MEDDOCS Open Access Publisher

ISSN: 2640-1223

Journal of Veterinary Medicine and Animal Sciences

Open Access | Review Article

Prevalence and Associated Risk Factors of Lameness in Dairy Farmsat Hawasa City, Sidama Regional State, Ethiopia

Mohammed Abrahim*; Chala Ahmed; Nesradin Umar; Abayineh Ayele; Ahmad in Mohammed

Livestock research coordination, Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia.

***Corresponding Author(s): Mohammed Abrahim**

Gursum, Eastern Ethiopia.

Tel: 251-922018046; Email: lukiya2151@gmail.com

Received: Dec 21, 2023

Accepted: Jan 22, 2024

Published Online: Jan 29, 2024

Journal: Journal of Veterinary Medicine and Animal Sciences

Publisher: MedDocs Publishers LLC

Online edition: http://meddocsonline.org/

Keywords: Dairy farm; Hawasa; Lactation; Lameness; Prevalence; Risk factors.

Abstract

Lameness is one of the greatest constraints to productivity, health, and welfare of dairy cattle. A cross-sectional study was carried out from March, 2022 to September, 2022 in Hawassa city with the aim of assessing prevalence and identifying associated risk factors of lameness in dairy farms. The minimum sample size was determined to be384animalsand the study was conducted on 440 animals belonged to 19 randomly selected dairy farms. All of visited farms keep their animals intensively, feed both concentrated and roughage and the floor of barn were concrete. A questionnaire format was developed on which both animal and farm level questions were prepared to collect information regarding lameness and possible risk factors. The study showed that the overall prevalence of lameness was 10.2% (45/440) in Hawassa city dairy farms. In the present study, the association of lameness prevalence with the various risk factors including milking status, herd size, sex, exercise, age, parity, milk yield and lactation stage were statistically tested. There was a significant variation in the prevalence of lameness (P< 0.05) between cattle with different milking status, age, parity, milk yield and stage of lactation. Milking animals (8%) with higher prevalence of lameness than the non-milking (2.2%). The occurrence of lameness increased with age, parity, and milk yield increment. The highest prevalence of lameness recorded in early stage of lactation. Lameness was more frequent in hind limbs (6.6%) than in forelimbs (3.6%). The main causes of lameness observed in this study were both claw overgrowth 10(2.3%), unequal claw size 10(2.3%), solar ulcer 8(1.8%), Interdigital necrobacillosis 2(0.5%), Interdigital hyperplasia 2(0.5%) and digital dermatitis 1(0.2%). There was no means of early lameness diagnosis in 94.7% of farms. Prevention and early diagnosis and treatment of lameness in cows should be part of dairy farm management practice.

Cite this article: Abrahim M,Ahmed C,N Umar,A Ayele,AI Mohammed.Prevalence and Associated Risk Factors Of Lameness In Dairy Farms At Hawasa City, Sidama Regional State, Ethiopia. J Vet Med Animal Sci. 2024; 7(1): 1137.

Introduction

Dairy production is one of the major sustenance factors for the rural economy of Ethiopia. Ethiopia holds large potential for dairy development due to its large livestock population, which comprises 59.5 million cattle, 30.70 million sheep, and 30.20 million goat populations [1]. Despite of the huge numbers of livestock resource and great potential for increased livestock production, productivity and commercialization of livestock is low [2].

The major constraint for livestock production in Ethiopia is mainly feed availability both in terms of quantity and quality [3]. Other factors are due to constraints of disease, poor management, inadequate animal health services, and poor performance of indigenous breeds. Nowadays, high demand for animal products such as meat and milk due to high growth rate of human population which can be balanced by either increasing the number of animals or improving their productivity through control of problems confronting productivities like Lameness, infertility and mastitis [4].

Lameness can be defined as the clinical manifestation of painful disorders, mainly related to the locomotor system, resulting in impaired movement or deviation from normal gait or posture. The severity of lameness can vary from stiffness or decreased symmetry of limb movement to an inability to bear weight on a limb, or even total recumbency [5]. It is a painful condition and causes economic losses through early culling [6] (Booth *et al*., 2004) and reduced milk yield [7].

The main cause of lameness is claw lesions-Claw lesions can be divided into non-infectious (such as white line disease, sole ulcer, sole hemorrhage, interdigital hyperplasia) or infectious such as digital dermatitis, interdigital dermatitis, heel erosion and foot rot [8].

Risk factors associated with lameness may include sex, environmental, management and nutrition factors. Animal (intrinsic) risk factors that cannot be changed include parity, breed, age, stage of lactation, season [9].

Bovine lameness took third ranking after reproductive failure and mastitis in modern intensive dairy production all over the world due to decreased milk production, treatment costs, involuntary culling and extending calving interval [10].

Economiclosses studies in Ethiopia showed that it was 7.33 USD (125.30 ETB) per cow, due to milk reduction and treatment cost, in Woilatasodo by Kifle Hentain 2011 and Sulayeman and Fromsa (2012) found that a mean loss in milk yield was 1.63 liter per cow per day in Hawassa dairy cattle.

In our country, there is a scarcity of information about the prevalence and the associated risk factors of lameness in dairy cows. Hence, the current study was:

- To assess prevalence of lameness in Hawassa city dairy farms
- To identify risk factors of lameness in dairy farms found Hawassa city

Literature review

Anatomy of hoof

Anatomical deformities can lead to an increased rate of lameness. Ideally, the conformation of the cow's foot should be short, steeply angled, high in the heel, and even clawed. The sole should be somewhat concave, with the majority of the weight placed over the hoof wall. It is important to know what constitutes normal claw size and conformation and improper trimming may result in sole damage [11].

