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Preliminary major health problems and associated risk factors of calves' mortality in selected districts of Ilubabor and Jimma Zones, Ethiopia

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Abstract
Introduction: Even though good beginnings of initiatives on calves to improve blood level of local breeds in Ethiopia through artificial insemination, health problems and calf mortality are becoming a bottle neck on livestock production and livelihood of poor farmers. The aim of the study was to know preliminary major health problems and associated risk factors of calves' mortality. Cross-sectional study was conducted on calves from February to June 2023. Binary outcome Logistic Regression data analysis was used to summarize using Stata software version 13. Cluster random sampling technique was used to accomplish the study.
Result: A total of 218 farmers and farm owners were interviewed and feacal samples, ectoparasites and skin lesions were collected from 389 calves. The gastrointestinal parasite infection was significantly related with body condition, age and breeds of calves (p<0.05). The ectoparasites infestation was significantly related with districts, body condition, age and breeds of calves (p<0.05). The variation of ring worm prevalence among risk factors ages, breeds and farms were statistically significant (p<0.05). There were a significant difference in morbidity rate and crude mortality rate between zones, breeds, weaning ages and farm production system (p<0.05).
Conclusion: In study areas gastrointestinal parasites, ectoparasites and ring worms were major health problem of calves and responsible for high morbidity rate and crude mortality rate. Therefore, awareness on diseases prevention and husbandry practices should be made. Also, Agricultural Bureau and all stakeholders should work cooperatively to reduce morbidity and mortality of calves.

Keywords: Cross-sectional, Ethiopia, calves, mortality, health problems

Introduction
Ethiopia is first by livestock population from Africa, with an estimated 70.3 million cattle, 9.12% of which are calves under the age of six months [1]. Dairy and beef farming in urban and peri-urban regions is growing swiftly across the country as a result of rising urbanization and increased demand for meat, milk and milk products, even though the extensive production system is still the country's leading method of livestock husbandry [2]. Urban and peri-urban dairies are semi-intensive to intensive production systems that maintain exotic and cross-bred cows with comparatively better management practices [3]. Although the dairy industry has grown significantly in recent years, it is reportedly suffer from inefficient reproduction, a low rate of calf survival, high calf morbidity and mortality, and a high incidence of diseases [4]. Inadequate quality feed, poor husbandry practices, and reduced attention to young stock management as a result of diverse responsibilities in small-scale mixed farming systems increase calf morbidity and mortality in tropical regions [5].
Parasitic infection of cattle is major factors responsible for economic losses through reduction in productivity and increased mortality in heavily parasitized animals [6]. Gastrointestinal parasites are the most important agents causing disease in calves [7]. Calves are most vulnerable to gastrointestinal parasites in their first grazing season, although yearlings and, less often, adults are sometimes affected [8]. Gastrointestinal parasitic infections, nematode and Eimeria species, play a key role in the economic losses in that they cause low productivity, delayed growth, declined weight gain and death of the animal, and significant expenses of treatment [7].

Ectoparasites; commonly ticks, mites, flee and lice affect the host by inflammation and through the damage they inflict on the skin and on the host physiology. They are also very important in different disease transmissions such as parasitic, bacterial, rickettsial, and viral diseases to man and animals [9]. The damages inflicted by ectoparasites are annoyance, stress, or blood loss. Lice and tick worry are recognized conditions that reduce feed efficiency and weight gains in livestock [9]. In Ethiopia, ectoparasites in ruminant causes a serious economic loss to small holder farmers, the tanning industry and the country as a whole through mortality of the animals, decreased production, down grading and rejection of skin and hide [10]. Dermatophytosis in domestic animals is an infection of keratinized tissues by one of the two genera fungi, Microsporum and Trichophyton [11]. Although information is lacking in Ethiopia, it is believed to pose the greatest economic and human health consequence in most developed countries [12]. Tartor [13] described that 84.91% calves showed ringworm lesions were positive for fungal elements in direct-microscopy and 79.72% were positive in culture. The detection rates were 84.91% by direct microscopy and 79.72% by fungal culture. As researchers described terbinafine and miconazole were effective antifungal drugs for dermatophytes followed by itraconazole and griseofulvin [14].

