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Comparative Endectocide Efficacy of Closantel and Ivermectin in Osmanabad Goats Reared under Semi-Intensive System in Kalyana Karnataka

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Abstract

A study was undertaken to evaluate the efficacy of endectocides, closantel and ivermectin in controlling the internal and external parasitic infestation in Osmanabad goats. One hundred and fifty Osmanabad goats reared under semi-intensive system were screened for endoparasites using faecal egg count method and those suffering were selected for the study. The study was carried out at Kalaburagi in Kalyana Karnataka and Osmanabad goats were randomly grouped into T1, T2 and T3 in equal numbers. The tick infestation was graded in the affected animals among different groups. Goats in T1 were not dosed with any of the drugs and were considered as Control. Goats in groups T2 and T3 were treated respectively with oral solutions of closantel (15%) and ivermectin (1%) at the rate of 1 ml and 0.40 ml per 20 kg body weight on day-1 and day -21.The animals were monitored for three months and parameters namely fecal egg count (FEC), texture of hair, number of ticks/sq inch, monthly body weight gain, haematology and economics were recorded. Reduction in FEC was significantly low in ivermectin group (T3) in comparison to T1 and T2. Coarse hairs in endectocide treated groups turned soft and lustrous by the end of third month and haemoglobin levels were significantly higher ($p \leq 0.05$) in both the treated groups. Numbers of ticks were reduced in both the groups and the reduction in number was noticed seven days after first treatment and was complete by first month. The body weight gain in treated groups was significantly higher ($p \leq 0.05$) compared to untreated control animals. Recovery and production performance was higher in T3 compared to T2. Ivermectin proved more effective over closantel in the control of ecto and endoparasites.

Keywords: Closantel, Efficacy, Endectocide, Ivermectin, Osmanabad goats

Introduction

Goats are among the main meat producing animals in India. It is a multi-functional animal and plays a significant role in the economy and nutrition of landless, small and marginal farmers' in India. Goat rearing is an enterprise which has been practiced by a large section of population in rural areas (Khan *et al.,* 2006). Chevon is preferred meat to mutton in Kalyana Karnataka region and hence large number of rural folk rear goats for their livelihood. Osmanabad is a well-known breed reared in this region. Shepherds have a fair idea of internal and external parasites that bother their animals and the resultant poor production. However, they lack knowledge on available effective control measures and their proper use.

Shepherds seldom approach competent field veterinaries for help and hence fail to use proper endectocide and in the right dosage. The money spent on treatment goes wasted and the problem of poor production performance persist leading to economic losses. Identifying the type of gastrointestinal nematode and their prevalence using laboratory back-up at veterinary hospitals and based on the area in which they are grazed whether marshy or dry land, may help in right choice of anthelmintic. The extensive, indiscriminate and improper use of anthelmintics for control of gastrointestinal nematodes has resulted in the development of resistance to one or more of the widely used anthelmintics in many countries including India (Srivastava *et al.,* 1995).

Knowing the extent and severity of parasitic infestations in sheep and goats and to have an updated data on prevalence and anthelmintic resistance to commonly used anthelmintic drugs would be helpful to undertake preventive and control measures in small ruminants. No new anthelmintics with different modes of action are expected on the market in the near future. So, the maintenance of the efficacy of existing anthelmintics is essential for continuing animal productivity and welfare. With this background, the present study was undertaken to compare the efficacy of two endectocides namely closantel and ivermectin in their oral formulations in Osmanabad goats in Kalyana Karnataka region.

Materials and Methods

The present study was taken up at ICAR- Krishi Vigyan Kendra, Kalaburagi -I, in three adopted villages in Kalaburagi district of Kalyana Karnataka.

Selection of Farmers and Experimental Design

Three villages in Kalaburagi district wherein shepherds rear Osmanabad goats for their livelihood were selected. They were Savalagi, Hadgil Haruti and Sharan Sirasagi of Kalaburagi Tehsil. From each village, two goat farmers with a minimum of 25 Osmanabad goats reared under semi-intensive system were selected. The adult female Osmanabad goats were screened for gastrointestinal worm load using quantitative fecal egg count (FEC) method (Stoll, 1930) and fifty animals in each village were treated as three different groups T_1, T_2 and T_3.

