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Prevalence and Identification of Major Ticks in Cattle in Damot Gale Woreda, Wolaita Zone, SNNPR, Ethiopia

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Abstract: Across-sectional study was designed and conducted in Damot Gale district of Wolaita zone, south Ethiopia. The major objectives of the research were: to determine the prevalence of major ixodid ticks; to identify the collected ticks into their respective species; and to assess the risk factor influencing the prevalence of tick infestation in the study area. For this purpose, 384 heads of cattle maintained under traditional management system were selected using simple random sampling statistical technique. All visible ticks were collected from half body part of selected cattle, preserved in70% alcohol and transported to WSU-SVM for subsequent identification into species, based on key standards. Questionnaire survey was conducted to collect baseline information regarding farmers' perceptions of the effects of ticks on livestock production. The collected data were analyzed using SPSS software (Version20.1) for descriptive and inference purposed. A total of 264 ixodid ticks were collected, which belonged to of Boophilus (59.85%), Rhippicephalus (25.38%) and Amblyomma (14.77%) genera, with the overall prevalence of tick infestation to be about 6%. At species level, Boophilus decoloratus (59.85), Rhippicephalusevertsievertsi (25.38%), Amblyomma variegatum (10.61%) and Amblyommagemma (4.16%) were the hard tick species identified during the survey period. Regarding spatial distribution, these ticks had the highest prevalence at Gacheno and Chocha and the lowest prevalence at Fate district. Regression analysis indicated that the prevalence of tick infestation did not reveal significant statistical difference between male and female sex groups (p>0.05). Nevertheless, adult cattle over the age of three years were more significantly challenged by tick infestation than young cattle (P<0.05). Similarly, the prevalence of tick infestation was significantly higher (p<0.01) in cattle with poor body condition than those with medium and good body condition score. In conclusion, the present research disclosed that tick infestation due to hard tick s is responsible for considerable pathogenic impacts and economic losses due to their deleterious effects on leather industry. Based on the present findings, it is recommended that integrate tick control efforts should be implemented, and the efficacy acaricides should be detected to control the risk of drug resistance in Damot Gale district.

Keywords: Cattle, Damot Gale District, Ixodid Ticks, Risk Factors, Tick Infestation

1. Introduction

Ethiopia has been reputed to hold one of the greatest opportunities for the expansion of livestock sub-sector, as the nation has diversified agro-ecological characteristics which suit the production and productivity of livestock. The country has the largest cattle population in Africa with an estimated population of 54 million cattle, 25.5 million sheep, and 24.06 million goats which are mostly found in the rural sedentary areas of the country [5].

Livestock production represents an integral component of the national agricultural sub-sector. As such, output of livestock accounts for 45% of the agricultural GDP; 26.4% of the value of annual crop production derives from animal draught power; and this comprises 31% of the total gross value of livestock output represented by the value of animal draught power [18]. Hence, the national livestock sub-sector plays a pivotal role in the development and acceleration of sustainable livelihoods, as part of the efforts to meet the millennium development goals [25].

Nevertheless, there are several factors that hamper the production and reproductive potential of Ethiopian livestock especially kept under extensive and poor management system. Here, the national livestock sub-sector has been primarily curtailed by seasonal feed scarcity, poor veterinary infrastructure and high prevalence of animal diseases [7]. From veterinary stand point, animal diseases have been incriminated as the predominant elements in the extreme deterioration of livestock biodiversity [1].

There are two families of ticks, the Ixodidae (hard tick) and the Argasidae (soft ticks). Over 79 different species of ticks have been reported in eastern Africa. Ticks either cause direct losses through tick worry, blood loss, damage to hides and udders, toxin production and body weight loss. They also pose indirect threats through transmission of bacterial, viral and protozoan infections, predisposing to secondary disease conditions, reduction in milk yield and stunted growth [22]. A single female engorged tick imposes a daily loss of 0. 5–2ml blood, 8. 9ml of milk and 1g of body weight. Hence, tick infestation poses severe global economic losses in livestock industry [17].