Calf morbidity and mortality are the two most important constraints for improving peri-urban and urban dairy production in Ethiopia. Annual calf mortality in urban and peri-urban dairy production systems is reported to be in the range of 15.3%-25% [15]. Similarly, 62% morbidity and 22% mortality are reported in market-oriented smallholder dairy farms of central Ethiopia [16]. However in the current study areas there has been no any information on calves' health problems. Therefore the aim of this study was to provide the following objectives.

1. To identify preliminary major health problems of calves
2. To know the magnitude of calf morbidity and mortality
3. To identify associated risk factors of calves' morbidity and mortality

Materials and Methods

Description of Study Area

This study was conducted in purposively selected districts of Ilubabor and Jimma zones (Figure 1). Ilubabor Zone is located in south-western part of Oromia, Ethiopia. In Ilubabor zone the study was done in three purposively selected districts of Metu, Ale and Yayo with cattle population of 146635, 70553 and 63769 respectively (Zone Agriculture office, 2023). In Jimma zone the study was done in two purposively selected Jimma city, Dedo and Gomma districts with cattle population of 67808, 435281 and 271332 respectively (Zone Agriculture office, 2023).

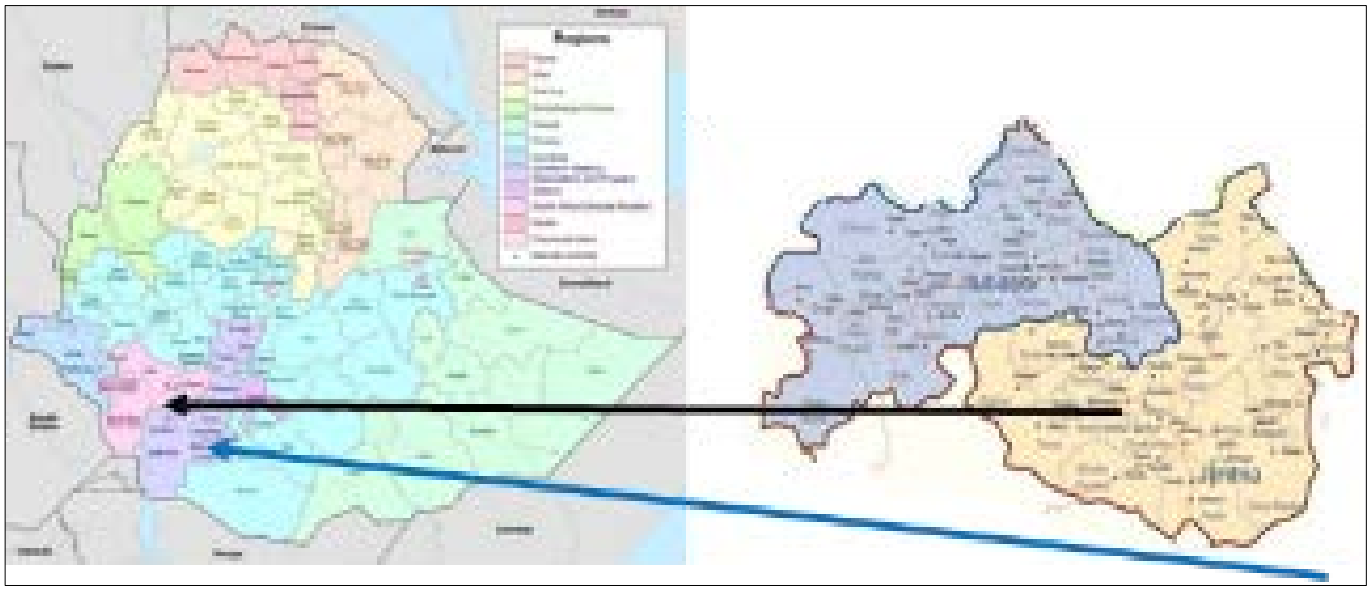

Fig 1: Map of study area

Study population

The study population consisted of local and cross breeds of calves. The target population was calves up to 12 months of age in purposively selected districts and Jimma city. The study population was all calves of 12 months in randomly selected kebele and households. Calves were categorized by: weaning age (< 6 months, 6-12 months), sex (Male, Female), body condition (good, poor), breed (cross, local), mixing different age group (yes, no), cleaning activity (regular, irregular), farm type (extensive, intensive, semi intensive), floor of house (soil, concrete, made from local tree), source of drinking water(tap, hand dung well, river) and colostrum feeding (suckling, hand feeding). Semi-structured questionnaire survey of selected household owner was used to assess factors associated with calf morbidity and mortality.

Study Design and Sampling method: A cross-sectional study was conducted from February, 2023 to June, 2023 to know the status of calf morbidity and mortality and also to assess risk factors as well. All calves of farmers or in farm of one year age was observed for any health problem and feacal samples and skin scraping for skin lesions were collected and submitted to regional laboratory to know prevalence and major gastrointestinal parasites of calves. Also all calves of owners were assessed for ectoparasites and submitted to regional laboratory to identify the genera of those ectoparasites.

Sample Size Determination and Sampling Technique

