, Ethiopia

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Abstract

Udder and teat health disorders (UTHDs) cause profound economic loss and have a major influence on dairy cows' welfare and productivity. This study was carried out to identify the prevalence and risk factors of UTHDs and to investigate a potential association with clinical mastitis (CM). The prevalence of UTHDs in this study was 28.4%. The UTHDs identified were CM (15.1%), teat ulcer/cracks (7.6%), udder wound (7.3%), teat end lesions (3.1%), teat papilloma (2.6%), pendulous udder (2.3%), hyperthelia (1.6%), athelia (1.0%), udder abscess (1.0%), teat stenosis (0.8%), teat gangrene (0.8%) and udder impetigo (0.8%). A significantly higher prevalence of UTHDs was identified in Holstein-Friesian (HF) cross breeds ($P < 0.001$; OR = 0.134) than indigenous breeds; in cows between 4-5 years of age ($P < 0.001$; OR = 11.666) compared to > 7 years; in cows with good BCS ($P = 0.007$; OR = 0.263) than those with poor BCS and in milking ($P < 0.001$; OR = 4.682) and dry cows ($P = 0.003$; OR = 4.226) than pregnant cows. Prevalence did not differ significantly ($P > 0.05$) between the locations and management systems of herds. In addition, the occurrence of CM was associated with teat ulcer/cracks ($P < 0.001$; OR = 0.036), udder wound ($P < 0.001$; OR = 0.068); teat end lesions ($P = 0.008$; OR = 0.142); pendulous udder ($P = 0.031$; OR = 0.153) and udder impetigo ($P = 0.040$; OR = 0.058). A statistically insignificant difference was found in the prevalence of UTHDs between free-grazing and zero-grazing smallholder dairy herds. The study identifies teat ulcers/cracks, udder wounds, and teat end lesions as risk factors for CM.

Introduction

The udder and its teats are the most important physical assets of a dairy cow, which play a vital role in sustainable economic milk production. The quantity and quality of produced milk as well as the efficiency of its production is directly dependent on the good health of cows and cow's udder [1].

Injuries to the udder and teat can be caused by various factors including trauma, infection, husbandry practices, and environmental factors [2,3]. The udder and teats are vulnerable to external trauma or injury because of their anatomical location, increase in the size of the udder and teats during lactation, faulty methods of milking, repeated trauma to the teat mucosa, injury by teeth of the calf, unintentionally stepped on the teat, paralysis resulting from metabolic disturbances at parturition [4].

UTHDs cause profound economic loss and have a major influence on dairy cows' welfare and productivity [5]. Udder and teat affections always lead to economic loss in milk yield; loss in antibiotics-treated milk, possible loss of a quarter if there is a necessity to dry off, and finally reflected on the economic value of the dairy animals [6]. Adverse changes in the quality of milk, as well as increased costs for treatment and early culling of the animals, make up for the negative economic effect [7-10].

The physical condition of the bovine udder and teat is an indicator of the quality of the environment, the milking management, and the milking system used on a dairy herd, and can also be used as an indicator for the risk of intra-mammary infections. Changes to teat tissue, particularly the skin of the barrel, teat end, and teat canal, will alter udder defense systems and may favor the penetration of bacteria into

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the udder [11]. A great number of individual cow-specific risk factors for CM have been identified, including breed, parity, period of lactation, udder, and teat morphology, age at first calving, milk leakage, udder edema, milk production, number of milk somatic cells and reproductive disorders [12,13]. However, the actual role of udder and teat affections in intra-mammary infection is underestimated, suggesting an up-to-date study on their potential role in causing intra-mammary infection.

Specific studies that indicate the type, prevalence, and risk factors of UTHDs in dairy cows in Ethiopia aren't available and virtually all the studies are limited to the surveys conducted during the study of bovine mastitis. In addition, limited information is presently available on the association between the presence or absence of udder and teat lesions and intra-mammary infection. Yet, there is a need for a better knowledge of udder and teat affections and abnormalities. Hence, the aim of this study is to investigate the prevalence and risk factors of UTHDs and to elucidate the association of non-mastitis UTHDs with that of CM.

Materials and methods

Description of the study area

The study was conducted from October 2017 to April 2018 in urban and peri-urban settings of Dessie and Kombolcha districts which are located in the South Wollo zone of the Amhara National Regional State (ANRS), Ethiopia. The South Wollo administrative zone is situated 400 km north of Addis Ababa, the capital of Ethiopia. The livestock population in the South Wollo zone includes 1,811,631 cattle, 2,779,076 small ruminants, 499,605 equines, and 1,700,690 chickens and the relative humidity of the region varies from 23.9% to 79% [14]. The smallholder dairy industry in South Wollo has grown impressively over the last 10 years and there are now over 400 smallholder dairy herds concentrated for the most part in peri-urban areas. The majority include some amount of Friesian in their genetic makeup [15].

Common dairy production systems are zero-grazing in urban and mixed crop-livestock systems in peri-urban and rural areas. Communal grazing, tended by herdsmen, is common in peri-urban areas and rural areas close to the peri-urban areas. A small number of large-scale dairy farms are also seen in these areas. Only the small holder dairy systems were represented in the animals sampled in this study.