In Ethiopia, about 47 species of ticks are found on livestock and most of the mare important as vectors for disease causing agents and also have damaging effects on skin and hide production. The major cattle tick-borne diseases in Ethiopia are Anaplasmosis, Babesiosis, Cowdriosis and theileriosis [12]. Among the two families of ticks, the most important one is the Ixodidae because of the existence of arigidchitinous scutumon the dorsal surface. Of the Ixoid ticks, Dermacentor, Rhipicephalus, Haemaphysalis, Boophilus, Amblyomma and Hyalomma genera have a great veterinary importance [2].

Extensive surveys have been carried out in different regions of Ethiopia regarding the prevalence of major ticks and their epidemiology. Accordingly, surveys showed *A. variegatum* to be the most widely distributed ticks species, followed by *R. evertsievertsi*, *Hyalommamarginatumrufipes*, *Hyalommatruncatum*, *A. cohaerens*, *A. gemma*, *A. lepidum*, *and Rhipicephaluspulchelluss* [23]. There are few surveys about the occurrence, distribution and impacts of tick infestation on livestock production in Wolaita zone, south Ethiopia.

However, there has been no scientific information on the prevalence and major species of ticks infesting cattle in Damot Gale woreda of Wolaita zone. Thus, is essential to conduct a baseline survey to determine the prevalence of ticks in the area, asset outs to design sustainable tick control strategies and, hence ameliorate livestock production. Therefore, the objectives of the search were;

1) To determine the prevalence of tick infestation in cattle under traditional management;
2) To identify the major ticks into their respective species; and
3) To assess the risk factors influencing the prevalence of tick infestation in Damot Gale district of Wolaitazone, south Ethiopia.

2. Literature Review

2.1. Classification and General Morphology of Ticks

Ticks are closely related to invertebrates such as insects and spiders, which are all without a spine. They belong to the groups called the phylum Arthropoda, the class Arachnida and order Acari. It is the largest and most conspicuous members of the orderacarina; they feed only on the blood of vertebrates, mammals, birds, reptiles and amphibians. Ticks differ from other mites; they are larger and have curved teeth or ridges on the central mouth parts. Ticks do not have wings and they cannot jump and they cannot run, hop, fly or even move quickly [33].

They also have a sensory pit on each of the first pair of legs. This pit detects stimuli such as heat and carbon dioxide. Ticks also detect light and dark as well as shapes, shadows and vibrations that help them to find their vertebrate hosts. Ticks are noted for crawling under clothing, hiding under fringes of hair and attaching to the skin. Ticks have lost all of the external signs of body segmentation and are divided into two body components that is the gnathostoma or capitulum, the mouth parts or a fusion of head and thorax, and the idiosoma [11].

Ticks are further divided into two families, hard ticks in the family Ixodidae, and soft ticks in the family Argasidae. Hard ticks have a hard, smooth shield on their backs and are tapered at the front with an apparent head; they are the ticks most readily recognized by most people. Female hard ticks feed once and lay as many as 10,000 eggs or more. Soft ticks lack the shield like plate on their upper surface; have a tough, leathery, pitted skin and no distinguishable head and look like animated pieces of barkordebris. Some soft tick females can feed several times and lay 20-50eggs after each meal. Both groups can swell to considerable size after a blood meal. Both are important vectors of disease causing agents to humans and animals throughout the world [2].

2.2. Biology and Life Cycle of Ticks

An important feature of the biology of ticks is their high potential of reproductive rate. They possess separate sexes, have tremendous reproductive capacity and reproduce sexually. Ixodidae contains almost all the species of ticks that can have veterinary importance in various livestock species, but most importantly in cattle. There are four developmental stages in the life cycle of Ixodid ticks; the egg, the six-legged larva; the eight-legged nymph and adult [30].

2.3. Effects of Tick Infestation on Livestock Production

2.3.1. Pathogenic Effects of Tick Infestation

Direct effect soft ticks on cattle are tick worry, blood loss, damage to hides and skins of animals and introduction of toxins. The ecology and physiology of ticks have made them second most important vectors after mosquitoes. Ticks transmit a large variety of intercellular bacteria in the Rickettsia group like Rickettsia, Ehrlichia and Anaplasma. Similarly, several piroplasm protozoa like *T.annulata*, *T.parva*

and *Babesiabigemmina* are also transmitted specifically by ticks [29].