The sample size was determined according to [17] for cluster random sampling using an expected animal level prevalence of 50% and a desired absolute precision of 5% with 95% CI, since there was no previously expected prevalence in the study area.

$$n = t^2 * p * q \left[\frac{*DEFF}{d^2} \right]$$

Where, n = sample size, t = linked to 95% confidence interval for cluster sampling (2.045), p = expected prevalence (fraction of 1), q = 1-p (expected non-prevalence), d = relative desired precision, DEFF = Design Effect =1. Accordingly, 389 local and cross breeds of calves were sampled and assessed for ecto parasites and scraped if any skin lesion found. First districts were purposively selected based on calves morbidity and mortality problem reports. In Metu, Ale, Yayo, Gomma, Jimma city and Dedo districts kebele and households or farms were randomly selected. At the 2nd stage household of each kebele was randomly selected. Finally, all caves of one year age were examined for ectoparasite and fecal sample was collected except those did not start feeding grass.

Sample Collection and Transportation

Sedimentation method

A total of 389 fresh fecal samples were collected from the rectum of the animals by wearing plastic hand gloves. The fecal samples were placed in a screw capped universal bottles, preserved with 10% of formalin and transported to Bedelle Regional Veterinary Laboratory. The fecal samples were examined by using standard sedimentation techniques. The presence of at least one parasite egg in either of the tests indicates that the result is positive. The egg morphology, appearance, size, color and presence of blastomeres were used to identify the parasites.

Tick collection and preservation

Firstly, the selected calves were properly restrained and checked for any tick infestation. Ticks were removed from different body regions of the host skin for identification using hand manually [18]. The collected ticks were preserved in separate pre-filled universal bottles with 70% alcohol before transportation to Bedelle regional veterinary laboratory for identification their genera. The collected ticks were identified in to different genera level by using stereomicroscope, according to standard identification keys given by Walker [19]. Accordingly the most prevalent tick genera was Boophilus, which followed by Ambyleyoma.

Lice collection and identification

Those detected lice that are unidentified during clinical examination was collected by forceps/hand picking, with hairs from their attachment site, put into a clean separate container (universal bottles), labeled and kept preserved with 70% ethyl alcohol before transportation to Asella regional veterinary laboratory for detailed laboratory examination as described by Urquhart [20]. Then the collected ectoparasites were examined by stereomicroscope and identification was performed according to the identification key given by Wall and Shearer [21]. Linognathus vituli and Damalina bovis were among the major lice species identified in different studies.