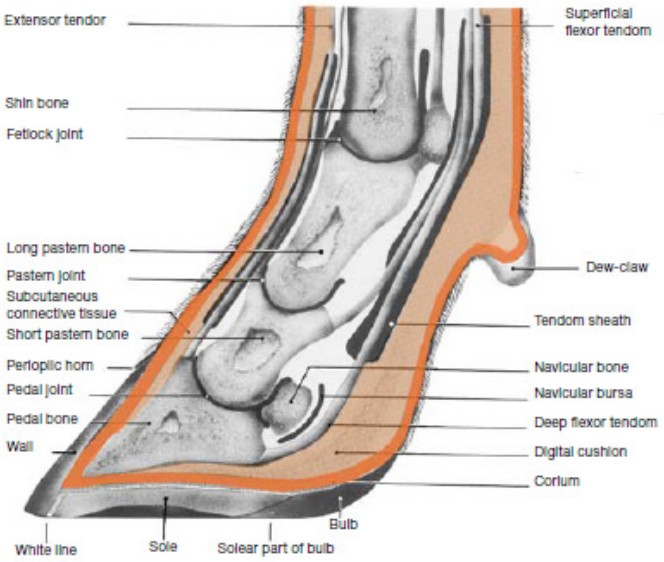

Diagram of the structure of the hoof showing the corium containing the nerves and blood vessels; along with the pedal bone, navicular bone and associated structures. Source: Toussaint-Raven, (2003)

Etiology

The factors contributing to the welfare consequences of lameness are multifaceted. Lameness arising from foot or claw lesions is one of the most painful conditions in dairy cattle [12]. About 90% of lameness disorders in dairy cows are attributed to claw lesions [13].

Claw lesions have been broadly categorized into infectious and non-infectious causes. The most common non-infectious causes are Sole Ulcers (SU), Sole Hemorrhages (SH), and White Line Disease (WLD). Digital Dermatitis (DD) and foot rot, on the other hand, are common claw disorders with an infectious etiology [14].

Disease can able to cause lameness in cattle are Contagious Bovine Pleuropneumonia (CBPP), Brucellosis, black leg, Foot and Mouth Disease (FMD) and Lumpy Skin Disease (LSD) (Refaai *et al*., 2013)

Other risk factors associated with lameness may include cow, environmental, management, and nutrition factors. Animal (intrinsic) risk factors that cannot be changed include parity, breed, age, stage of lactation, season [9].

Signs of lameness

Various gait characteristics, including as stride length, asymmetrical steps, speed, and weight distribution, have been used to detect lameness in cows. In comparison to non-lame cows, lame cows walked slower, had longer stride durations, shorter steps, and a more uneven weight distribution over the limbs [15].

Several postural changes are common in lame cows including the presentation of the limbs when standing, back presentation and the position of specific parts of the body during locomotion. Arched-back posture is associated with lameness in

cattle, both while standing and walking. Head movements or head 'bobs' (nodding, vertical movements of the head as the lame limb makes contact with the ground) have also been mentioned as a lameness characteristic in cattle [15].

Lame animals tend to shift their body weight onto non-affected limbs to reduce pain [16]. When cows are lame on both hind limbs, weight is seldom transferred to the front limbs in an attempt to reduce pressure on the painful limbs. In contrast, cows that were lame on both front limbs were found to transfer some of the weight to the hind limbs [17].

Besides locomotion, the most important natural behaviors for cow health, welfare and productivity are resting, eating and socializing. Lameness has been associated with longer lying times, longer periods of standing in alleys and decreased feeding behavior [18].

Detection of lameness

Locomotion Scoring Systems (LSS) are widely used for the detection of lame cows and monitoring lameness prevalence in dairy herds. This system entails trained personnel scoring the cow on a numerical scale by observing certain gait and postural variables during locomotion [19].

Various scoring systems are available but in [20] 5-point system, cows are visually scored from 1 (cow with a normal posture and gait) to 5 (cow is severely lame, often only bearing weight on three legs).

1 Normal with flat back Cow stands and walks with a level back and Gait is normal, 2 Mildly lame Cow stands and walks with a level back, but develops an arched back to walk with Normal gait, 3Moderately lame Arched back is evident while standing and walking. Walk with a short lame stride, 4 Lame Arched back is always evident and gait is one deliberate step at a time. Cow favours one or more legs/hooves. 5 Severely lame a three-legged cow which demonstrates an inability or extreme reluctance to bear weight on one or more limbs/hooves.

Automated lameness detection methods

The automatic methods of lameness detection broadly fall into three categories: kinematic, kinetic and indirect methods. Kinematic principle involves the assessment of changes in specific body segment at a given time interval using automated systems such as accelerometers and image processing techniques [21].

Kinetic gait analysis gather information from the force applied to the limbs as seen in ground reaction force systems such as force plates or weight recording platforms. Impaired locomotion is evaluated by measuring the force exerted on the floor by the hooves when a cow walks on the force plates, or the weight distributed when standing on the platform [22].

Indirect approach include analysis of variables not involving any gait characteristics such as thermographic imaging, feeding and grooming behaviour, social behaviour such as milking order, and production and health parameters.

cts of lameness

Causes of economic losses

The economic losses due to lameness can be director indirect costs [23]. Indirect costs include:-Reproductive disorders, Loss of milk yields due to pain whereas Direct cost includes:-Veterinary cost for treatment (including cost of milk discarded due to antibiotic therapy), extralabour cost (by the owner, employees) and Cost of early culling [24].