Hard ticks (Acari: Ixodidae) are obligate haematophagous ectoparasites and important vectors of viruses, bacteria and protozoa. They are considered second only to mosquitoes as the most medically important group of arthropods. Tick worry is a generalized state of unease and irritability of cattle severely infested with ticks, often leading to serious loss of energy and weight. This negative effect on the growth of animals and their production is thought to be due to the effects o f a toxin in the saliva of ticks [16].

2.3.2. Economic Significance of Tick Infestation

Ticks are one of the most harmful parasites for any livestock species; the impact of ticks on animal health can be twofold. These are effect of the tick burden as ectoparasites and disease transmission by tick serving as vectors. Ticks as the ectoparasite can have an effect of blood loss. Losses from tick damage to hides and skin were claimed in 1979 to be in the region of one million Ethiopian birr per annum but are likely to be much higher. Another financial loss is treatment cost; likewise, an estimate of the yearly cost of acaricides in 1989 was three million Ethiopian birr. When other losses such as death, reduced growth rate, and reduced milk production are added, economic losses due to tick sand tick borne disease are highly significant [6].

2.4. Tick Borne Diseases

The term vector-borne disease refers to any of abroad array of infectious diseases caused by pathogens that are transmitted by arthropods or other biologic intermediaries. Although transmission usually occurs on blood feeding by an infected in sectoracarineparasite, infection can also result when a vertebrate host ingests a vector or on contamination of a wound by infectious organisms in the feces of the arthropod intermediary. Regardless of the means of transmission, the vector, a critical component in disease transmission, engages in a lifestyle that is at least partially parasitic and that somehow contributes to its ability to both acquire and serve as a source of infection to animals. Theileriosis, heartwater, Babesiosis and Anaplasmosis are considered the most important tick-borne diseases of livestock in sub-Saharan Africa [4].

The tick-borne diseases of livestock constitute a complex of several diseases whose etiological gents may be protozoal, rickettsial, bacterial or viral. Their single common feature is that they can all be transmitted by ticks. Ticks and tick borne disease (TBD) are widely distributed throughout the world particularly in tropical and subtropical countries, which causes a tremendous economic importance in livestock production [4]. Ticks, besides being important vectors for diseases like theileriosis, Anaplasmosis, Babesiosis and rickettsiosis (heartwater) in domestic animals; they also cause non specific symptoms like anemia, dermatosis, toxicosis and paralysis. Ticks have many effects on animals which may include loss of blood (anemia), Tick toxicosis, tick worry, bite wound, wounds and myiasis, tick-borne disease [10].

3. Methods

3.1. Description of the Study Area

The study was conducted in Damot Gale woreda of Wolaita zone, south Ethiopia. Sodo town is the administrative seat of the zone, located at about 330km south west of Addis Ababa following the tarmac road that passes through Hosanna to Arba Minch. Wolaita zone is situated at 6°40'N latitude and37°50'E longitude, with a height of about 700-2900m.a.s.l. The area is divided into three ecological zones: Kola (lowland<1500m), 'Woina Dega' (mid-altitude 1500-2300m) and 'Dega' (highland>2300m). The zone has a total area of 4,541km^2 and is composed of 12woredas and 3municipaltowns. Damot Gale woreda is one of the three municipal towns, Boditi being its administrative seat. The human population of Wolaita zone is about 1,527,908 of which 49.3% are male and 51.7% females [5]. Most of the area lies within the mid altitude zone. Rain fall is bimodal; with an average amount of about 1000mm. Mean monthly temperature varies from 26°C in January to11°C in August [32].

The Primary occupation of the woreda is farming with mixed crop-livestock production predominating being the dominant agricultural activity [5]. Livestock production includes 66,971 cattle, 5,771goats, 33,251sheep, 7,938equines and 94,320 poultry. Generally, the climatic condition is conducive for livestock production [32].

3.2. Study Population

The study population for this study was all livestock keepers and their cattle herds in Damo Gale woreda. Cattle herds in selected Pas of the Woreda constitute the target animals. The selected animals from the target Pas were categorized based on their sex, age, breed and body condition scoring. Questionnaire was administered to a random sample of households selected from the target PAs, namely Gacheno, Fate, Gedo Boditi and Chocha.