Skin scraping lesions

The samples of skin scraping were collected from the periphery of the lesion after cleaning with 70% ethyl alcohol in sterile falcons. Samples were collected from infected animal's suffering from lesions suggesting ring worm infections (Circumscribed areas of hair loss filled with raised white scales on head, neck or all over the body). One or two drops of 20% KOH (potassium hydroxide) were placed on a microscopic slide and a small amount of the specimen was added and then, the slide was gently passed through a low flame and covered by a cover slip. After 2 h, the specimen was examined for the presence of hyphae under a light microscope (40 x objectives) according to [22].

Data Management and Analysis

All data obtained from the field was recorded in the record sheet format and later entered into Microsoft Excel worksheet and Binary outcome Logistic Regression data analysis was used to summarize using Stata software version 13. The overall prevalence was calculated by dividing positive samples by the total number of examined samples and multiplied by a hundred. The Odds Ratio was used to assess the association between the dependent and independent variables. P-value of less than 0.05 ($p<0.05$) was set for the significance of statistical associations [23].

Results

During the study period 164 small holder farmers, 31 semi intensive dairy farm owners and 23 intensive dairy farm owners with total 561 calves up to 12 months age they owned were interviewed. A total of 389 caves were observed for any ectoparasite infestation, feacal samples and skin lesion samples were collected from up to one year.

Prevalence of gastrointestinal parasites

Out of 389 fecal samples collected 148 (38%) were positive for eggs of different species of gastrointestinal parasites in both Jimma and Ilubabor zones. The prevalence was 43.8% and 31.9% in Ilubabor and Jimma zones respectively. The gastrointestinal parasite infection was significantly related with zone, body condition, age and breeds of calves. The odds of gastrointestinal parasite infection was 3.4, 2.6 and 2.75 in good body condition, 6-12 months ages and local calf breeds respectively ($p<0.05$) (Table 1). However, there was no significant association among districts and sex ($p>0.05$) (Table 1).

Table 1: Risk factors associated with gastrointestinal parasites

Variables	No. of calves examined	No. infected	Prevalence (%)	OR (95% CI)	P.V
Zone					
Ilubabor	201	88	43.8	2.3(1.45-3.73)	0.013
Jimma	188	60	31.9	RF	RF
Total	389	148	38		
District					

Metu	69	27	39.1	0.74(0.512-1.290)	0.234
Ale	71	33	46.5	1.4(0.83-2.16)	0.062
Yayo	61	26	42.6	0.97(0.47-1.59)	0.187
Gomma	62	22	35.5	0.64(0.42-1.15)	0.143
Jimma city	55	18	32.7	1.2(0.65-1.79)	0.057
Dedo	71	19	26.8	RF	RF
Body condition					
Good	162	81	50	3.4(2.13-5.57)	0.029
Poor	227	67	29.5	RF	RF
Age					
6-12 month	215	91	42.3	2.6(1.74-3.78)	0.040
< 6 month	174	57	32.8	RF	RF
Sex					
Female	223	90	40.40	1.33(0.74-2.45)	0.109
Male	166	58	34.90	RF	RF
Breed					
Local	251	103	41	2.75(1.84-3.91)	0.004
Cross	138	45	32.6	RF	RF

Prevalence of ectoparasites

Out of 389 calves observed 280 (71.98%) were positive for either one or more of ectoparasites in both Jimma and Ilubabor zones. The prevalence was 89.55% and 53.20% in Ilubabor and Jimma zones respectively (Table 3). Ticks, fleas and lice were known calves' ectoparasite infestation with 54.5% (212/389), 32.4% (126/389) and 3.3% (13/389) prevalence respectively (Table 2).

The ectoparasites infestation was significantly related with study area, body condition, age and breeds of calves ($p<0.05$). The odds of ectoparasites infestation was 2.8, 2.2 and 3.5 in good body condition, 6-12 months ages and local calf breeds respectively ($p<0.05$) (Table 3). However, there was no significant association between sex ($p>0.05$) (Table 3).

During surveillance two ticks genera were identified namely Boophilus and Ambyleyoma. Boophilus was the most tick genera that infested calves. Biting lice (*Damalinia bovis*) and sucking lice (*Linognathus vituli*) were identified during surveillance.

