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Research Article

Evaluation of the Effectiveness of Diazinone for the Control of Ectoparasites in Small Ruminants in Selected Districts of West Shoa, Ethiopia

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Abstract

Ectoparasites diseases are ubiquitously occurring in the world that significantly affect animal health, welfare, and hide quality including Ethiopia. This study was aimed to determine pre and post intervention prevalence of ectoparasites in small ruminant to indirectly evaluate effectiveness of diazinone in the control of ectoparasites under field condition.

A cross-sectional study was conducted to assess pre and post control prevalence of ectoparasites from April 2019 to June 2019. The sample size (n=475) of small ruminants was determined using Thrusfield formula that consists of 381 sheep and 94 goats. Sampling was randomly performed on the sheep and goats found in the selected Peasant Associations which are grazing in communal pastures prior to control intervention. Pre intervention ecto-parasite prevalence in sheep and goat were 100% of infestations. The most abundant species were tick and tick& louse identified with an overall prevalence of 32.21 and 15.16 among single and two ecto-parasite infestations respectively. Ecto-parasite infestations with one, two and three species were 68.4, 30.97 and .63 prevalence respectively. Post intervention ecto-parasite infestation overall prevalence showed that 87.37 were cleared but 12.63% were not cleared.

A paired t-test analysis has shown mean pre control (1.7 ± 1.6) at 95% CI ranges from 1.556679 to 1.849637) and post- control (0.2105263 ±0.6346988) at 95%CI ranges from 0.1533022 to 0.2677505 (p-value ≤ 0.0000) which is highly significant. Chi -square test of post control status for effectiveness of diazinone with associated risk factors demonstrated a significant difference among the types of ectoparasites (X2 =248.9033, p=0.000) .It was also observed that susceptibility of ectoparasites by type to the effect of diazinone in the order of flea > louse > tick. Diazinone is effective in the control of ectoparasites that significantly reduced the prevalence of ectoparasites in shoats. This was witnessed by 87.37% clearance of all types of ectoparasites from the study subjects. Community awareness creations and further study should be suggested as recommendations.

INTRODUCTION

Ethiopia owns about 30.7 and 30.2 million sheep and goats populations, respectively [1]. However, the country could not benefit from this huge resource to the expected potential level because of factors such as draught, management, infectious and parasitic diseases. Among the major parasitic diseases, ectoparasitic diseases are very common and widely distributed in all agro-ecological zones in Ethiopia [2-3]. Tick, mite and lice affect the host species because of the inflammation and the infection they inflict on the skin [4]. With regard to indirect effect of ectoparasites, ticks alone transmit several important protozoal, rickettsial, bacterial and viral diseases to animals, thereby causing great economic losses [5].

Different studies done on ectoparasites' prevalence of small ruminants in the country revealed that 48.9%, 45.5%, 57.43% and 25.7% respectively [6-9]. Similarly, in a comparative study of ectoparasites' prevalence in controlled and uncontrolled area in sheep has determined 57.43% and 88.24% prevalence rates, respectively [10]. To mitigate this problem the Ministry of Agriculture and Rural Development of Ethiopia in 2005 launched control program against ectoparasites and skin diseases in 2005 in Tigray, Amhara and Afar regions and in 2010 in Oromia regional state. Despite, such national and regional efforts and emphasis given to the control programs the disease still remains alarming. Thus, either the consistency of control approach or effectiveness of the ectoparaciticide used needs to be evaluated post control.

Several *in vitro* and *in vivo* trials on effectiveness of ectoparasiticidal demonstrated 90-100% efficacies [11-12]. It was also stated that ideal insecticide should destroy all parasitic stages of life cycle [13].

Accordingly, comparison of pre and post intervention prevalence of ectoparasites was done under field condition to evaluate effectiveness of diazinone on ectoparasites of small ruminants include ticks, lice and fleas. Thus, post control data collection was done on thirtieth day of initial application of diazinone.

Therefore the objectives of this study were

I. To determine Pre and post intervention prevalence of ectoparasites in small ruminant

II. To learn how significant the difference between pre and post intervention prevalence to indirectly evaluate effectiveness of diazinone in ectoparasites control

MATERIALS AND METHOD

Study area

Study animals were indigenous sheep from three districts (Dire Hichini, Dendi and Toke Kutaye) of West Shoa Zone which are found 154, 79 and 112 km away from Addis Ababa, respectively. According to the livestock population data obtained from the districts Livestock and Animal Heath Offices (2018) the small ruminant population comprised of a total of sheep 197,769, and goats 53,193, respectively. Topographically, the districts have an elevation of 2200–3023, 2000-3288 and 1500-2800m a.s.l, respectively. The area mean annual rainfall is 1700mm and the mean annual temperature is 18°C. The farming system in the area is characterized as mixed crop-livestock production systems.

Study Population

Sheep and goats found in the selected study area were target population. Animals were selected based on the following selection criteria on their infestation level with ticks, lice and flea and mites before control intervention.