3.3. Sample Size and Sampling Method

The study was conducted on village cattle managed under traditional livestock management system. The total number of animals required for the study was calculated based on the formula developed by Thrusfield, M. [27], as given below:

$$N = \frac{Z^2 \times Pexp \, x(1 - Pexp)}{D^2}$$

where:

N=the total sample size required for the study;

Pexp=minimum expected prevalence in the study area, which is 50%;

D=desired accuracy l evel a t95% interval;

Z=Corresponding critical value for 95%CI, which is1.96

Accordingly, 384 cattle heads were selected for the study. The age, sex and breeds of each animal were recorded during the study period. Body condition of individual animals was categorized as poor good, medium and good, according to the

protocol described by [8]. All visible ticks were manually collected from half part of the sampled cattle using forceps, preserved in 70% alcohol and labeled with the date of collection, species, sex and age of the host. Then, the collected ticks were transported to SVM-WSU and identified using stereo microscope, according to the standard tick identification keys [15]. The count of ticks from half body zone of each animal was doubled to give the total number of ticks per animal, assuming equal number of infesting ticks on both sides of an animal.

3.4. Data Management and Statistical Analysis

All the collected data were recorded on designed formats, appropriately handle and entered into Microsoft Excel sheet. The data collected for inference purposes were analyzed by the help of Statistical package for Social Sciences (SPSS, version 20). Chi-square (x^2) test was used to assess the presence of significant association of the prevalence of tick infestation with hypothetical risk factors such as sex, age, breed and body conditions core of cattle in the survey area. For

quantitative data analysis, 95% confidence level was employed in order to extrapolate there search findings to the target population in the study area. Thus, the difference was declared significant at p≤0.05.

4. Result

4.1. Questionnaire Survey

The present research was conducted in Damot Gale district of Wolaita zone, southern Ethiopia. For this purpose, 40 household heads (livestock owners and community representatives) were selected and interviewed to collect baseline information about major livestock diseases, farmers' knowledge regarding seasonal variation of tick infestation and its effects on livestock production in the research area. The results indicated that majority of the respondents were males (92.5%) and the rest females (7.5%). The average family size of the respondents was 5, while the age of house hold heads ranged between 35and 62years.

Table 1. Socio-economic features of interviewed households in Damot Gale district.

Age category (%)		Formal education (class years)		Major means of livelihood (%)		Average livestock holdings/household*	
35-45years	17.5%	0years	47%	Mixed farming	93%	Cattle	6.8 (0.19)
46-50years	52.5%	1-4class	43%	Off-farm jobs	7%	Sheep/goats	7.3 (1.22)
>50years	30%	>4[th]class	10%			Drought oxen	3.6 (2.14)

*:Standard deviations were reported in the parenthesis

On the other hand, the interviewed livestock owners wholly indicated that they have been engaged, for decades, in mixed agriculture comprising of both crop production and livestock raising (Table 1). They also disclosed that their livestock have been facing a wide range of health problems, which often lead to deterioration in the health and productivity of their herds. Accordingly, livestock owners listed the main diseases and syndromes which recurrently affect their herds (Figure 1).
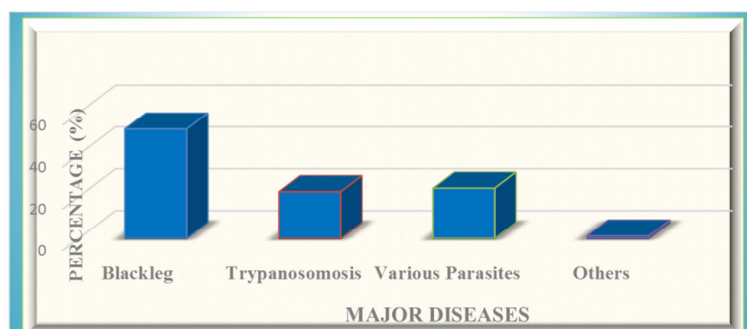
Figure 1. Major livestock health problems in Damot Gale district, south Ethiopia.