Goats in group T_1were not treated with any of the ecdectocide and were considered as control. Goats in group T_2 were dosed with oral closantel (15%) solution on day-1 and on day-21 at the rate of 1 ml per 20 kg body weight. T_3 group goats were treated with oral ivermectin (1%) solution on day-1 day and day-21 at the rate of 0.40ml per 20 kg body weight. Deworming was carried out during cooler parts of the day, without inflicting any stress on the animals. The level of tick infestation in all the groups was also recorded before the treatment and then at the end of 30 days after the first endectocide dose. Similarly, FEC and haematological parameters were studied during this period. The animals were observed continuously for three months after the first endectocide dose for hair texture and monthly body weight gain and economics were worked out.

Feeding

Feeding and management practices were similar for all the three groups. The animals were grazed for eight hours in a day and were offered concentrate mixture @250g per doe during night. The concentrate mixture was prepared at respective farmer's house with the advice of Animal Scientist and comprised locally available agricultural produce and by-products like maize, cotton seed cake, red gram chuni, rice bran. The mineral mixture and salt were made available by KVK.

Sampling and Analysis

Fecal egg count was done as per standard procedure described by Stoll (1930). The haematological parameters namely Packed Cell Volume (%), Haemoglobin (g/dL), Total Erythrocyte Count ($x10^6/\mu L$) and Total Leucocyte Count ($x10^3/\mu L$) were analysed on fully automated haematology cell counter (Model-PCE 210, Erma Tokyo). Blood smear for differential leucocyte count were stained with Giemsa stain and cells were counted using Battlement method as described by Jain (1993) and individual cells were expressed in percentage.

Statistical Analysis

In the present study, mean as a measure of central tendency and the standard error as a measure of random error were employed for the statistical analysis. The student's 't' test ($p \leq 0.05$) was used to know the significant variation between the groups as per the procedure described by Snedecor and Cochran (1994).

Result and Discussion

The results of the study on comparative evaluation of endectocide efficacy of closantel and ivermectin in goats are discussed below.

Faecal Egg Counts

The details of faecal EPG are presented in Table 1. The eggs of trichostrongyles were observed in the goats of all the three groups and the quantum of infection was similar in all of them before treatment. FEC in control group showed a significant increase ($p \leq 0.05$) one month later. However, goats in treatment groups T_2 and T_3 showed a significant ($p \leq 0.05$) decline on day-30 indicating the effectiveness of drugs on gastro intestinal nematodes. The decline of FEC in ivermectin treated goats in group T_3 was significantly ($p \leq 0.05$) less than that observed on day 30 in goats of group T_2.

Higher FEC in control group T_1 could be due to persistence of infection as the animals were not treated with any drug and re-infection with infective larvae that could have been added continuously to common grazing lands in a given village by the infected goats. A higher FEC was earlier reported in goats left for grazing (Ogunsusi, 1978) and an observation was made that heavily infected pasture with *Haemonchus sp* and the infective larvae present on the grass led to heavy infection in goats. Reduction in FEC in T_2 group where goats were treated with closantel could be due to the fact that closantel results in starvation and death of parasite by increasing mitochondrial permeability and diminishing oxidative phosphorylation to result in poor ATP production (Mitra and Basu, 2005). Similarly, ivermectin exerts its action by selectively binding to glutamate-gated chloride channels (GluCls) leading to hyperpolarization, paralysis and death of parasites (Yadav and Srivastava, 2005). Ivermectin was comparatively more efficacious as a pronounced decline in FEC was noticed in group T_3 on day-30 after the first dose of drug.

Effect on Tick Infestation

The details of tick infestation are presented in Table 1. The goats also suffered from tick menace and the severity of infestation was graded based on number of ticks per square inch on the common predilection areas of body surface like ear pinna, perineum and brisket region.