Reduced milk yield

The largest economic losses came from the significant reduction in milk yields and discarded milk due to antibiotic treatment. Lame cows do not go to pasture, feed less from the main bunk and spend most of their time lying down. If the cows are not able to get the proper daily nutrient intake, their body condition score will decrease and they cannot maintain their milk production [25].

Extended calving interval

Lameness has an adverse effect on the reproductive performance of the animals, because they have movement difficulties with movement. Therefore, their body condition worsens; the detection of oestrus is reduced or absent, and the cows need more services, thus the calving interval and the number of empty days increase that results in higher production costs [26].

Extra labour costs

This cost due to consuming the extra time for the farmers to treat the animals, and the animals that are affected by some sort of foot disorder walk slower, therefore, the duration of herding the animals from the field/barn up to the milking parlour will increase, that is, the milking time is lengthened [27].

Higher culling rate and reduced live weight

Foot problems can result in premature disposal of the animals from a dairy herd and it can be stated that the lameness is the third most common reason for early culling after mastitis and reproductive disorders. The slaughter value of the culled cows will be greatly reduced due to feet disorders because the lame cows usually have a significant weight loss, because the lame animals cannot graze or eat as much due to discomfort and that is why they have a lower body condition score than that of the healthy individuals [28].

Prevention and treatment of lameness

Early identification and treatment of lame cows will have shorter healing times and less deleterious effects on milk yield [29]. It is also important to prevent cows using a foot bath usually containing copper sulfate or formalin and Ration formulation is also recommended to minimize the risk of laminitis (Relun*et al*., 2012).

To prevent nutritionally induced acidosis/laminitis: depending on the grain source, the non-structural carbohydrates should not exceed 40 to 45 percent of the ration. Grains also must be properly processed to reduce ruminalupsets and maximize starch digestion. Feeding low NDF percentage levels (below 27 percent of the ration dry matter) can predispose cows to lameness, metabolic disorders, and overall poor performance [30].

Routine foot trimming at drying off period has an important influence on the development of lameness than at parturition which predisposes to coriosis (Blowey, 2011). Minimizing hoof traumas by providing cows with good, non-slip, trauma-free surfaces and keeping optimal foot hygiene (by ensuring cubicle and feed passages with adequate width (3 m and 4.5 m, respectively) regular scraping of passages, supplying ample bedding), avoiding dietary upsets that disrupt the corium and lead to excess slurry (by ensuring correct concentrate to fiber ratio, ad-

equate long fiber in the ration) and ensuring prompt treatment of lame cows to produce rapid healing with reduced recurrence rates [31].

Materials and methods

Study area

The study was carried out in Hawassa city which is found in southern Ethiopia situated 270 km south of Addis Ababa. The area has latitude of 7° 3' 0" N and a longitude 38° 28' 0" Eon the escarpment of the Great Rift Valley. The altitude ranges from 1650 to 1700 meter above sea level. The average annual rainfall of the study area ranges from 800-1000 mm and the mean temperature ranges from 11.14°C-29.1°C.The soil type of Hawassa city is lacustrine type that is medium to fine textured and alluvial soil type that includes clay, sand, and gravel. The area is mainly covered by dry savanna and bush type of vegetation includes mainly short grasses and shrubs and in some extent eucalyptus, shola and other indigenous and exotic plants (SNRSAB, 2012). The total livestock population of the study area constitute 1,721,341 cattle, 228,941 goats, 457,465 sheep and 57,643 horses, 54066 donkeys, 725, 5540 poultry and 44,492 beehives (CSA, 2010).

Study animals

The study was conducted on 440 Holstein Friesian dairy cattle belonging to 19 farms kept under intensive management system in Hawassa city. Each animal was identified by site of farm, age, parity, amount of milk per day, stage of lactation and herd size using history from the dairy personnels. The age of the animals were determined primarily based on the information obtained from the animal owners and also by looking to the dentition pattern of animals [32]. The floor system was concrete and both roughage and concentrated feed were given to animals. All visited farms have bedding for their animals but have no practice of bedding change and numbers of dung removal per day were above two in all farms included in the study.

Study design and sampling method

A cross-sectional study was carried in Hawassa city from March, 2022 to September, 2022. According to the information obtained from the agricultural office of Hawassa city, the city has 157 dairy farms. From the 157 dairy farms 19 were selected using simple random sampling technique. All animals of each selected farms were included in the study.

Sample size determination

The sample size for the study was determined based on the description of Thrust field (2005) and taking the expected prevalence of 50%, the confidence interval of 95% and 5% required absolute precision.

Then the minimum required sample size was calculated using the following formula:

$$N = \frac{(1.96)^2 Pexp\ (1-Pexp)}{d^2}$$

Where, N=sample size, Pexp=expected prevalence and d=required precision. By substituting the values in the formula and taking d=0.05;

$$N = \frac{(1.96)^2\ 0.5(1-0.5)}{(0.05)^2} = 384$$

But the study was conducted in a total of 440 animals to increase the accuracy.

Data collection

A questionnaire format was developed on which data containing both animal and farm level question to collect information. Data were collected about, floor type; frequency of dung removal, physical observing, and production status, animal's age, sex, and lactation stage, type of feed and site of lesion. Animals were examined for any abnormal gaits and posture indicative of lameness and physically examined for lesions causing lameness.

Data analysis

The data collected on the paper format was then transferred to and stored in Microsoft Excel database program and then was transferred to Stata/MP version 16 for analysis. The prevalence of lameness was calculated as the number of animals examined lame divided by the total number of animals examined. Pearson's chi-square was used to evaluate the association of different variables with the prevalence of lameness. In all the statistical analysis executed, a confidence level of 95% is used and P-value of less than 0.05 (at 5% level of significance) was considered as statistically significant.