Table 2: Ectoparasite prevalence

Zone	District	No. of calves sampled	Ticks	Fleas	Lice
Ilubabor	Metu	69	45	36	1
	Ale	71	62	35	1
	Yayo	61	25	39	0
Total		201	132	110	2
Jimma	Gomma	62	38	7	2
	Jimma city	55	0	0	0
	Dedo	71	42	9	9
	Total	188	80	16	11
Grand total		389	212	126	13

Table 3: Risk factors associated with ectoparasite infestation

Variables	No. of calves examined	No. calves infested	Prevalence	OR (95% CI)	P.V
Zone					
Ilubabor	201	180	89.55	4(3.10-5.68)	0.000
Jimma	188	100	53.20	RF	RF
Total	389	280	71.98		
District					
Metu	69	58	84.10	3.4(2.32-5.18)	0.013
Ale	71	67	94.40	3.79(2.52-5.65)	0.004
Yayo	61	55	90.20	4.2(2.86-6.29)	0.001
Gomma	62	44	70.97	2.69(1.59-3.81)	0.023
Dedo	71	56	78	3.3(2.29-4.89)	0.019
Jimma city	55	0	0	RF	RF
Body condition					
Good	162	152	93.80	2.8(1.34-3.94)	0.021
Poor	227	128	56.40	RF	RF
Age					
6-12 month	215	160	74.40	2.2(1.13-3.67)	0.039
< 6 month	174	120	68.97	RF	RF
Sex					
Male	166	128	77.11	1.3(0.88-1.95)	0.102
Female	223	152	68.16	RF	RF
Breed					
Local	251	223	88.84	3.5(2.23-5.64)	0.031
Cross	138	57	41.3	RF	RF

Prevalence of ring worm

According to the results of this study among 389 calves, 16 of them (4.10%) were clinically positive for skin ringworm lesions (Figure 2). After microscopic examination, 11 calves (2.83%) were positive for dermatophyte infections. However skin lesions were negative for mangemitis and Dermathophilosis. The variation of ring worm prevalence among risk factors ages, breeds and farms were statistically significant (p<0.05) (Table 4).

Fig 2: Ring worm infection

Table 4: Prevalence and risk factors associated with ring worm

Variables	No. of calves Examined		No. calves with clinical lesion (Ring worm)	No. of positive calves (Direct Microscopic examination)		OR (95% CI)	P.V
			Prev (%)	Prev (%)			
Zone							
Ilubabor	201		7 3.5	4 2		0.86(0.57-248)	0.166
Jimma	188	9	4.8	7	3.7	RF	
Total	389	16	4.10	11	2.83		
District							
Metu	69	5	7.3	3	4.4	1.2(0.87-2.98)	0.118
Ale	71	1	1.4	1	1.4	0.74(0.43-2.31)	0.220
Yayo	61	1	1.6	0	0	0.79(0.65-3.12)	0.451
Gomma	62	5	8.1	4	6.5	1.44(0.96-3.22)	0.077
Dedo	71	4	5.6	3	4.2	1.35(1.02-3.04)	0.104
Jimma	55	0	0	0	0	RF	
City							
Body							
condition							
Good	162	7	4.3	5	3.1	1.1(0.85-2.86)	0.740
Poor	227	9	4	6	2.64	RF	
Age							
< 6 month	174	12	6.9	8	4.60	3.6(2.42-5.62)	0.027
6-12 month	215	4	1.9	3	1.4	RF	
Sex							
Male	166	7	4.2	4	2.4	0.97(0.71-2.86)	0.316
Female	223	9	4	7	3.1	RF	
Breed							
Local	251	14	5.6	11	4.38	4.3(3.42-7.85)	0.002
Cross	138	2	1.2	0	0	RF	
Farm							
Extensive	287	15	5.22	11	3.8	6.3(3.64-10.52)	0.000
Intensive	102	1	0.98	0	0	RF	

Morbidity and mortality of calves and semi intensive

Generally the morbidity rate and crude mortality rate were 34.90% (196/561) and 12.30% (69/561) respectively (Table 5). There was a significant difference in crude mortality rate between Jimma zone (13.75%) and Ilubabor zone (10.96%), with an Odds ratio of 1.8 higher mortality risks in Jimma zone.