Dessie is a large metropolitan town and a separate district in north-eastern Ethiopia located at a latitude and longitude of 11°8′N 39°38′E, with an elevation between 2,470 and 2,550 meters above sea level (m.a.s.l.). The district is characterized by a cold climate. Kombolcha is an industrial town in north-eastern Ethiopia located at latitude and longitude of 11°5'N 39°44'E/11.083°N 39.733°E, with an altitude of 1500- 1847 m.a.s.l. which is characterized by high humidity and warmer climate. It has an average monthly minimum and maximum temperature of 11.7 °C and 23.9 °C respectively. The mean annual rainfall of Kombolcha is in the range of 581-1216 mm [16] (Figure 1).

Study population

The study population included both indigenous Zebu and Holstein-Friesian (HF) indigenous Zebu cross-breed dairy cows in urban and peri-urban areas of South Wollo. Animals were categorized on the basis of geographic location, breed, age, body condition score (BCS), production stage, and management systems. All the animals in the study were dairy cows above four years of age. The age of the animals was identified using records from the farmers. Where such records did not exist, age

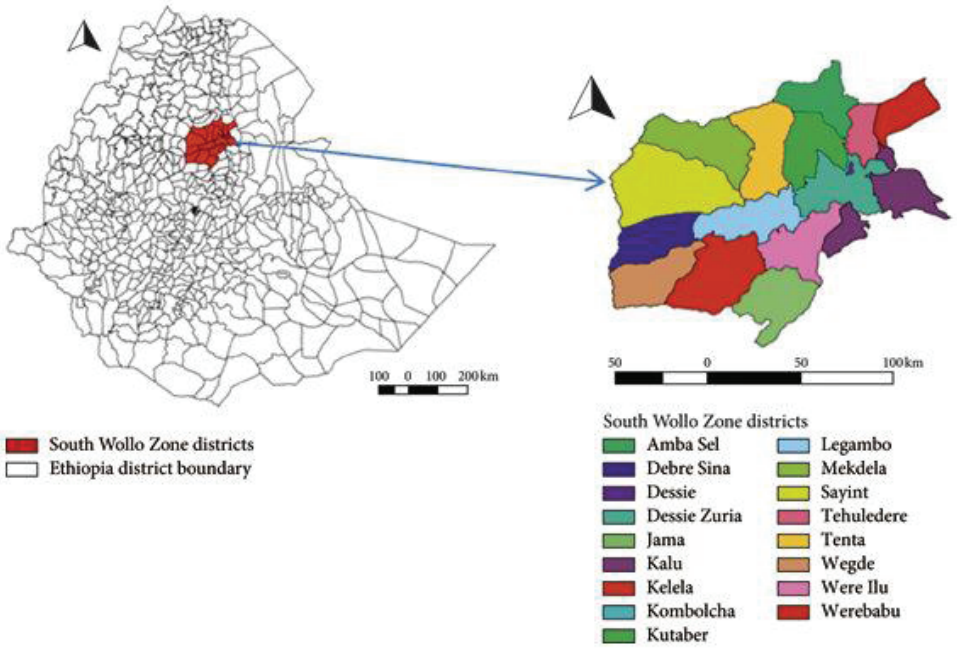

Figure 1: Map of south wollo zone districts. Image Source: [43].

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estimation was done using dentition [17]. The animals were grouped into three age categories 4-5 years, 5-7 years, and >7 years [18]. They were also classified into good, moderate, and poor based on the appearance of their body condition [19]. Great proportions of the herds were managed semi-intensively using communal free grazing of varying intensity. The reminders of the herds were managed intensively which is based on zero-grazing of different grass species including *Cynodon aethiopicus*, *Hyparrhenia hirta*, and *Cenchrus ciliaris* together with the use of available byproducts such as maize stover, teff, and wheat straw. In all of the herds hand milking is practiced twice daily at 6-7 am and 5-6 pm.

Study type

A cross-sectional study was conducted from October 2017 to April 2018 to determine the prevalence of UTHDs and to identify their distribution among different age groups and body condition scores and between the geographic locations, breeds, production status, and management systems.

Sampling method and sample size

A multistage sampling technique was used in the selection of the study animals, and the respective peasant associations (Pas). Pas were regarded as the primary units, the dairy herds as the secondary units, and the individual animals as the tertiary units. Of the total 31 Pas in the two study districts, a total of eight Pas were selected randomly. Four of the Pas were in the urban zone and the remaining four were in peri-urban. Since no sampling frames were available for selection of herds within Pas, herds were selected by visiting the farms and taking the first few that agreed. Averages of 40% of the dairy cows aged 4 years and above were picked randomly from each selected herd. The selection of additional participants was then continued until the sample size for the study was met.

The desired sample size for the study was calculated using the formula given by Thrusfield [20] with a 95% confidence interval and 5 % absolute precision. N = 1.962 *Pexp (1-Pexp) / D^2; Where; N = sample size, Pex*P* = expect prevalence, D = absolute precision (5%). A 50% expected prevalence was taken since there is no previous report on the prevalence of udder and teat lesions of dairy cows in the study area. Accordingly, 384 dairy cows were included in the study.

Study protocol

The study was conducted by taking history and doing a thorough physical examination to record major gross udder and teat diseases/lesions. Before a special examination of the udder and teat region, a general physical examination was conducted on each animal. Data regarding current clinical manifestations of the disease were recorded with special attention to the udder and teat region. All this information was preceded by age, body condition, and other related information.

A special examination of the udder and teat was then carried out using history-taking and physical examination techniques. During history taking the animal owners were asked about the animal data including, pregnancy, lactation, feeding, previous udder and teat disorders, and previous udder and teat treatment and recorded appropriately [21].