Results

Socio-demography of farm workers

All workers of the farms included in this study have more than two years of work experience. Both male and female workers were involved to take care of the animals. The highest number of farm workers have an educational level of elementary school 31.57% (6/9), followed by diploma and above 26.3% (5/19), and the least number of workers were able to read and write 10.5(2/19). There were also 3 Illiterate works. Sixteen farms were the primary source of income (**Table 1**).

Table 1: Gender, educational status and income role of farm workers.

Respondents		Frequency	Percentage
Gender	Male	8	42.1
	Female	7	36.8
	Both	4	21.1
Educational level	Illiterate	3	15.78
	Read and write	2	10.5
	Elementary	6	31.57
	High school	3	15.78
	Diploma and above	5	26.3
Income role	Primary source of income	16	84.2
	Not primary source of income	3	15.78

Overall and farm level prevalence of lameness

The current study revealed an overall lameness prevalence of 10.2% (45/440) as shown in (**Table 2**). From the 19 observed farms, lameness has occurred in 17 farms and there was no lameness in the two farms during the study period.

Table 2: The prevalence of lameness in the individual farms examined.

Farm examined	Number of animals examined	Number of lame animal
Farm 1	10	2(20.0%)
Farm 2	24	3(12.5%)
Farm 3	10	2(20.0%)
Farm 4	6	1(16.7%)
Farm 5	6	1(16.7%)
Farm 6	9	3(33.3%)
Farm 7	52	4(7.7%)
Farm 8	22	4(18.2%)
Farm 9	15	4(26.7%)
Farm 10	12	2(16.7%)
Farm 11	24	4(16.7%)
Farm 12	20	3(15.0%)
Farm 13	20	2(10.0%)
Farm 14	5	1(20.0%)
Farm 15	6	0(0.0%)
Farm 16	56	5(8.9%)
Farm 17	129	2(1.6%)
Farm 18	7	0(0.0%)
Farm 19	7	2(28.6%)
Total	**440**	**45(10.2%)**

Prevalence of lameness with associated risk factors

In the present study, the association of lameness prevalence with the various risk factors including milking status, herd size, sex, animal allowed to exercise, age, parity, milk yield and lactation stage were figured (**Table 3**). There was a significant variation in the prevalence of lameness (P< 0.05) between cattle with different milking status, milking animals with higher prevalence of lameness than the non-milking. High prevalence rate of lameness in small herd (1-10) size than large herd size (> 50), female cows particularly high producing and more than two parity cows more suffer and also during early stage of lactation. There was no significant association between lameness (p> 0.05) and exercise, in that animal confined in the house more prone to lameness.

Site of lesions and lesions that caused lameness

From the total of 45 lameness's recorded 32(7.2 %) were due to problems on foot and 13(3%) due to legproblems. The lesions that were found causing lameness were sole ulceration 8 (1.8%), digital dermatitis1 (0.2%), claw overgrowth 10(2.3%), unequal size claw 10(2.3%) and interdigital hyperplasia and interdigital necrobacillosis 2(0.5%) (**Table 4**)

Prevalence of lameness and limbs affected

From the total of 45 animals found positive for lameness, hind limb more prone to lameness than fore limb. The occurrence of lameness and the limb affected are statistically significantly associated (**Table 5**).

Table 3: Prevalence of lameness with associated risk factors.

Risk factors		Number of animals visited	Number of positive animals	X^2(p value)
Milking status	Non milking	276	10(2.2%)	35.175(0.00)
	Milking	164	35(8%)	
Herd size	1-10	66	12 (18.2 %)	17.677(0.00)
	11-50	137	22(16.1%)	
	>50	237	11(4.6%)	
Sex	Male	54	1(1.9%)	4.703(0.030)
	Female	386	44(11.4%)	
Exercise	Allow to exercise	259	22(8.8%)	1.210(0.271)
	Not allow to exercise	191	23(12%)	
Age	< 2 years	163	0(0%)	29.497(0.00)
	>2 years	277	45(10.2%)	
Parity	None	233	1(0.2%)	51.856(0.00)
	One	31	7(1.6%)	
	>2	176	37(8.4%)	
Milk yield	4 litre	42	4(9.5%)	58.825(0.000)
	4-8 litre	78	14(17.9%)	
	8-16 litre	34	13(38.2%)	
	>16 litre	9	4(44.4%)	
Lactation stage	2 month	44	7(15.9%)	58.866(0.000)
	2-6 months	52	16(30.8%)	

	6-9 months	34	6(17.6%)	
	>9months	33	7(21.2%)	
	Dry cow	45	8(17.8%)	
Total		**440**	**45(10.2%)**	

Table 4: Site of lesions and causes of lameness.

Lesion identified		Animals examined	Positive animals
Site of lesion	leg	440	13(3%)
	Foot	440	32(7.2%)
Lesions that caused lameness	Solar ulcer	440	8(1.8%)
	Digital dermatitis	440	1(0.2%)
	Interdigital necrobacillosis	440	2(0.5%)
	Interdigital hyperplasia	440	2(0.5%)
	Both claw over growth	440	10(2.3%)
	Unequal size claw	440	10(2.3%)

Table 5: The prevalence of lameness and limbs affected.

Limb affected	Number of animal visited	Number of lame animals
Right forelimb	440	6 (1.4%)
Left forelimb	440	4 (0.9%)
Right hind limb	440	10 (2.3%)
Left hind limb	440	14 (3.2%)
Both forelimb	440	6 (1.4%)
Both hind limb	440	5 (1.1%)
Total	**440**	**45 (10.2%)**

x^2= 440.000, p=0.000

Table 6: Practice of early lameness detection and treatment.