As described in figure 1 above, livestock herds in the Damot Gale district have been frequently affected by black leg, animal trypanosomosis, and various parasites, among others. On the other hand, livestock owners unanimously (100%) indicated that tick and lice infestation, as well as different end parasites remain to be the common animal health problems which seriously influence the production potential of their cattle herds. When asked to describe the seasonal dynamics of tick infestation in their area, all the respondents (100%) witnessed that tick infestation and its challenges predominate during rainy season than dry season. Furthermore, livestock owners explained the direct and in direct effect soft ticks on

cattle, include in emaciation, weight loss, anemia, reduction in drought power, market value of skin and disease transmission.

4.2. Prevalence of Tick Infestation in Cattle

Out of the four Pas (Kebeles) of Damot Gale district in which the survey was conducted, 23 cattle heads were infested by one or more hard ticks. A total of 49 larvae and 215 adult ticks were collected, with the overall prevalence of tick infestation of about 6%. Spatially, the highest prevalence of tick infestation was recorded at Gacheno (11.6%) followed by Fate (5.7%), while the lowest prevalence was recorded at Gedo Boditi (3%), as indicated in Table 2 below.

Table 2. *Prevalence of ixodidticks in selected Kebeles of Damot Gale district, south Ethiopia.*

Kebeles	No. animals examined	No. animals affected	Prevalence (%)
Gacheno	95	11	11.6
Fate	88	5	5.7
G/Boditi	99	3	3
Chocha	102	4	3.9
Total	384	23	5.989

### 4.3. Identification of Major Ixodid Ticks and Their Abundance

A total of 264 hard ticks belonging to three genera were collected during the survey period. Thus, the results indicated that Boophilus (59.85%, Rhippicephalus (25.38%) and Amblyomma (14.77%) are the dominant hard ticks which mostly infest cattle in Damot Gale district (Table 3and Figure 2). Regarding the spatial distribution of the ixodid ticks, the highest prevalence (35.89%) of Amblyomma ticks was

recorded at Chocha Kebele, and the lowest prevalence (15.38%) of this tick was recorded at Gedo Boditi Kebele. On the other hand, the highest (37.97%) and lowest prevalence (13.29%) for Boophilus ticks were detected at Gacheno and Fate Kebeles, respectively. Finally, the highest prevalence (38.81%) of Rhippicephalus ticks was recorded at Chocha Kebele, the lowest prevalence (17.91%) being recorded at Fate Kebele.

Furthermore, the collected ixodidticks were identified and differentiated to their respective species, comprising of four different species. Accordingly, *Boophilusdecoloratus* was the only species identified in the study areas. On the other hand, two species were identified for Amblyomma (*Amblyommavariegatum, 10.61%*, and *Amblyommagemma,* 4.16%). Similarly, *Rhippicephalusevertsi-evertsi* (25.38%) was the only single species in genus Rhippicephalus, as indicated in Figure 2 below.

Table 3. *MajortickgeneraandtheirabundanceinselectedKebelesofDamotGaledistrict.*

Kebeles	Tick genera							
	Amblyomma		Boophilus		Rhippicephalus		Total	
	number	%	Number	%	Number	%	Number	%
Chocha	14	16.27	46	53.48	26	30.25	86	32.58
GedoBoditi	6	11.53	31	59.62	15	28.85	52	19.67
Gacheno	8	9.75	60	73.17	14	17.08	82	46.2
Fate	11	25	21	47.73	12	27.27	44	47.75
Total	39	14.77	158	59.85	67	25.38	264	100
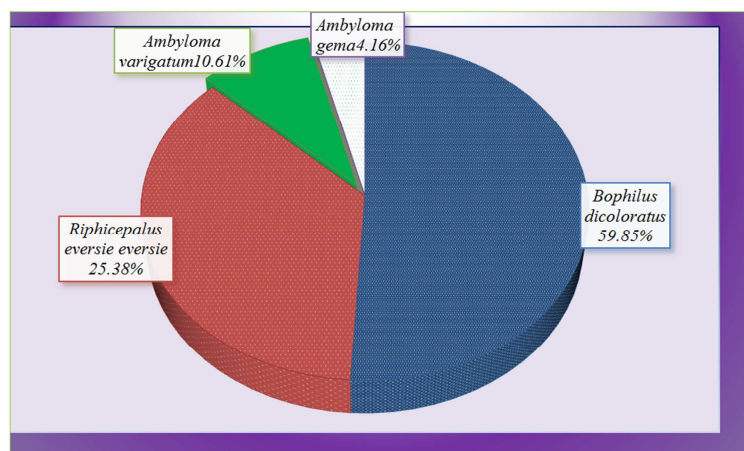
Figure 2. *Relative abundance of the ixodidticks species identified in Damot Gale district.*