Study Design

A cross-sectional, pre and post control ectoparasites prevalence study in small ruminants was conducted in selected Woreda's of West Shoa Zone, Oromia Regional State from April 2019 to June 2019.

Sample size and Sampling Method

To determine pre control ectoparasites prevalence and evaluate post control effectiveness of diazinone .Accordingly, three districts were involved peasant associations (PAs) and sheep and goats as a sampling unit. The districts were selected purposively based on their representation of ectoparasites controlled three PAs from each district having the corresponding control program were also selected randomly. In each selected PA the objective of the study was explained and consent of flock owners was obtained to avail the animals for pre and post intervention data collection Sheep and goats found in selected PAs were selected randomly from animals grazing in communal pastures

The required sample size was determined as described by Thrusfield (20070. The expected prevalence of ectoparasites average of controlled area and uncontrolled areas (Bedada *et al*., 2015) 72% was taken and by setting 95% confidence level and 5% desired level of precision. Based on the formula $N=1.96^2P_{exp}(1-p_{exp})/d^2$

Where N= required sample size

Pexp= expected prevalence

D= desired precision

Z= 1.96 for 95% confidence interval

$n=1.96^20.72(1-0.72/0.05^2=3,84x0./0.77/0.0025=310$ inflated to a total of 475 small ruminants consisting of 381 sheep and 94goats were sampled and examined for ectoparasites. For the post intervention traceability of the sheep and goats selected and treated with diazinone the owners' addresses and the numbers of animals held by each household were recorded.

Pre and post treatment parasite count

Collection of ticks, lice and fleas was done two weeks before and a month after treatment, respectively in a labeled universal bottles containing 70% ethanol then identified, counted and recorded for data processing.

Data management and analysis

Raw data was carefully recorded and stored in Microsoft Excel database system used for data management the variables to be analyzed were pre and post intervention prevalence of ectoparasites to evaluate the effectiveness of diazinone. Statistical analysis of data was carried out using STATA version 13.Descriptive statistics and percentages were used to summarize the proportion pre and post intervention infestations.

RESULT

Pre intervention prevalence of ecto-parasites in sheep and goats

Pre intervention ecto-parasite prevalence in sheep and goat were 100% of infestations. The most abundant species were tick, tick& louse, and Tick, louse and flea identified with an overall prevalence of 32.21, 15.16 and .63 among single/one, two and three ecto-parasite infestations respectively as indicated in (Table 1). Ecto-parasite infestations with one, two and three species were 68.4, 30.97 and .63 prevalence (Figure 1).

Before control the small ruminants had tick 153(32.21%), louse 100(32.79), flea 72(15.16%), tick and louse 75(15.79%), tick and flea 38(8%), louse and flea 34(7.16%), tick, louse and flea 3(0.63%) with an overall 100% prevalence of ectoparasites.

Post intervention status of ecto-parasites

Post intervention ecto-parasite infestation overall prevalence showed that 87.37 were cleared but 12.63% were not cleared as described in (Table 2).

Post control the small ruminants had tick 22(4.63%) , louse 8(1.68%), flea 2(0.42%) ,tick and louse 17(3.58%), tick and flea 6 (1.26%) , louse and flea 4(0.84%), tick, louse and flea 1(0.21%) with an overall 12.63% prevalence of ectoparasites. (Table 3).

Table 1: Pre intervention prevalence of ectoparasites in sheep and goats.

Type of ectoparasites	Sheep n=381		Goat n=94		
	Count	Prevalence (%)	count	Prevalence (%)	Overall prevalence (%)
Tick	116	30.45	37	39.36	32.21
Louse	87	22.83	13	13.83	21.05
Flea	64	16.80	8	8.51	15.16%
Tick and louse	56	14.70	19	20.21	15.79%
Tick and flea	25	6.56	13	13.83	8%
Louse and Flea	30	7.87	4	4.25	7.16
Tick ,louse and flea	3	0.79	0	0	0.63
Total	381	100	94	99.99	100