Response		Frequency	Percentage
Means to recognize lameness	Yes	1	5.26
	No	18	94.7
Treatment condition	Farmer	3	15.78
	Vet	16	84.2

Practice of early lameness detection and treatment

Only one farm has means of recognizing early lameness from the 19 farms observed. Most of the treatments of lames were done by veterinarians (16/19) (**Table 6**). The treatment of success in the study area was 100%. Ten cows were culled in the last two years due to lameness.

Discussion

Lameness is unquestionably a major problem in dairy herds due to reduced milk yield, loss of body weight, poor fertility and, increased treatment costs. Foot lameness may be caused by a single factor such as direct trauma to the sole of the foot, but more commonly a number of factors may contribute to an increased incidence of lameness in a herd [33].

The present study, shown that the prevalence rate of lameness in Hawassa city dairy farms was 10.2%. This finding is higher than the report made by Lobago, *et al*. (2001) in that 73 (7.7%) animals out of 964 animals examined clinically exhibited clear signs of lameness in dairy cattle under urban and peri-urban production systems in Addis Ababa milk shed and by kiflehenta (2011) in Wolaita Soddo dairy farms was 4.0%. The prevalence recorded in this study was less as compared to the published prevalence of 36.8% in England and Wales [34], 28.5% in Canada [35, 36] who reported 13.9% prevalence of lameness in intensive dairy farms of Bishoftu town.

The variation in the prevalence of lameness between the various studies conducted in different countries may be described to the differences in management system, climate, study period, productivity of the cows and methods employed in lameness detection. Geographical variability and seasonal differences in incidence and prevalence of lameness is also evident [37].

This study considered risk factors that include milking status, sex, age, lactation stage, limb affected, parity, herd size, animals allowed to exercise and site of lesion. The lameness prevalence varied among the farms, ranging from 0 % to 33.3%. The difference in the prevalence of lameness between the farms might be due to the differences in awareness. There was statistically significant association between the prevalence of lameness and the examined farms (p< 0.0 5).

Lameness in milking and non-milking cows were 35(8%) and 10(2.2%) respectively the high prevalence rate in milking cows might beat tributed to mobilization of fat from various tissues including digital cushion to support milk production [4]. It was hypothesized that high milk yield leads to thinner digital cushions and exposed cows to sole ulcers and white line diseases [38]. Finally the study revealed milking status were statistically significantly associated with lameness.

During the study period, the studied farm owners had more than two years of job experience. Lameness was less likely on farms where females were in charge because females pay more attention to their animals than males. Because of the considerable weight bearing during pregnancy, the thick udder, and the nutrient enhanced diet provided during and after parturition, female animals, particularly high producing cows, are more prone to lameness than male cattle [39].

Highest prevalence of lameness (10.2%) was recorded in the age group (> 2 years) than < 2 years age group (0%). More lameness with increasing age was recorded in several studies [40, (Ward, 1999; Offer *et al*., 2000)].

This study discovered a high incidence rate of lameness in early lactation, which could be due to a lack of feed intake and weight loss, and was significantly associated with lameness. The occurrence of lameness was higher in animals that gave more than 16 litres of milk per day (44.4%).

In this study, occurrence of lameness and the limb affected are statistically significantly associated where lameness was most common in hind limbs than in forelimbs since due to hind legs are more prone to infectious causes of lameness because

of manure contaminations. Hedges, (2001) also reported that on average, approximately 80% of lame cows are lame in the hind limbs.

Singh *et al*., (1998) also reported similar findings from Punjab where the distribution of lameness in cattle was 28.9% in forefeet, 54.7 in hind feet and 16.3% in both forefeet and hind feet. The same authors have also reported more frequent foot abnormalities in the hind feet (80%) than in the forefeet (20%) in buffaloes.

The report made by Sadiq *et al*. (2017) who reported that the prevalence of lameness was not associated with parity (P> 0.05) but the present study revealed that there was significant association between occurrence of lameness and parity accordingly animal that have zero parity show only 0.2%, uniparous animal with 1.6% and animal with more than two parity show higher prevalence rate (8.4%). Possible explanations we might consider in this study is the higher prevalence of lameness estimated in animal more than two parity was supposed to be due to the longer period of stay in uncomfortable barn type and lack of any means of recognizing early cases of lameness in the farm.

Special thing we could also have to consider in this study area is believes of dairy personnel's in that when dairy cows especially lactating ones are left out for exercise milk production will be low. So that some of the dairy personnel in the study area were not willing to allow their cattle out. Thus the more the parity of animals the more they will be confined. This could lead to physical damage of hooves in more than one parity animals because of longer standing time and thus more heel and sole cracks were observed. In contrast to this [38] recommended that lameness in dairy cows can occur anytime throughout the lactation, as is true for many other diseases.

Herd size was supposed to be extrinsic risk factor associated with the prevalence of lameness in that in large and medium scale farms dairy cattle will be confined more as compared to small scale farms [41]. Similarly [11], introduced that large herds and herds with corral housing in winter (muddy conditions) were risk factors cited in California. The difference in animal level prevalence of lameness between the herd sizes was statistically significant in this study ($p < 0.05$). The majorities of farms that one or more cases of lameness observed were herd size 1-10 (18.2%), herd size 11-50 (16.1%) and herd size > 50 (4.6%) thus herd level prevalence of lameness was higher in 1-10 herd size might be giving less attention of owners to care their animals.