Table 1: Efficacy of closantel and ivermectin in control of internal and external parasites

Particulars	T_1		T_2		T_3	
	Day-1	**Day-30**	**Day-1**	**Day-30**	**Day-1**	**Day-30**
Faecal EPG (Stoll's Method)	3405±128.91[a]	3875±176.83[b]	3690±141.25 [a]	128±8.23[c]	3620±138.19[a]	37±1.58[d]
No. of ticks / Sq. inch area	+++	+++	+++	+	+++	+
	(n=26)	(n=33)	(n=28)	(n=12)	(n=27)	(n=3)

[a,b,c&d] Means bearing different superscripts differ significantly ($p \leq 0.05$) between groups at corresponding intervals + 1-2 ticks/unit area (Sq. inch), +++ 3-4 ticks/sq. inch

The number of tick infested goats in each group before they were treated on day-1 and later on day-30 are detailed in Table 1. On day-1, severity of tick infestation in all groups was +++ (3-4 ticks/sq.inch). On day-30, the severity

of infestation in control group T_1 remained same but the number of affected animals increased from 26 to 33. The severity of infestation as well as number of animals affected got reduced in both closantel and ivermectin treated groups with a greater recovery rate in later group (T_3). Similar findings were observed by Jalajakshi and Reddy Vara Prasad (2019) where they studied efficacy of oral ivermectin against tick infestation in Nellore Brown Sheep in comparison to efficacy of oral closantel and fenvalerate dipping. Oral ivermectin @ 400 µg/kg body weight was more effective in control of ovine acariasis.

Hair Texture

The details of hair texture are presented in Table 2. Initially, rough hair coat was noticed in goats of all the treatment groups. Treatment with closantel (T_2) and ivermectin (T_3) resulted in recovery from both the endo-ecto parasites. This had led to improvement in feed intake. Better assimilation and availability of essential nutrients could have followed leading to improvement in hair coat texture which appeared smooth and lustrous on day 90 after first dose of endectocide in both these groups. Clinical signs of rough hair coat, dullness, emaciation, inappetance and diarrhoea were also observed in goats suffering from endo and ecto parasites by Pandave *et al.* (2004). The loss of fluid from the body due to diarrhoea and resultant emaciation could be cited as reason for these signs (Sastry, 1983).

Mean Body Weight (kg)

The details of mean body weight (kg) are presented in Table 2. The average weight of the goats was significantly ($p \leq 0.05$) decreased from 24.50±1.58 to 18.35±1.23 with 6.15±0.35 kg body weight loss at the end of three-month study period in T_1goats. Contrarily, the average weight of the goats significantly ($p \leq 0.05$) increased from 23.80±1.47 to 32.18±1.79 and 24.15±1.27 to 34.65±1.98 with 8.38±0.32 and 10.50±0.71 kg body weight gain at the end of three-month study period in treatment groups of T_2 and T_3 groups respectively.

A resultant reduction in feed intake and disturbed digestion, absorption and metabolism of feed nutrients due to gastrointestinal worm load lead to reduction in body weight of goat (Waghmare *et al.,* 1993 and Islam *et al.,* 2003). An improvement in body weight in treated groups T_2 and T_3 could be the result of elimination of parasites facilitating proper digestion and assimilation as well as prevention of blood loss due to the arrest of tick menace.

Table 2: Effect of Closantel and Ivermectin on growth and status of health in goats

Particulars	T_1		T_2		T_3	
	Day-1	**Day-90**	**Day-1**	**Day-90**	**Day-1**	**Day-90**
Hair Texture	Rough	Rough	Rough	Smooth and lustrous	Rough	Smooth and lustrous
Mean Body Weight (kg)	24.50±1.58 [a]	18.35±1.23 [b]	23.80±1.47 [a]	32.18±1.79 [c]	24.15±1.27 [a]	34.65±1.98 [d]