Physical examination was then followed in which inspection was made from a near distance, standing beside the animal inspecting the forequarters from both sides then behind the animal to inspect hind quarters, the level of the eyes was adjusted to cope with the level of the udder, to detect the abnormal size, superficial growths, wounds, swelling, accessory teats, and skin lesions [10].

Palpation then began with rolling of the teats between the tips of the fingers along the teat canal, this was followed by deep palpation of each quarter with extended fingers while holding the udder with the other hand. Palpation was carried out starting from the tip of the teat upward to the base of the udder to detect hotness, consistency, peas or cords in the teat canal, and any other abnormalities [22]. Milking and insertion of teat siphon were done in the detection of the obstruction site and to check milk color, odor, and consistency [10].

Data analysis

Microsoft Excel 2007 (Microsoft Corp., USA) was used for data management. Descriptive statistics were used to summarize the data. Location, breed, age, BCS, production stage, and management system of the animals were considered potential risk factors for the occurrence of udder and teat lesions. Associations with the dependent variable (udder and teat health disorder) were assessed initially by univariable logistic regression using SPSS software v. 20 (IBM Corp., USA) to compute the odds ratio associated with potential risk factors. The association of CM with non-mastitis udder and teat lesions was also computed using univariable logistic regression. Non-collinear variables that presented a P-value < 0.25 in the univariable analyses were included in the multivariable logistic regression model. In the final model, results were considered significant at P < 0.05.

Results

Prevalence of udder and teat health disorders

Of the total 384 clinically examined dairy cows, 109 (28.4%) were affected with one or more of the different UTHDs. The UTHDs identified in this study were CM (15.1%), Teat ulcer/cracks (7.6%), Udder wounds (7.3%), Teat end lesion (3.1%), Teat papilloma (2.6%), Pendulous udder (2.3%), Hyperthelia (1.6%), Athelia (1.0%), Udder abscess (1.0%), Teat stenosis (0.8%), Teat gangrene (0.8%) and Udder impetigo (0.8%). The cross-breed dairy cows had a higher prevalence of UTHDs (P < 0.001; OR = 0.134) than the indigenous breeds. Cows between the ages of 4 and 5 years had a higher prevalence of UTHDs (P < 0.001; OR = 11.666) than the reference category (>7 years); similarly, 5-7 years had higher UTHDs (P = 0.013; OR = 4.239) than >7 years. In addition, a higher prevalence of UTHDs was recorded in milking (P < 0.001; OR = 4.682) and dry-off cows (P = 0.003; OR = 4.226) than in pregnant cows. However, variations in the location of farms, management system, and body condition of the study animals had no significant effect (P > 0.05) on the prevalence of UTHDs. The frequency of occurrence and prevalence of UTHDs is summarized in Table 1.

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Binary logistic regression analysis of risk factors on the overall UTHD prevalence

Of the total six variables, that is, location, breed, BCS, age, production status, and management system, tested by the univariate analysis, three of these that is, breed, age, and production stage were significantly associated ($P < 0.05$) with the occurrence of UTHDs. Four variables including breed, age, BCS, and production status remained significant ($P < 0.25$) in the final multivariable model. The final multivariate logistic regression analysis of the risk factors showed an association of UTHDs with the cross-breed cows ($P < 0.001$; OR = 0.131) compared to the indigenous breeds. A strong association of UTHDs also existed with cows between 4-5 years of age ($P < 0.001$; OR = 11.777) and cows between 5-7 years of age ($P = 0.011$; OR = 4.347) compared to cows > 7 years of age. Moreover, milking ($P < 0.001$; OR = 4.821) and dry ($P = 0.002$; OR = 4.308) cows showed a strong association with UTHDs compared to pregnant cows. The results of the univariate and multivariate logistic regression analysis for the association of UTHDs with the different risk factors are summarized in Tables 2,3.

Binary logistic regression analysis of non-mastitis UTHDs on CM prevalence

Of the total 11 variables tested in the univariable analysis, 6 of them were associated ($P < 0.05$) with the occurrence of CM. Five variables remained significant ($P < 0.25$) in the multivariable model (Table 5). In the multivariable analysis, the occurrence of CM was associated with teat ulcer/cracks ($P < 0.001$; OR = 0.035), udder wounds ($P < 0.001$; OR = 0.065); teat end lesions ($P = 0.007$; OR = 0.137); pendulous udder ($P = 0.027$; OR = 0.146) and udder impetigo ($P = 0.038$; OR = 0.055). The relation of CM with different non-mastitis UTHDs is summarized in Tables 4,5.

Table 1: Prevalence of UTHDs encountered in urban and peri-urban small holder dairy cows in Dessie and Kombolcha districts, South wollo zone of Amhara region (n = 384).

Lesion type	*Frequency*	*Prevalence (%)*
*CM	58	15.1
Teat ulcer/cracks	29	7.6
Udder wound	28	7.3
Teat end lesions	12	3.1
Teat papilloma	10	2.6
Pendulous udder	9	2.3
Hyperthelia	6	1.6
Athelia	4	1.0
Udder abscess	4	1.0
Teat stenosis	3	0.8
Teat gangrene	3	0.8
Udder impetigo	3	0.8

*CM: Clinical Mastitis;
N.B: Since two or more udder and teat problems were observed on the same animal, the sum of the prevalence of different UTHDs encountered was greater than the overall prevalence (28.4%).