In addition to herd size, animal confinement was also investigated in this study supposed to be extrinsic risk factor associated with the prevalence of lameness in dairy cattle. As a result, out of 440 dairy cows considered in statistical analysis, 191of them were found to be kept under confined management systems for the whole day and 259 of them were under no confinement systems result showed that the 22 (8.8%) and 23 (12%) respectively animals kept in house or not allowed to exercise more prone to lameness than animals allowed to exercising. finally the study showed that animal confinement was not significantly associated with the prevalence of lameness. This is because confinement on hard surfaces is sufficient alone to cause a mechanical form of laminitis that with subsequent claw overloading could lead to claw disease [11].

Similarly, [34] discussed that cows being housed for 61 days or longer at the time they were locomotion scored by the visiting researcher was found to be important risk factor associated with the prevalence of lameness in dairy herds in England and Wales. This is because overstocking and animal confinement on hard surface will lead to physical damage of hooves (Shearer and van Amstel, 2011; Bicalho and Oikonomou, 2013).

Singh et al., (1998) have reported the prevalence of various foot lesions that caused abnormal gait and lameness to be 28.3% interdigital wound, 20.1% overgrown hooves, 10.6% cork screw hoof, 9.4% laminitis, 9.4% hoof crack, 8.9% white line disease and 15% miscellaneous causes (coronet swelling, gluteal degeneration and tendon injury).

In this study lesions that were found causing lameness were Sole ulceration 8(1.8%), digital dermatitis 1(0.2%), claw overgrowth 10 (2.3%), unequal size claw 10(2.3%) and interdigital hyperplasia and interdigital necrobacillosis 2(0.5%) each the high prevalence rate of lesion causing lameness in study was unequal claw size and both claw over growth this might due to poor practice of hoof trimming and lack of awareness about such factors causing lameness due to make uncomfortable animal during walking.

Lameness affects the economic performance of dairy cows in various ways, such as; Reduced milk yield due to stress, and extended calving interval; Increased costs of veterinary treatments, Mean number of days taken to recover from lameness with and without treatment is even vary and cause discarding of milk until recovery; due to treatment with antibiotics; Higher herd culling rate and hence higher replacement costs; Lower value of a culled cow: due to reduced body weight; Higher fertility cost: due to the cost of extra services; Increased labourcost: due to time spent on treatment and attention by the herdsman. Therefore farmers should give attention to lactating cows for early detection and prevention of lameness to minimize animal suffer.

Conclusion and recommendations

Lameness can be defined as the clinical manifestation of painful disorders, mainly related to the locomotor system, resulting in impaired movement or deviation from normal gait or posture. The present study indicated the overall animal level prevalence was found to be 10.2 % and varied among the farms ranging from 0 to 33.3%. The study found that the hind limb of dairy cattle is more prone to foot lesions than the forelimb and milking cows are more suffering to lameness. High occurrence of lameness in early lactation period and poor means of recognizing early cases of lameness in the farm. The study also revealed that no practice of left out their animals for exercise particularly more parity animal and lameness is an economically important disease of dairy cattle that reduces milk production significantly and except animals allowed to exercise, the other risk factors includes sex, age, herd size, milk yield, limb affected, lactation stage and parity of animals were found related to the prevalence of lameness in dairy farms at Hawassa city.

Based on this conclusion, the following recommendations were forwarded:-

- Trainings to farmers and animal health professionals about means of early recognize of lameness should be given.
- Caring animals during early lactation period by improving management system.
- Attention to the hygiene of dairy cattle is essential to reduce incidence of lameness associated with limb affected

particularly hind limb.

- Creation of awareness to owner about the importance of allowing animal to exercise to reduce incidence of lameness.

Acknowledgments

First and foremost, I want to thank Almighty God for being with me throughout my life. Then, I would like to highly impressed to my heartfelt thanks and gratitude to my advisors Dr.Abayineh ayele and Ahmad in Mohammed (co advisor) for their invaluable comments, kindly advise and devoting of their time during preparation of this paper.

Then my thanks go to Hawassa university specially faculty of veterinary medicine and farms owners in Hawassa city for their willingness and collaboration.

Finally I would like to extend my appreciation to my family for their endless love and support throughout my academic career. Furthermore, I would like to thank everyone who helped me to complete my research paper.

8. Annexes

Annex 1: Questionnaire

General information about the farm

Part 1

Name of farm ----------owner's name----------year of service----------place---

1 Herd size------numbers of cows----------Heifers------ Bulls----------Calves---------

2 Types of production system intensive-------semi-intensive-----extensive--------

3 Are the animals allowed to exercises yes -------No----------

4 Types of floor of the stall concrete-----Soil-------Stone layered------Wood layered--------

5 Dung removal time per day once------- Twice------Threes and above-------

6 Is there bedding yes------ No--------- If yes when is the bedding changed every day------- Every other day----After two days-------

7 Is the farm primary source of income yes --------No -------

8 Who take cares of animals; females ----- Males--------- Both---------

9 Educational level of animal take cares; illiterate-------- Reading and writing---- Elementary---High school------- Diploma and above--------

10 Working experience of animal take cares; months------ One year ------Two years and above----

11 Types of animal the animals are feed; concentrate------ Roughage----- Roughage +concentrate------

12 Water supply; adlibitam------ Once per aday------ Twice per aday------Three --------

13 Is there any means of recognizing early cases of lameness in the farm Yes ------No--------

14 Are lame animals treated; Yes-----No------

If yes who treats farmer------Veterinarian------

15 Was treatment successful? Yes------No----------

16 How many animals were culled due to lameness during the last two years? No-------

Part 2

Individual animal record

1 Name of (ear tag no) of the cow---------- age---------parity--------

2 lactation stage; upto 2 months----2-6 months-----6-9 months----above 9 months-----dry cow----