Calves in Jimma zone 1.8 more likely at higher risk of morbidity and mortality. The odds of calf morbidity and mortality were 2.02 times more likely in cross breeds in compare to local breeds which was statistically significant. The odds of calf morbidity and mortality were 2.67 times more likely in calves weaned in age of less than six months. The odds of calf morbidity and mortality were 2.2 and 1.66 times more likely in calves in intensive production and semi intensive production system respectively. The odds of calf morbidity and mortality were 2.04 times more likely in calves feed colostrums by hand (Table 5). While risk factors like: districts, body condition, sex, mixing different age groups, cleaning activities, floor of the house and source of water were statistically not significant (p>0.05, Table 5)

Table 5: Risk factors associated with calves' morbidity and mortality

Variables Area	No. of calves of the owners	No. of calves diseased	No. calves died	Morbidit rate	Crude mortality rate	OR (95% CI)	P.v y
Jimma	269	89	37	33.10	13.75	1.8(0.16-3.72)	0.044
Ilubabor	292	107	32	36.64	10.96	RF	
Total	561	196	69	34.90	12.30		
District							
Metu	101	51	17	50.50	16.83	0.78(0.57-1.94)	0.650
Ale	89	24	8	26.96	8.99	1.1(0.62-1.71)	0.910
Yayo	93	32	7	34.41	7.53	0.92(0.64-2.32)	0.731
Gomma	94	37	19	39.36	20.21	1.3(0.88-1.93)	0.184
Jimma city	82	29	13	35.37	15.85	0.85(0.52-2.12)	0.609
Dedo	93	23	5	24.73	5.38	RF	
Breed							
Cross	158	68	32	43	20.25	2.02(1.34-3.08)	0.001
Local	403	128	37	31.76	9.18	RF	
Sex							
Female	321	122	47	38	14.6	1.2(0.72-1.86)	0.170
Male	240	74	22	30.80	9.20	RF	
Weaning age							
< 6 month	251	102	43	40.60	17.13	2.67(1.86-3.84)	0.000
6-12 month	310	94	26	30.30	8.40	RF	
Mixing different age group							
No	437	155	58	35.5	13.30	1.13(0.84-3.45)	0.107
Yes	124	41	11	33.06	8.90	RF	
Cleaning activities							
Regular	462	168	62	36.35	13.40	0.97(0.68-2.52)	0.134
Irregular	99	28	7	28.3	7.8	RF	
Farm							
Intensive	78	35	16	44.87	20.51	2.2(1.35-3.62)	0.002
Semi	24	9	4	37.5	16.70	1.66(1.19	- 0.011
intensive						3.23)	
Extensive	459	152	49	33.10	10.67	RF	
Floor of house							
Soil	373	134	41	35.92	11	0.94(0.61-2.37)	0.105
Concrete	102	41	19	40.20	18.63	1.3(0.78-3.56)	0.210
Local material	86	21	9	24.41	10.46	RF	
Source of water							
Tap	145	61	25	42	17.24		0.236
Hand dung well	78	29	10	37.18	12.80		0.705
River	338	106	34	31.36	10	RF	
Colostrum feeding							
Hand feeding	129	58	23	44.96	17.83	2.04(1.35-3.09)	0.001
Suckling	432	138	46	32	10.65	RF	

Discussion

The current study showed that calves from study area were infected with gastrointestinal parasites, ring worms and infested by ectoparasites. The overall prevalence of gastrointestinal parasites in calves was 38% in dairy farm in towns and rural areas of small holder dairy farms that were agree with Tigist [24] who reported to be 41.30% in Amhara regional state. The gastrointestinal garasite infection was significantly related with age of calves (p<0.05) that agree with Cheru [25] who noted that the incidence of gastrointestinal garasites rises with age.