Table 2: Univariate logistic regression analysis of UTHDs in relation to, location, breed, age, BCS, production stage, and management system.

Variables	Categories	No. of cows	No. of UTHDs	OR	95% CI (OR)	p - value#
Location	Kombolcha	192	47	0.778	0.467-1.295	0.334
	Dessie*	192	62			
Breed	Cross	257	10	0.134	0.063-0.283	<0.001
	Indigenous*	127	99			
Age	4-5 years	167	66	11.666	3.480-39.106	<0.001
	5-7 years	177	38	4.239	1.353-13.284	0.013
	>7 years*	40	5			
Body condition score	Good	127	33	0.263	0.099-0.700	0.007
	Moderate	204	62	0.658	0.278-1.599	0.342
	Poor*	53	14			
Production stage	Milking	196	77	4.682	2.115-10.365	<0.001
	Dry off	97	23	4.226	1.652-10.810	0.003
	Pregnant*	91	9			
Management system	Free-grazing	251	74	1.231	0.716-2.114	0.452
	Zero-grazing*	133	35			

* Reference category # Wald p - value; significant at $p < 0.05$.

Table 3: Multivariate logistic regression analysis of UTHDs in relation to, breed, age, BCS, and production stage.

Variables	Categories	No. of cows	No. of UTHDs	OR	95% CI (OR)	p - value#
Breed	Cross	257	99	0.131	0.062-0.278	< 0.001
	Indigenous*	127	10			
Age	4-5 yrs	167	66	11.777	3.523-39.369	<0.001
	5-7 yrs	177	38	4.347	1.392-13.580	0.011
	>7 yrs*	40	5			
Body condition score	Good	127	33	0.258	0.098-0.679	0.006
	Moderate	204	62	0.648	0.275-1.524	0.320
	Poor*	53	14			
Production status	Milking	196	77	4.821	2.184-10.643	<0.001
	Dry off	97	23	4.308	1.691-10.974	0.002
	Pregnant*	91	9			

* Reference category, # Wald p - value; significant at $p < 0.05$.

Discussion

Prevalence of udder and teat health disorders

Out of the 384 dairy cows examined, 28.4% had one or more udder and teat health disorders. This finding was comparable to previous observations of Maina and Mulei [23] and Uddin, et al. [24] who had reported a prevalence of 29.5% and 26%, respectively. A lower result of 19.87% and 19.61% were reported by Ragab, et al. [10] and Nouh, et al. [3], respectively. This variation in the overall prevalence of UTHDs between the

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Table 4: Univariate logistic regression analysis of CM in relation to non-mastitis udder and teat problems (P≤0.05).

Variables	Categories	No. of cases	No. of mastitis cases	OR	95% CI (OR)	*p* - value#
Hyperthelia	Present	6	0	99230998.3	0.000	0.999
	Absent*	378	58			
Teat ulcer	Present	29	21	0.036	0.013-0.096	<0.001
	Absent*	355	37			
Udder wound	Present	28	19	0.068	0.024-0.189	<0.001
	Absent*	356	39			
Pendulous udder	Present	9	4	0.153	0.028-0.840	0.031
	Absent*	375	54			
Teat papilloma	Present	10	2	0.915	0.087-9.635	0.941
	Absent*	374	56			
Teat end lesions	Present	12	6	0.142	0.034-0.600	0.008
	Absent*	372	52			
Athelia	Present	4	0	99231006.3	0.000	0.999
	Absent*	380	58			
Udder abscess	Present	4	0	99230988.7	0.000	0.999
	Absent*	380	58			
Udder impetigo	Present	3	3	0.058	0.004-0.881	0.040
	Absent*	381	55			
Teat stenosis	Present	3	3	0.000	0.000	0.999
	Absent*	381	55			
Teat gangrene	Present	3	1	0.123	0.011-1.422	0.093
	Absent*	381	57			

* Reference category, # Wald *p* - value; significant at $p < 0.05$.

Table 5: Multivariate logistic regression analysis of CM in relation to teat ulcer/cracks, udder wound, teat end lesions, pendulous udder, and udder impetigo.

Variables	Categories	No. of cases	No. of mastitis cases	OR	95% CI (OR)	*p* - value#
Teat ulcer/cracks	Present	29	21	0.035	0.013-0.092	< 0.001
	Absent*	355	37			
Udder wound	Present	28	19	0.065	0.023-0.181	< 0.001
	Absent*	356	39			
Teat end lesions	Present	12	6	0.137	0.032-0.580	0.007
	Absent*	372	52			
Pendulous udder	Present	9	4	0.146	0.027-0.803	0.027
	Absent*	375	54			
Udder impetigo	Present	3	3	0.055	0.004-0.846	0.038
	Absent*	381	55			

* Reference category, # Wald *p* - value; significant at $p < 0.05$.

present and previous studies might be due to differences in the genetic composition of the study cows, their management, and geo-climatic conditions in the location of studies [24].

CM was detected in 15.1% of the cows. This is comparable with the report of Biffa, et al. [25] and Hunderra, et al. [26] who reported a CM prevalence of 15.1% and 16.11%, respectively. However, studies conducted by Tewedros [1] and Gizat, et al. [27] reported a lower prevalence of 9.4%, and 10.9%, respectively. The relatively higher prevalence of CM in this study could be the failure to employ established and reliable methods of mastitis control by the small holder dairy farmers [28].