Table 4. *Distribution of identified tick species in different body regions of infested cattle.*

Attachment sites	Genera of ticks collected from different body parts			
	Rhippicephalus	Boophilus	Amblyomma	Total
Dewlap	4	76	3	83
Udder	6	13	14	33
Scrotum	8	10	7	25
Tail	47	46	0	93
Leg	2	13	15	30
Total	67	158	39	264

4.4. Distribution of Ixodid Ticks in Different Body Parts of Infested Cattle

According to the findings of the research (Table 4),

Rhippicephalus ticks more commonly (82%) prefer tail and scrotum for attachment; Boophilus ticks attach more (77.22%) to dewlap and tail, while legs and udder are preferred sites (74.36%) for the attachment of Amblyomma ticks.

4.5. Risk Factors Influencing the Prevalence of Tick Infestation

The collected data was analyzed for the presence of statistical association between tick prevalence and hypothetical risk factors like sex, age, breed, body condition score of sampled animals. The results are summarized in Table 5 below. As shown in the table, the prevalence of tick infestation did not reveals significant statistical difference between male and female cattle (p=0.056). On the contrary side, adult cattle over the age of three years were highly infested by various ixodidticks than young animals the difference in infestation status being statistically significant (p=0.023). In addition, the prevalence of tick infestation was significantly higher (p=0.001) in cattle with poor body condition than those with medium and good body condition score (Table 5). Similarly, local cattle breeds were less infested by ixodidticks than cross breeds, where the difference in the infestation r ate was significant (p=0.031).

Table 5. Association of tick prevalence with possible risk factors in cattle, Damot Gale district.

Risk factors		No. animal examined	No. positive animals	X^2	P-value
Sex	Male	174	6		
	Female	210	17	3.65	0.056
Age	≤1year	67	1		
	2-3years	86	5		
	>3years	231	17	2.92	0.023
Body condition	Poor	236	15	82.38	
	Medium	143	5		0.001
	Good	5	3		
Breed	Local	283	0		
	Cross	101	23	8.73	0.031

5. Discussion

Tick infestation poses one of the major threats to the productive opportunities of livestock industry; with over 80% of livestock resource has been challenged by these pests. In Ethiopia, tick infestation poses significant economic losses, where the distribution and abundance of tick species infesting domestic ruminants reveals great variations based on agro-ecological differences and seasonal dynamics across the country.

In the present study, an overall prevalence of about 6% was recorded during the survey period, which is lower than the reports of Kassa and Yalew [14] who reported a prevalence of 33. 21% in Haramaya district. A significantly higher prevalence (16. 0%) was also reported in Benchi Maji Zone of the Southern Ethiopia [26]. The lower prevalence of tick infestation in the present study could be explained in relation to the seasonal variation and control efforts. The present research was conducted during dry season (November–April) where tick infestation was expected to be lower than the rainy season (June-October). It has been universally accepted that tick infestation is influenced by variations in the agro-climatic conditions, including temperature and humidity [19, 22].

The above finding is also justified by the questionnaire findings, where livestock owners disclosed that ticks pose more challenge to livestock during rainy months. This finding is in agreement with the findings of Solomon, et al. [22], who showed that the prevalence and intensity of tick infestation are generally higher during the rainy seasons, as the result of the greatest reproduction during rainy months. Similarly, the lower prevalence of tick infestation in the current research could be due to successive application of acaricides to curb the effects of tick infestation on livestock resource in Wolaita zone, including Damot Gale district.