3 Milk yield; 4 litre/day----4-8 litre/day----8-16 litre/day----->16 litre/day----

4 Is the cow affected by lameness? Yes----- No ----------

5 With what is the lameness associated? Leg--------- foot---------

6 lesion of the foot; solar ulcer RF-------RH-------LF---------- LH--------

Digital dermatitis RF-------RH--------LF----------LH------

Inter digital necrobacillosis RF------RH--------LF------LH----

Interdigital hyperplasia RF------RH-------LF------LH------

Both claw overgrowth RF----------RH------LF------LH-----

Unequal size claw RF--------RH------LF---------LH-----

References

1. CSA Agricultural Sample Survey 2016/2017: Report on Livestock and Livestock Characteristics (private peasant holdings). Addis Ababa Ethiopia. 2017; 2: 9-12.

2. Mebrate G, Tewodros A, Dawit A, et al. Dairy Production in Ethiopia Existing Scenario and Constraints. Biomed J Sci & Tech Res. 2019; 16: 2019.

3. Mengistu A, Kebede G, Feyissa F, Assefa G, et al. Review on major feed resources in Ethiopia: Conditions, challenges and opportunities. Academic Research Journal of Agricultural Science and Research. 2017; 5: 176-185.

4. Green LE, Hedges VJ, Schukken YH, Blowey RW, Packington AJ, et al. The impact of clinical lameness on the milk yield of dairy cows. Journal of dairy science. 2002; 85: 2250-2256.

5. Maas J. Musculoskeletal abnormalities. In: Smith B.P., editor. Large Animal Internal Medicine Mosby, Inc; ST. Louis, MS, USA. 2009.

6. Booth CJ, Warnick LD, Gröhn YT, Maizon DO, Guard CL, et al. Effect of lameness on culling in dairy cows. Journal of dairy science. 2004; 87: 4115-4122.

7. Amory JR, Barker ZE, Wright JL, Mason SA, Blowey RW, et al. Associations between sole ulcer, white line disease and digital dermatitis and the milk yield of 1824 dairy cows on 30 dairy cow farms in England and Wales from February 2003–November 2004. Preventive veterinary medicine. 2008; 83: 381-391.

8. Greenough PR. Bovine laminitis and lameness: A hand on approach. Elsevier Health Science. 2007.

9. Boettcher PJ, Dekkers JCM, Warnick LD, Wells SJ, et al. Genetic analysis of clinical lameness in dairy cattle. Journal of dairy sci-

ence.1998; 81: 1148-1156.

10. Garbarino EJ, Hernandez JA, Shearer JK, Risco CA, Thatcher WW, et al. Effect of lameness on ovarian activity in postpartum Holstein cows. Journal of dairy science. 2004; 87: 4123-4131.

11. Shearer J. Laminitis-More than How You Feed Your Cows. Proceedings 2nd Florida Dairy Road Show, p.8.Somers, JGCJ, Frankena K, Noordhuizen-Stassen, EN. and Metz, JHM.(2003):. Prevalence of claw disorders in Dutch dairy cows exposed to several floor systems. Journal of dairy science. 2005; 86: 2082-2093.

12. Whay HR, Shearer JK, et al. The impact of lameness on welfare of the dairy cow. The Veterinary Clinics of North America. Food Animal Practice. 2017; 33: 153-164.

13. Manske T. Hooflesions and lameness in Swedish dairy cattle. 2002; 135: 135.

14. Potterton SL, Bell NJ, Whay HR, Berry EA, Atkinson OCD, et al. A descriptive review of the peer and non-peer reviewed literature on the treatment and prevention of foot lameness in cattle published between 2000 and 2011. The veterinary journal. 2012; 193: 612-616.

15. Flower FC, Sanderson DJ, Weary DM, etal. Effects of milking on dairy cow gait. Journal of dairy science. 2006; 89: 2084-2089.

16. Neveux S, Oostra J, de Passille AM, Rushen J, et al. June Validating on-farm tools for their ability to detect lameness in dairy cows. In Proceedings of the 37th International congress of the ISAE, BanoTherme, Italy. 2003; 24-28.

17. Pastell M, Hautala M, Poikalainen V, Praks J, Veermäe I, et al. Automatic observation of cow leg health using load sensors. Computers and Electronics in Agriculture. 2008; 62: 48-53.

18 Blackie N, Bleach E, Amory J, Scaife J, et al. Impact of lameness on gait characteristics and lying behaviour of zero grazed dairy cattle in early lactation. Applied Animal Behaviour Science. 2011; 129: 67-73.

19. Main DCJ, Leach KA, Barker ZE, Sedgwick AK, Maggs CM, et al. Evaluating an intervention to reduce lameness in dairy cattle. Journal of dairy science. 2012; 95: 2946-2954.

20. Sprecher DEA, Hostetler DE, Kaneene JB, et al. A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. Theriogenology. 1997; 47: 1179-1187.

21. Van Hertem T, Maltz E, Antler A, Romanini CEB, Viazzi S, et al. Lameness detection based on multivariate continuous sensing of milk yield, rumination, and neck activity. Journal of dairy science. 2013; 96: 4286-4298.

22. Chapinal N, De Passillé AM, Rushen J, Wagner SA. Effect of analgesia during hoof trimming on gait, weight distribution, and activity of dairy casttle. Journal of dairy science. 2010; 93: 3039-3046.

23. Warnick LD, Janssen D, Guard CL, Gröhn YT, et al. The effect of lameness on milk production in dairy cows. Journal of dairy science. 2001; 84: 1988-1997.