Teat ulcers/cracks were encountered in 7.6% of the examined cows. This result is higher than the study of Uddin, et al. [24] who had reported a prevalence of 5.5%. But, lower than a 28.16% report by Nouh, et al. [3]. A much lower prevalence of 2.02% was also reported by Ragab, et al. [10]. The higher prevalence of teat ulcers/cracks in this study could be related to the climate of the study areas where there can be lots of cold and wind in summer, which leads to teat chapping, skin roughness, and dryness [29]. Chaps usually occur as horizontal cracks in the teat skin resulting in ulceration and focal necrosis of the affected teat [30]. It may also be due to the endemicity of viruses that can affect udder and teat health including bovine herpes virus 2, cowpox, pseudo cowpox, vesicular stomatitis, foot-and-mouth disease (FMD) viruses, and bovine papillomaviruses [28]. These viruses induce udder and teat blisters [29], which aggravated by the action of milking, may rupture and form ulcers.

The prevalence of udder wounds in this study was 7.3%. A higher prevalence of 15% was reported by Uddin, et al. 2009 [24]. A much lower result of 0.26%, 0.84%, and 1.4% was reported by Thomas, et al. [31], Ragab, et al. [10], and Abd-EI-Hady [21]. The higher prevalence of udder wounds in this study could be due to poor management and unhygienic practices of the smallholder dairy farmers. It could also be due to the abundance in the study area of ecto-parasites and infectious diseases that primarily affect the skin of the udder. Liver dysfunction associated with the abundance of liver flukes in the study area may account for some of the udder skin lesions due to hepatogenous photosensitization. The skin of cows affected with photosensitization appears red and edematous,

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and may later become hard, dry, and leathery, or sheets of dead skin flake off [26,32].

Of the cases, 3.1% had evidence of teat end lesions. This is lower than the report of Uddin, et al. [24] and Nouh, et al. [3] who reported a prevalence of 12.6% and 10.93% in machine milking herds, respectively. Ragab, et al. [10] reported a much lower prevalence of 0.66% teat end problems in dairy cows. Biting flies, particularly *Hydrotaea irritans* are responsible for the initial damage to the teat end [30]. Teat-end lesions may also occur as a result of the application of improperly mixed or defective teat-dip products [28,30]. The relatively lower prevalence in this study however, could be the result of hand milking practice by the farmers which exerts lower pressure on the teat sphincter as compared to machine milking which causes hemorrhage and laceration of the teat end [29].

Teat papilloma recorded in the present study is 2.6%. This is lower than the work of Uddin, et al. [24] who reported 4.5%, but higher than the study by Abd EI Hady (1993), Ragab, et al. [10], and Nouh, et al. [3] who reported a prevalence of 0.2%, 0.18%, and 1.65%, respectively. The higher prevalence in this and other studies could be related to the geo-climatic characteristics of the study areas. It has been described that areas close to low-lying river plains and forestation are more prone to warts [32].

The prevalence of pendulous udder in this study was 2.3%. This is in agreement with a 2.8% report by Abd-El-Hady [21]. While it was far lower than the 49.46 % report of Yomiyu, et al. [33] in cross-breed dairy cows. This may be because high milk-yielding dairy cows have large udder; hence, it makes it prone to rupture of suspensory ligaments of the udder that results in the so-called pendulous udder.

The prevalence of hyperthelia in this study was 1.6%. This result is comparable with the study by Abd-EI-Hady [21], Rambabu, et al. [34], and Abdel-kawey [35] who reported a prevalence of 1.4%, 2.22%, and 2.05%, respectively. But, much lower than the 36.8% prevalence of hyperthelia reported by Nouh, et al. [3]. The lowest prevalence recorded in this study might be due to differences in the genetic composition of the study cows.

Udder abscess encountered in this study was 1.00 %. This result is slightly higher than a 0.54 % report by Ragab, et al. [10] but lower than the result of Abd-El-Hady [35] who reported a prevalence of 5.8% udder abscess in dairy cows. The unhygienic conditions of animal husbandry and the ever presence of sores, rough skin, and cracks in small holder dairy herds may facilitate bacterial penetration and abscess development.

In this study teat stenosis, teat gangrene, and udder impetigo were detected each at a prevalence of 0.8%. This lower prevalence rate of the above four lesions was also supported by the report of Ragab, et al. [10] and Abd-El-Hady [35].

Relationship of risk factors with the overall prevalence of UTHDs

Cross-breed cows had a higher prevalence of UTHDs compared to the indigenous breeds (P <0.001; OR = 0.131). This is not in agreement with the work of Uddin, et al. [24] who reported a higher prevalence in indigenous cows than the cross breeds. This variation in the prevalence of udder and teat lesions between the two breeds might be due to a genetic difference in the udder and teat conformation; according to [36], cows with undesirable teats and teat tips conformation and more udder depth are more susceptible to injury and infection by pathogens. The higher prevalence in HF cross-breed cows might be because they are less resistant to most of the ectoparasites particularly ticks which in most cases predispose udder and teat to bite lesions. Moreover, crossbreeds are more susceptible to most systemic diseases such as FMD which primarily involve the udder and teat of the cows to cause ulceration and erosion of the skin [28]. In addition, HF crosses are higher-yielding cows [37], that are more susceptible to mastitis owing to the position of the teat and udder and the anatomy of the teat canal, making them prone to injury [38].