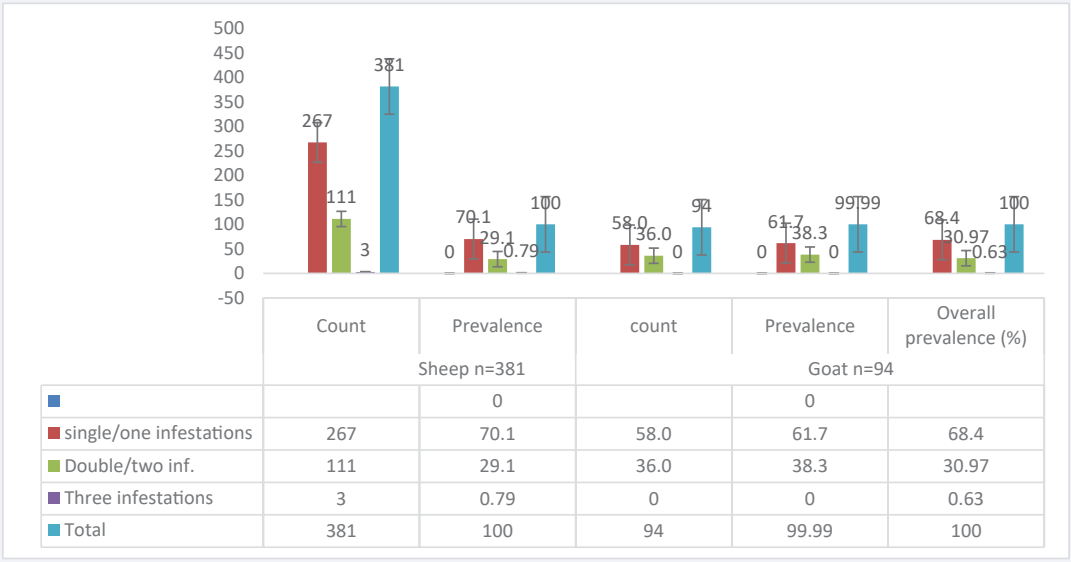

Figure 1 Mixed infestations status of seep and goat with one or more than one ecto-parasite.

A paired-samples t-test was conducted to compare whether there was a statistically significant mean difference between pre and post control prevalence of ectoparasites to measure effectiveness of diazinone. The mean pre control (1.7±1.6) at 95% CI 1.556679 to 1.849637 and post- control 0.2105263 ±0.6346988 at 95%CI.1533022 to .2677505, p-value ≤ 0.0001 which is highly significant.

DISCUSSION

In vivo and *in vitro* effectiveness of diazinone ectoparasites, especially on ticks has long been established [14]. However, its effectiveness was not explored under field condition where extensive application is conducted. Therefore, this study expounded this fact by comparing pre and post control prevalence as a measure of diazinone effectiveness. In this study an overall 87.37% of ectoparasites were cleared, while the current finding is lower than the finding of Abdel (2015) where the *in vitro* activity achieved 100% effective control after nine days. This difference could be because of strict laboratory trial and extensive application under field condition. Prevalence comparison in pre and post control revealed an overall 100% prevalence with one or more types of ectoparasites infestation in small ruminants. Whereas the ectoparasites post control has given an overall 12.63%. A paired t-test was conducted to compare whether there was a statistically significant mean difference between pre and post control prevalence of ectoparasites to measure effectiveness of diazinone. The mean pre control (1.7±1.6) at 95%CI ranges from 1.556679 to 1.849637 and post- control (0.2105263 ± 0.6346988) at 95%CI ranges from 0.1533022 to 0.2677505(p-value ≤ 0.0001) which is highly significant. A similar Chi -square analysis performed on post control status for effectiveness of diazinone with associated risk factors revealed a significant difference among the types of ectoparasites (X^2=248.9033, p=0.000). This result has shown the order of susceptibility of ectoparasites by type to the effect of diazinone on flea> louse> tick.

Finally, it is possible to relate the effectiveness of diazinone for the control of ectoparasites to the significant difference

Table 2: Post intervention status of ectoparasites.

Types of ectoparasites	Cleared	%	Not cleared	%
Tick	131	27.58	22	4.63
Louse	92	19.37	8	1.68
Flea	70	14.37	2	0.42
Tick and louse	58	12.21	17	3.58
Tick and flea	32	6.74	6	1.26
Louse and Flea	30	6.32	4	0.84
Tick ,louse and flea	2	0.42	1	0.21
Total	415	87.01	60	475
Overall %	87.37%		12.63%	

Table 3: Analysis of post control status for effectiveness of diazinon with associated risk factors.

Variables	Infestation	Status		X^2	P-Value
		Cleared	Not cleared		
Sex				0.769	0.942
female	319	279	40		
Male	156	136	20		
Total	475	415	60		
Age				4,3512	0.361
Young	201	180	21		
Adult	274	235	39		
Total	475	415	60		
Ectoparasite				248,9033	0.0000
Tick	153	131	22		
Louse	100	92	8		
Flea	72	70	2		
Tick and louse	75	58	17		
Tick and flea	38	32	6		
Louse and flea	34	30	4		
Tick louse and flea	3	2	1		
Total	475	415	60		

100% and 12.63% prevalence rate in pre and post intervention, respectively. This was witnessed by 87.37% clearance of all types of ectoparasites from the study subjects.

Limitation of the study as this type of approach to evaluate effectiveness of diazinone other than *in vitro* and *in vivo* laboratory controlled trial there was no a published data similar to the current study thus the study team could not compare thoroughly with other findings.

Recommendation further study is highly recommended to ascertain pre and post control prevalence study could give similar results with in vivo and in vitro efficacy trials.

CONCLUSION

To conclude, it is possible to relate the effectiveness of diazinon for control of ectoparasites to the significant difference between 100% and 12,63% prevalence rate in pre and post intervention respectively. This was witnessed by 87.37% clearance of all types of ectoparasites from the study subjects.

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