24. Bruijnis MRN, Hogeveen H, Stassen EN, et al. Assessing economic consequences of foot disorders in dairy cattle using a dynamic stochastic simulation model. Journal of dairy science. 2014; 93: 2419-2432.

25. DEFRA. Dairy cattle lameness Practical solutions to a persistent problem. 2008.

26. Barkema HW, Westrik JD, Van Keulen KAS, Schukken YH, Brand A, et al. The effects of lameness on reproductive performance, milk production and culling in Dutch dairy farms. Preventive veterinary medicine. 1994; 20: 249-259.

27. Kossaibati MA, Esslemont RJ, et al. The costs of production diseases in dairy herds in England. The veterinary journal. 1997; 154: 41-51.

28. Egger-Danner C, Cole JB, Pryce JE, Gengler N, Heringstad B, et al. Invited review: Overview of new traits and phenotyping strategies in dairy cattle with a focus on functional traits. Animal. 2015; 9: 191-207.

29. Alawneh JI, Laven RA, Stevenson MA. Interval between detection of lameness by locomotion scoring and treatment for lameness: A survival analysis. The veterinary journal. 2012; 193: 622-625.

30. Van Amstel S, Shearer J. Manual for treatment and control of lameness in cattle. John Wiley & Sons. 2008.

31. Ishler V, Wolfgang D, Griswold D, et al. Prevention and control of foot problems in dairy cows. Department of Dairy and Animal Science and Department of Veterinary Science, College of Agricultural Sciences and Cooperative Extension. 1999; 1-20.

32. Mushonga B, Shinexuugi I, Mbiri P, Samkange A, Madzingira O, et al. Applicability of teeth examination as a tool for age estimation in a semi-arid cattle production environment in Namibia. Tropical animal health and production. 2020; 52: 1649-1654.

33. Vermunt JJ, Malmo J. Description and treatment of claw lesions and diseases in cattle, Proceedings of the Society of Dairy Cattle Veterinarians of the NZVA Annual Conference, Proceedings of the Australian and New Zealand Combined Dairy Cattle Veterinarians Conference - incorporating the 20th Annual Seminar of the Society of Dairy Cattle Veterinarians of the New Zealand Veterinary Association. 2003; 249-267.

34. Barker ZE, Leach KA, Whay HR, Bell NJ, Main DCJ, et al. Assessment of lameness prevalence and associated risk factors in dairy herds in England and Wales. Journal of dairy science. 2010; 93: 932-941.

35. Ito K, Von Keyserlingk MAG, LeBlanc SJ, Weary DM, et al. Lying behavior as an indicator of lameness in dairy cows. Journal of dairy science. 2010; 93: 3553-3560.

36. Abunna F, Zeben I, Waketole H, Mamo G. Epidemiology of lameness in extensive and intensive dairy farms in Bishoftu town, central Oromia, Ethiopia. Biomirror. 2017; 8.

37. Espejo LA, Endres MI, Salfer JA, et al. Prevalence of lameness in high-producing Holstein cows housed in freestall barns in Minnesota. Journal of dairy science. 2006; 89: 3052-3058.

38. Bicalho RC, Machado VS, Caixeta LS, et al. Lameness in dairy cattle: A debilitating disease or a disease of debilitated cattle across-sectional study of lameness prevalence and thickness of the digital cushion. Journal of dairy science. 2009; 92: 3175-3184.

39. Das BR. Claw affections associated with lameness in cattle (Doctoral dissertation, PhD Thesis, Department of Surgery and Obstetrics, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh).) 2004.

40. Manske T, Hultgren J, Bergsten C, et al. Prevalence and interrelationships of hoof lesions and lameness in Swedish dairy cows. Preventive veterinary medicine. 2002; 54: 247-263.

41. Cook NB, Hess JP, Foy MR, Bennett TB, Brotzman RL, et al. Management characteristics, lameness, and body injuries of dairy cattle housed in high-performance dairy herds in Wisconsin. Journal of Dairy Science. 2016; 99: 5879-5891.

42. Enting H, Kooij D, Dijkhuizen AA, Huirne RBM, Noordhuizen-Stassen EN. Economic losses due to clinical lameness in dairy cattle. Livestock production science. 1997; 49: 259-267

43. Flower FC, Sanderson DJ, Weary DM, et al. Hoof pathologies influence kinematic measures of dairy cow gait. Journal of dairy science. 2005; 88: 3166-3173.

44. Lehoczky J. Treatment of foot disorders of infectious origin part II (in Hungarian). 2009.

45. Manske T, Hultgren J, Bergsten C, et al. The effect of claw trimming on the hoof health of Swedish dairy cattle.Preventive veterinary medicine. 2002; 54: 113-129.

46. Ozsvari L, Barna R, Visnyei L, et al. Economic losses due to bovine foot diseases in large-scale Holstein-Friesian dairy herds. Magyar Allatorvosok Lapja. 2007; 129: 23-28.

47. Pingali P. Agricultural policy and nutrition outcomes–getting beyond the preoccupation with staple grains. Food security. 2015; 7: 583-591.

48. Thrusfield M. Veterinary epidemiology (3rdedn) Blackwell Science. United Kingdom. 2005; 158.

49. Vanegas J, Overton M, Berry SL, Sischo WM, et al. Effect of rubber flooring on claw health in lactating dairy cows housed in free-stall barns. Journal of dairy science. 2006; 89: 4251-4258.

50. Wilson-Welder JH, Alt DP, Nally JE, et al. Digital dermatitis in cattle: Current bacterial and immunological findings. Animals. 2015; 5: 1114-1135.