In the present study, the prevalence of UTHDs decreased with age, with the odds of having UTHDs 11.777 times greater among dairy cows between the ages of 4 and 5 than those above 7 years. Similarly, cows between the ages of 5-7 were 4.347 times at risk of getting UTHDs (P = 0.011; OR = 4.347) compared to cows above 7 years. This is in agreement with the study of Uddin, et al. [24] who reported a strong association of udder skin and teat diseases in cows aged 4-7 years than >7 years. The higher association of UTHDs in cows between 4 to 5 years of age may be related to the high susceptibility of young animals to many of the viruses such as FMDV that cause teat blister and skin erosions [30]. It has been reported that older animals exhibit higher detectable antibody titers for FMD [28]. It may also be attributed to the fact that the teat skin of young animals is more sensitive to blood-sucking flies causing pin prick wounds or bites, often with an inflammatory reaction which are obvious on the teat orifice or barrel [32]. Young animals are also very prone to extreme weather conditions, e.g. chapping which alters the teat skin condition and predisposes them to injury [30].

In this study, the significantly higher prevalence of UTHDs in milking compared to pregnant cows by the univariable analysis did not change in the final multivariable model. Milking cows were 4.8 times at risk of getting UTHDs (P < 0.001; OR = 4.821) compared to pregnant cows. This may be the result of over-milking which coupled with the rough hand of milkers can produce bruising of the teat. The primitive tendencies of rough dragging away of suckling calves could also cause injury and ulceration of the teat [39]. The higher odds of UTHDs in dry cows (P = 0.002; OR = 4.308) than in pregnant cows is likely associated with a lack of awareness and practice of dry cow therapy by dairy farmers [37].

The prevalence of UTHDs was significantly higher in cows having good BCS (P = 0.006; OR = 0.258) than in poor BCS. This is contrary to the findings of Uddin, et al, [24] and [13] who reported that well-fed animals have better udder health and are less susceptible to udder and teat disease. The higher prevalence of UTHDs in good BCS animals in this study could be attributed to the positive correlation between good BCS and milk production [28]. High milk production renders

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susceptible to mastitis owing to lowered immunity and less efficacy of phagocytic cells in high-producing cows associated with dilution [38].

Although not statistically significant, the prevalence of UTHDs was somewhat lower in zero-grazing than in free-grazing herds. The intensive stall feeding in zero-grazings that minimizes contact between animals and herds may be responsible for the relatively low prevalence [37]. Animals in the zero-grazing system are generally well-fed, have protein and mineral supplementation, and improved udder health, which may partly explain the low prevalence in such systems. The insignificant variation ($P > 0.05$) between the two systems in this study however, could be because the dairy activities in both systems are done by layman farmers, who are often poorly educated and may perform suboptimal udder and teat health management, leading to a uniform trend of UTHDs in both free-gazing and zero-grazing herds.

Relationship of CM with different non-mastitis udder and teat health disorders

The occurrence of teat ulcers/cracks was highly associated with CM ($p < 0.001$; OR = 0.035). This is in agreement with previous reports of Saloniemi [40] and Uddin, et al. [24]. The high association may be because, in cases of teat ulcers/cracks, there is an acute inflammation of one or more teats with subsequent thickening, or narrowing of the teat canal [41], which in effect weakens the physical barrier and increased bacterial colonization on the damaged teat canal [30]. It may also be due to the fact that teat ulcers/cracks create a conducive environment for the growth and multiplication of *Staphylococcus aureus*, *Streptococcus dysgalactiae*, and *Actinomyces pyogenes* and predispose to new intra-mammary infections.

In this study, udder wounds were highly associated with CM ($P <0.001$; OR = 0.065). This is in agreement with previous reports by Saloniemi [40], Uddin, et al. [24], and Radostits, et al. [28]. This could be because udder skin lesions provide a medium for the growth of the contagious pathogens which may later colonize the mammary gland to cause mastitis.

Half of the cases with a teat end lesion in this study were associated with CM ($P = 0.007$; OR = 0.137). This is in agreement with previous reports of Uddin, et al. [24] and Nouh, et al. [3]. The higher association of teat end lesions with CM could be due to the fact that teat end is the first barrier against invading pathogens, and the efficiency of teat defense mechanisms depends on the integrity of teat tissue; its impairment leads to an increase in the risk of intramammary infection [28].

Four out of nine dairy cows with a pendulous udder had a concurrent CM. This high association ($P = 0.027$; OR = 0.146) could result from dropping of the udder ventrally to the level of the hocks or lower results decrease teat-end-to floor distance, which in turn increases the risk of CM [42]. The occurrence of udder impetigo was also associated with CM ($P = 0.038$; OR = 0.055). Since the udder is already infected with *Staphylococcus aureus* in impetigo [28], it is more likely for the cow to acquire new *staphylococcal* mastitis probably through the milker's hand.

Conclusion

This study demonstrated a higher occurrence of UTHDs in 4-5 years of H-F cross-breed dairy cows kept in both free-grazing and zero-grazing systems. The result suggests that UTHDs cause a reduction in productivity and may lead to possible quarter loss and early culling of cows. UTHDs vary significantly with the breed, age, BCS, and production stage of the animals. A specific detailed investigation of the genetic predisposition of UTHDs is recommended. In addition, teat ulcer/crack, udder wound, and teat end lesions were found to a risk factors for the occurrence of CM. Most of the teat ulcers and udder wounds identified in this study were a sequel to the endemic contagious viruses such as FMD that induce teat lesions and predispose the animal to bacterial udder infections. Hence, vaccination should be considered in the effort to control UTHDs. The role of contagious bacterial pathogens in some of the UTHDs including udder abscess and udder impetigo encountered in this study couldn't be underestimated. This makes the implementation of biosecurity measures to prevent their introduction and spread within the farms a necessity. This study emphasizes rigorous and integrated herd health planning to reduce the occurrence and spread of UTHDs both at the farm and government level.