[a,b,c&d] *Means bearing different superscripts differ significantly ($p \leq 0.05$) between groups at corresponding intervals of T_1,T_2 and T_3 animals.*

Haematological Analysis

The measure of various blood parameters is presented in the Table 3. In T_1, there was decrease in haemoglobin, packed cell volume and total erythrocyte count on day-30 (7.18 ±0.12, 22.54±0.04, 7.19±0.10) in comparison to status on day-1(7.45 ± 0.19, 27.16±0.91, 7.50 ±0.06) respectively. On the other hand, an increase in total leucocyte count, neutrophil and eosinophil counts were recorded on day-30 (11.06 ±0.14, 34.68±0.12, 7.11±0.51) against the respective values on day-1 (9.68±0.15, 32.50±0.76, 6.39±0.51). This showed persistence of infection and the resultant worm load.

An improvement in health was reflected in terms of different haematological parameters in both T_2 and T_3 groups on day-30. Between T_2 and T_3, animals in T_3 showed better health parameters on day-30. Increase in haemoglobin values and a decline in inflammatory cells could be correlated to better body weight and lustrous hairs observed in these groups. The reduction of Hb, PCV and TEC in goats of group T_1 might be due to blood sucking *Haemonchus contortus* causing continuous blood loss (Rahman and Collins, 1991). A minimal increase in Hb, PCV and TEC in T_2 goats could be due to the narrow spectrum endectocide activity of closantel specially against blood sucking

parasites (Owen, 1988). The moderate increase of Hb, PCV and TEC in T_3 goats might be due to the arrest of *Haemonchus* species at fourth stage larvae (Yazwinski *et al.*, 1999) and thus an effective use of ivermectin (Reddy *et al.*, 2006) for control of both endo-ecto parasites.

The increase of TLC, neutophil count, eosinophil count and decrease of lymphocyte count in T_1 goats might be due to inflammation of abomasum produced by blood sucking *Haemonchus contortus* worms resulting in abomasitis and anaphylaxis reaction (Sastry, 1983). The moderate decrease of TLC, neutrophil, eosinophil counts and increase of lymphocyte count in T_2 goats might be due to closantel that causes death of this parasite by inhibiting anaerobic phosphorylation of ADP, an energy producing process of this worm (Prasad, 1999). The sharp decrease of TLC, neutrophil, eosinophil counts and increase of lymphocyte count in T_3 goats might be due to ivermectin inhibiting electrical activity of nerve cells in parasites causing paralysis and death of worms (Yadav and Srivastava, 2005). However, the variations in hematological parameters in both the control and treatment groups were noticed within normal physiological limits.

Table 3: Haematological parameters (Mean ± SE) in different treatment groups

Particulars	T_1		T_2		T_3	
	Day-1	Day-30	Day-1	Day-30	Day-1	Day-30
Hb (g %)	7.45± 0.19	7.18 ±0.12	7.36 ±0.12	8.46±0.08	7.56 ±0.09	8.63 ±0.06
PCV (%)	27.16±0.91	22.54±0.04	24.61±0.13	28.89±0.35	23.58±0.10	29.80±0.25
TEC ($x10^6/\mu L$)	7.50 ±0.06	7.19±0.10	7.20±0.04	8.30±0.09	7.05±0.02	8.55±0.10
TLC ($x10^3/\mu L$)	9.68±0.15	11.06 ±0.14	9.21±0.09	8.26±0.08	9.19±0.07	7.86±0.04
DLC- Neutrophil (%)	32.50±0.76	34.68±0.12	36.50±0.76	32.33±0.61	38.50±0.76	31.66±0.49
Lymphocyte (%)	63.33±1.23	59.63±0.26	52.50±1.59	61.16±0.60	49.33±1.86	62.00±0.57
Eosinophil (%)	6.39±0.51	7.11±0.51	6.83±0.60	3.50±0.22	7.50±0.56	3.25±0.21

Economic Analysis

The cost and benefit analysis are depicted in Table 4. The dressing percentage of 50% and Rs. 400/- chevon as the current market price of the goat meat in Kalaburagi district are taken for calculation purpose.