The present research identified Boophilus, Rhipicephalus and Amblyomma as the three important genera of ticks encountered in Damot Gale district. The prevalence and relative abundance of Boophilus ticks (59. 85%) recorded in this study were greater than the corresponding values reported by Tikit, B. and Addis, M [28] in and around Holeta (18. 13%) and in Asella (15. 41%) reported by [24]. Nonetheless, the prevalence and abundance of Amblyomma and Rhippicephalus ticks were similar to the figures reported by the above researchers.

Comparing tick challenge with age of infested animals, the results disclosed high prevalence of tick infestation in adult animals as compared to young animals, the difference being statistically significant (P<0. 05). This could be attributed to the outdoor management of adult cattle and their movement over long distance in search of feed and water as compared to young animals, so the chance of exposure is higher. This finding is also in agreement with the findings of [9] in which higher proportion of tick infestation was recorded in adult cattle. Other researches on similar issues have also found similar findings [21].

Attempts were made to assess the presence and degree of association of prevalence of tick with possible risk factors. Accordingly, as indicated in the results section, breed of cattle was a risk factor where local cattle were less affected compared with cross breed cattle, the difference being statistically significant (P<0. 05). This finding is in agreement with the findings of Kaiser. M. et al. [13] who reported the presence of significant variations between breeds in relation to tick infestation and consequent impacts. The higher prevalence of tick infestation in cross breed animals may be attributed to their relatively higher susceptibility due to immunes aspects, where as local breed cattle have developed innate resistance to successive challenges to tick infestation over years Therefore, the level of resistance to tick challenge in local breed cattle is greater than those of cross breeds [31].

In relation to body condition score of infested cattle, the result indicated that highest prevalence of tick infestation was recorded in animal switch poor body condition, followed by animals with medium body condition, while animals with good body condition were least infested by ixodidticks. Accordingly, there was higher statistical difference between these groups of animals (P<0. 01). This finding strongly agrees with plethora of researches which revealed the impact of body condition on the level of tick challenge. For instance, Seid, B [20] found that tick burden on cattle with poor body condition was significantly higher (an average of 22. 49 tick

per animal) than cattle with good body condition (an average of 17. 76ticks per animal). In similar manner, studies in different agro-ecologies of Ethiopia disclosed that variation in body condition of cattle has considerable effects on the prevalence of tick infestation in both local and exotic cattle breeds [31].

6. Conclusion and Recommendation

Despite the presence of huge livestock industry in Ethiopia, the production and productivity of this resource has been curtailed primarily by the deleterious effects of rampant animal diseases and parasitic infestations, including tick challenge. Ticks are obligate haematophagous ectoparasites of vertebrates, causing the greatest economic losses in livestock population either by transmitting a wide variety of tick-borne diseases (TBDs) or by upsetting the health of animals as well as the quality of hide and skins.

It has been realized that the various agro-climatic conditions and natural vegetation of our country are highly conducive for ticks and, thus maintenance of tick-borne disease maintenance. Hence, tick infestation and epidemiological distribution of the common tick species has been established by different researches conducted in different ecological zones of Ethiopia.

The present research has made similar efforts to determine the prevalence of tick infestation, and to identify dominant genera and species of ixodidticks which pose considerable threats to the productive opportunities of livestock resources in Damot Gale district, south Ethiopia. Consequently, it was inferred that ixodidticks belonging to genus Boophilus, Rhipicephalus and Amblyomma have been prevalent in the study area. For this reason, it is apparent that tick infestation in Damot Gale district could result in considerable annual economic losses, as the common tick species identified were hard ticks which have been responsible for down grading or total condemnation of skin and hide of animals. In addition, it was realized that age, breed and body condition score of animals are the risk factors which significantly influence the prevalence and intensity of tick challenge in the district. Thus, based on the aforementioned research findings and conclusions, the following recommendations were forwarded:

1) Further studies should be conducted to determine the true prevalence of the common ticks, their holistic distribution and seasonal dynamics in the study area;
2) Special emphasis should be paid to tick control strategies, by using integrated approaches entailing a combination of the available control methods;
3) Research should be conducted to determine the efficacy of the acaricides which have been repeatedly applied for the control of tick infestation in the research area.

Acknowledgements

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