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References

1. Tewedros A. Prevalence and economic significance of bovine mastitis in and around Gondar DVM thesis Mekelle University Faculty of Veterinary Medicine, Ethiopia. 2007.

2. Ghamsari SM, Taguchi K, Abe N, Acorda JA, Sato M, Yamada H. Effect of different suture patterns on wound healing of the teat in dairy cattle. J Vet Med Sci. 1995 Oct;57(5):819-24. doi: 10.1292/jvms.57.819. PMID: 8593286.

3. Nouh R, Korittum S, Elkammar H, Barakat M. Retrospective study of teat surgical affections in dairy farms of armed forces and their treatment. Alexandria Journal of Veterinary Sciences. 2014; 40: 65-76.

4. Ramesh T, Hoque M, Kumar B, Prabhakar K. Surgical condition of udder and teats in cow. Indian Veterinary Research Institute, Izatnagar. 2005; 5: 25-27.

5. Hogeveen H, Huijps K, Lam TJ. Economic aspects of mastitis: new developments. N Z Vet J. 2011 Jan;59(1):16-23. doi: 10.1080/00480169.2011.547165. PMID: 21328153.

6. Mahdy A. Teat surgery in dairy animals. Ph.D. of Vet.Med. (surgery), Zagazig University. 1998.

7. Anderson D, Hill B, Pugh D. Diseases of the mammary gland. In: Sheep and Goat Medicine, WB. Saunders, Philadelphia. 2002; 341-357.

8. Bergonier D, de Crémoux R, Rupp R, Lagriffoul G, Berthelot X. Mastitis of dairy small ruminants. Vet Res. 2003 Sep-Oct;34(5):689-716. doi: 10.1051/vetres:2003030. PMID: 14556701.

9. Khan M, Khan A. Basic facts of mastitis in dairy animals: A review. Pak. Vet. J. 2006; 26: 204-208.

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10. Ragab G, Seif M, Abdel-Rahman M, Qutp M. Prevalence of udder and teat affections in large ruminant in Beni-Suef and El-Fayoum provinces. Journal of veterinary medical research. 2017; 24: 45-59.

11. O'Shea J. Machine milking and mastitis section 2: machine milking factors affecting mastitis-A Literature Review. Bulletin of the International Dairy Federation. 1987; 28: 5-32.

12. Peeler EJ, Green MJ, Fitzpatrick JL, Morgan KL, Green LE. Risk factors associated with clinical mastitis in low somatic cell count British dairy herds. J Dairy Sci. 2000 Nov;83(11):2464-72. doi: 10.3168/jds.S0022-0302(00)75138-1. PMID: 11104265.

13. Valde JP, Lystad ML, Simensen E, Østerås O. Comparison of feeding management and body condition of dairy cows in herds with low and high mastitis rates. J Dairy Sci. 2007 Sep;90(9):4317-24. doi: 10.3168/jds.2007-0129. PMID: 17699052.

14. CSA Central Statistical Agency. Report on livestock and livestock characteristics. The Federal Democratic Republic of Ethiopia, Private Peasan Holdings. Statistical Bulletin 570, Addis Ababa, Ethiopia. 2015.

15. SWZAO. Livestock Statistical data of South Wollo Zone, South Wollo zone agricultural office livestock and natural resource development team. 2013.

16. National Meteorology Service Agency (NMSA). Annual metrological analysis and report. Addis Ababa, Ethiopia. 2013.

17. Torell R, Bruce B, Kvasnicka B, Conley K. Methods of Determining Age of Cattle. The University of Nevada, Cattle Producer's Library - CL 712. 2003.

18. Mai HM, Irons PC, Kabir J, Thompson PN. A large seroprevalence survey of brucellosis in cattle herds under diverse production systems in northern Nigeria. BMC Vet Res. 2012 Aug 25;8:144. doi: 10.1186/1746-6148-8-144. PMID: 22920578; PMCID: PMC3482151.

19. Ferguson J. Review of body condition scoring dairy herd. 2011. http://www.txanc.org/wp-content/uploads/2011/.../Body-Condition-Scoring.pdf

20. Thrusfield M. Veterinary Epidemiology. 3rd ed. Singapore; Black well Science. 2005; 47 (11): 1117.

21. Abdel-hady A. Clinical observations on some surgical udder and teat affections in cattle and buffaloes. Scholars Journal of Agriculture and Veterinary Sciences. 2015; 2: 270-28.

22. Klaas IC, Enevoldsen C, Vaarst M, Houe H. Systematic clinical examinations for identification of latent udder health types in Danish dairy herds. J Dairy Sci. 2004 May;87(5):1217-28. doi: 10.3168/jds.S0022-0302(04)73272-5. PMID: 15290970.

23. Maina A, Mulei C. prevalence of udder and teat lesion in dairy cows in Kenya. Bull. Anim. Production. Afr. 1993; 41: 161-162.

24. Uddin M, Kamal M, Haque M. Epidemiological study of udder and teat diseases in dairy cows. Bangladesh Journal of Veterinary Medicine. 2009; 7: 332-340.