In this study, the prevalence of gastrointestinal parasite was found significant (p<0.05) higher in local breed calves (41%) than cross-breed calves (32.6%) which is in agreement with the report of Tigist [24] in and around Gonder town and Gudeta [26] in East Wollega Ethiopia. This may be due to the fact that farmers owned cross-breed or farmers that found in urban area are tend to follow intensive management system where as those farmers that haves our indigenous breed were tend to follow free grazing system mean extensive management system. Thus, the chance of exposure to infective parasitic egg or larvae of local-breed calf is higher than that cross-breed calf. In this study, the prevalence of gastrointestinal parasite was found significant (p<0.05) higher in calves with good body condition (50%) than calves with poor body condition (29.5%) which is in agreement with the report of Hailu [27].

In the present study, overall ectoparasites prevalence was 71.89% that was agree with Singh and Rath [28] who were reported 72.59% in India. The odds of ectoparasite infestation were 3.5 times more likely in local calf breeds in compare to cross breed calves which was statistically significant (P.V< 0.05) that was in agreement with Assefa [29] who showed significant difference between breeds on prevalence of ectoparasite infestation and recorded higher significant ectoparasite infestation in local calf breed than exotic breeds. In this study, the prevalence of ectoparasite infestation was found significant (p<0.05). In this study, the prevalence of ectoparasite infestation was found significant (p<0.05) higher in calves 6 to 12 months age (74.40%) than

calves less six months age (68.97%). The odds of ectoparasite infestation were 2.2 times more likely in calves 6 to 12 months age in compare to calves less six months age. The difference might be due to adult calves can more move from one grazing area to other, from one herd to other herd, from one home to other in compare to younger calves.

In the current study the prevalence of ring worm was 4.10% and 2.83% by clinical lesions and direct microscopic examination respectively. That was in agreement with Zekarias and Berhanu, [30] who described the clinical case prevalence of ring worm was 6.2% in Ethiopia. The ring worm infection was significantly related with age and 3. 6 more likely to occur in calves less than 6 months (6.9%) in compare to calves 6-12 months (1.9%) age that agree with previous Tartor [13] which young animals are particularly susceptible to infection by ringworm fungi specially calves with poor husbandry practice. The odds of ring worm infection were 4.3 times more likely in local calf breeds in compare to calves in cross breeds that was statistically significant (P.V< 0.05) that was in agreement with Hameed [31] those showed significant difference between breeds on prevalence of ring worm infection. The odds of ring worm infection was 6.3 times more likely occur in calves of extensive production system in compare to calves of intensive and semi intensive calves production system which was statistically significant (P.V< 0.05) and agree with Tartor [13] that showed significant ring worm infection among production system.

In the present study, the estimated morbidity rate and crude mortality rate across all rural areas of districts and towns were 34.94% and 12.30% respectively. That in agreement with Rahmeto [32] with 39.8% and 13.5% morbidity rate and crude mortality rate respectively. There was a significant difference in mortality rate between Jimma zone and Ilubabor zone, with an Odds ratio of 1.8 higher mortality risks in Jimma. The mortality variation can be explained by the difference in environment or production system. The difference may be due to larger number of cross breed calves in Jimma zone those difficult to resist poor husbandry practices and endemic diseases. This finding is consistent with results from previous studies [33]. The odds of calf mortality were 2.2 and 1.66 times more likely in calves in intensive production (20.51%) and semi intensive production system (16.70%) respectively in compare to calves in extensive production system (10.67%) which was statistically significant. That in agreement with Fentie [33] reported calf crude mortality in the range of 9.4%-14% in mixed crop-livestock production, 15%-25% in urban and peri-urban dairy production. The odds of calf morbidity and mortality were 2.04 times more likely exposed to the risk of death in calves feed colostrums by hand (12,8%) in compare to calves feed colostrums by suckling(10%) which was statistically significant and agree with Rahmeto [32] and Amold [34] those described importance of colostrum on calf morbidity and mortality. In the current study weaning age of the calves was associated with calf mortality with rate of 17.13% and 8.40% in weaning age less than six months and six to twelve months respectively.