25. Biffa D, Etana D, Fekadu B. Prevalence and Risk Factors of Mastitis in Lactating Dairy Cows in Southern Ethiopia. Int. J. Appl. Res. Vet. Med. 2005; 3:189-198.

26. Hunderra B, Etana D, Ademe Z, Sintayehu A. Dairy cattle mastitis in and around Sebeta, Ethiopia, International Journal. Appel. Reser. Veterinary Medicine. 2005; 3: 432.

27. Almaw G, Zerihun A, Asfaw Y. Bovine mastitis and its association with selected risk factors in smallholder dairy farms in and around Bahir Dar, Ethiopia. Trop Anim Health Prod. 2008 Aug;40(6):427-32. doi: 10.1007/s11250-007-9115-0. Epub 2007 Dec 12. PMID: 18575970.

28. Radostits M, Gay C, Hinchcliff W, Constable P. Veterinary Medicine: A text Book of the diseases of cattle, sheep, pigs, Goats and Horses, 10thed. Saunders company, Philadelphia, U.S.A. 2006; 471-541.

29. Ohnstad I. The use of regular teat condition scoring as a milk quality management tool. Mastitis Research into Practice: Proc of 5th IDF Mastitis Conference, New Zealand. 2010; 106-109.

30. Andrews A, Blowey R, Boyd H, Eddy R. Bovine Medicine: Diseases and Husbandry of Cattle, 2nd ed. Blackwell Publishing, Oxford, UK. 2004; 363-372.

31. Thomas JD. Diseases of teats and udder. In Rebhun's diseases of dairy cattle 2nd Edn. Saunders Elsevier, St. Louis Missouri. Philadelphia. USA. 2008; 327-395.

32. Ohnstad I, Mein G, Baines J, Rasmussen M, Farnsworth R, Pocknee B, Hemling T, Hillerton J. Addressing Teat Condition Problems, Teat Club International. 2015. (ian.ohnstad@thedairygroup.co.uk).

33. Yomiyu M, Yonas G, Tesfu K. The Prevalence of Bovine Mastitis and Associated Risk Factors in Cross Breed Lactating Dairy Cows in Sebeta, Central Ethiopia. European Journal of Biological Sciences. 2017; 9: 106-112.

34. Rambabu K, Makkena S, Suresh R, Rao T. Incidence of udder and teat affections in buffaloes. Tamilnadu. Journals of Veterinary and Animal Sciences. 2011; 7: 309-311.

35. Abdel-kawey H. Prevalent surgical affections in ruminants at Qena governorate. M. V. Sc. South Valley University, Egypt. 2015.

36. Singh RS, Bansal BK, Gupta DK. Udder health in relation to udder and teat morphometry in Holstein Friesian × Sahiwal crossbred dairy cows. Trop Anim Health Prod. 2014 Jan;46(1):93-8. doi: 10.1007/s11250-013-0454-8. Epub 2013 Aug 13. PMID: 23943355.

37. Mekonnen SA, Koop G, Melkie ST, Getahun CD, Hogeveen H, Lam TJGM. Prevalence of subclinical mastitis and associated risk factors at cow and herd level in dairy farms in North-West Ethiopia. Prev Vet Med. 2017 Sep 15;145:23-31. doi: 10.1016/j.prevetmed.2017.06.009. Epub 2017 Jun 21. PMID: 28903872.

38. Hunderra S, Ademe Z, Sintayehu A. Dairy Cattle Mastitis In and Around Sebeta, Ethiopia. Intern J Appl Res Vet Med. 2005; 3:332-338.

39. Zirintunda G, Ekou J, Omadang L, Mawadri P, Etiang P, Akullo J. Occurrence of Mastitis at Cow and Udder Quarter Level in the AgroPastoral District of Soroti, Uganda. Journal of Veterinary Science & Technology. 2017; 8: 2157-7579.

40. Saloniemi H. Udder diseases in dairy cows, field observations on incidence, somatic and environmental factors, and control. Journal of Scientific Agricultural Society Finland. 1980; 52: 85-184.

41. Lokanadhamu M, Sreedevi B, Venkata R. Studies on etiology, symptomatology, diagnosis, and therapy in ulcerative thelitis of buffaloes in Andhra Pradesh (INDIA). Buffalo Bulletin. 2005; 24: 56-6.

42. Terefe S. Review on the current status of bovine mastitis and its risk factors in dairy farms of Ethiopia. Academia Journal of Microbiology Research. 2018; 6: 005-018.

43. Reda AA, Almaw G, Abreha S, Tadeg W, Tadesse B. Bacteriospermia and Sperm Quality of Cryopreserved Bull Semen Used in Artificial Insemination of Cows in South Wollo Zone, Ethiopia. Vet Med Int. 2020 Jan 23;2020:2098315. doi: 10.1155/2020/2098315. PMID: 32411339; PMCID: PMC7204317.

44. Shukla S, Dixit V, Thapliyal D, Garg S, Kumar A. A note on the incidence of bovine mastitis in relation to teat shape size and quarters affected. Indian Veterinary Journal. 1997; 74: 989-990.

Citation: Adem MA, Fenta A, Alemayehu A (2024) Prevalence and analysis of risk factors of udder and teat health disorders in free-grazing and zero-grazing small holder dairy cows in south wollo, Ethiopia. Int J Vet Sci Res 10(1): 001-008. DOI: https://dx.doi.org/10.17352/ijvsr.000143