The odds of calf morbidity and mortality were 2.02 times more likely exposed to the risk of death in cross breed calves (20.25%) in compare to local breed calves (9.18%). Breed was having significant effect on calf mortality in the current study and crossbred were recorded significantly higher mortality than local calve breeds that in agreement with Tadesse [35]. Crossbred calves are not well adapted to the tropical environment and are often subjected to environmental stress which leads them to high risks of health problems.

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Conflict of Interests

The authors declare that they have no conflicts of interests.

Author Contribution

Moti Wakgari: Project administration; Conceptualization; Formal analysis; Investigation; Software; Writing-original draft; Writing-review & editing.

Dagne Guta: Sample collection; Sample process and Investigation Mammedamin Isa: Sample collection; Sample process and Investigation

Ethics approval and consent to participate

A local ethics committee ruled that no formal ethics approval was required to conduct this research. Before conducting the research, informed consent was obtained from the owners of the lactating cows used in this study

Data availability' statement

All data generated and analysed during this study are included in this published article.

Conclusion and Recommendations

The overall high prevalence of gastrointestinal parasites in the current study shows that parasites can be considered as one of the production constraints of calves in the study areas. Zones study area, body condition, age and breeds of calves showed a statistically significant variation with the occurrence of gastrointestinal parasites.

Ectoparasite infestation in calves has significant economic importance due to direct and indirect loss of production, reduce weight gain, retard growth, skin damage, immunosuppression, nuisance and biological vectors of different bacteria, viruses and protozoa. The present study showed high prevalence of ectoparasites on calves in the study area. The problem of external parasite seems to be crucial as they are widely distributed in relation to breed and management system. Ticks, Fleas and Lice were important ectoparasite investigated study areas. Risk factors: study area, body condition, age and breed were significantly associated with ectoparasite infestation.

Even though low ring worm infection in this study, it causes adverse effect on the calf production, tanning industry and health of the public and concomitantly pose huge economic loss. Age, production system and breeds of calves showed a statistically significant variation with ring worm infection.

In the present study, the estimated morbidity rate and crude mortality rate across all rural areas of districts and towns were high. Study area, breeds of calves, weaning age, farm production system and colostrums feeding showed a

statistically significant association with Calf morbidity and mortality.

Based above conclusions the following recommendations are forwarded

- Awareness should be created for farmers to manage their calves intensively(zero grazing), improve feeding and watering of calves, regular cleaning of calf floor, separate their pen from adults, making appropriate floor, avoiding grazing in marshy areas, improving management of cross breeds
- Anti-parasitic drugs are still an important part of parasite control in the grazing livestock. As study area climatic conditions the grazing animals must be dosed by broad spectrum anthelmintic at least twice in year at the onset rain (March and April) and offset of rain (September and October)
- Awareness should be created for owners of intensive and semi intensive production systems to rear in appropriate place with enough land, store feeds in appropriate place, avoid feeding fresh green grass, manage their calves intensively and to keep an environmental sanitation in addition to strategic deworming of cattle with effective broad spectrum anthelmintic
- It is better to encourage and adapt deworming supporting by laboratorical investigation
- There should be a close attention by all stakeholders; farmers, veterinarians and government on control and prevention measures of losses caused by ectoparasites infestation and transmission of pathogens to domestic animals.
- Further detailed study should be conducted to have appropriate information on the seasonal occurrence, species of ectoparasite, burden and the effect of these ectoparasites on calves and economic losses caused by them in the study area.
- For effective control of ringworm proper cleaning and disinfection of house and environment is mandatory
- Reducing the density of animals and direct contact with infected calves
- Isolation and treatment of ring worm infected calves by antifungal drugs like terbinafine and miconazole.
- Awareness creation on extension production system to provide supplementary feed, enough water, forage and grass, improve their house, bedding house floor, calves receive colostrum within one hour of life, avoid early winning, separate from adults, early treatment of sick calves, proper disposal of died calves or animals(burring).

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