Table 4: Economic analysis in different treatment groups

Parameters	T_1	T_2	T_3
Gross cost (Rs/goat/90 days)	1350 (Rs 15/day/goat)	1356 (Rs 15/day/goat plus cost of drug)	1350.8 (Rs 15/day/goat plus cost of drug)
Gross returns on day-90(Rs) (Dressed meat yield x Rate of chevon**)	3672 (Av. Bwt on day-90 is 18.35kg. Dressed meat weight* is 9.18 kg)	6436 (Av. Bwt on day-90 is 32.18 kg. Dressed meat weight*is 16.09 kg)	6932 (Av. Bwt on day-90 is 34.65 kg. Dressed meat weight*is 17.33 kg)
Net returns (Rs/per goat/90 days)	2322	5080	5581.2
Benefit to Cost ratio	1:2.72	1:4.75	1:5.13
Difference In Net Profit on 90th day in T_2over T_1 (Rs/per goat)	2758		-
% Increase in Body Weight on 90th day in T_2over T_1	75.37		-
Difference In Net Profit on 90th day in T_3over T_1 (Rs/per goat)	-	3259.2	
% Increase in Body Weight on 90th day in T_3over T_1	-	88.83	
Cost of drug	-	Costlier;(500 ml @Rs.1500/-); (1 ml@ Rs.3/-); Per goat per dose- Rs. 3/-	Cheaper; (500 ml @Rs.500/-); (1 ml@Rs. 1/-); Per goat per dose- Rs.0.40/-

The cost incurred during 90 days of study period including cost of drug used was Rs. 1350, Rs.1356 and Rs.1350.80 in T_1, T_2 and T_3 respectively. The cost of closantel and ivermectin per goat per dose was Rs. 3/- and Rs. 0.40/- respectively. So, gross cost of T_2 and T_3, becomes higher than T_1. The difference in net profit per goat on day-90 between T_2 and $T_1$and T_3 and T_1 were Rs. 2758/- and Rs. 3259.20/- respectively. The net profit gain per goat in ivermectin treated goats was Rs. 501.20/- over the closantel treated goats in 90 days.

The present findings were in agreement with the findings of Jalajakshi and Reddy Vara Prasad (2019). They observed that cost of the treatment per animal was cheaper with Fenvalerate dipping solution when compared to other treated groups but it was highest with closantel oral solution and was moderate with oral ivermectin @ 400 µg/kg body weight. Also, percentage increase in body weight in T_2 over T_1 was 75.37 on 90^{th} day. Percentage increase in body weight in T_3 over T_1 was 88.83 on day-90. This indicates that, percentage increase in body weight in ivermectin goats was 13.46 over closantel goats within 90 days.

Conclusion

In conclusion, with an overall improvement in health and the resultant significantly high body weight gain in goats and comparatively low cost of drug, ivermectin could be a better choice for shepherds as an endectocide in control of both internal and external parasites.

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Conflict of Interests

There is no conflict of interest.

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References

1. Islam, A., Mustafa, M., Awal, M.A., Islam, M.R., Alam, J., Rahman, M.M., Rahman, M. and Anwar, A.K.M., 2003. Efficacy of ivermectin against gastrointestinal nematodes and endoparasites in calves. *Indian Veterinary Journal.,* 80, 1173-1176.
2. Jain, N.C., 1993. Essentials of Veterinary Haematology. Lea and Fabiger, Philadelphia, *p* 417
3. Jalajakshi, K. and Reddy Vara Prasad, A., 2019. Efficacy of oral ivermectin against tick infestation in Nellore Brown Sheep. *International Journal of Science, Environment and Technology.,* 8 (1), 89 – 94.
4. Khan, H., Fida, M., Riaz, A., Gul, N., Rahimullah and Muhammad, Z., 2006. Relationship of body weight with linear body measurements in goats. *Journal of Agriculture and Biological Sciences.,* 1 (3), 51-54.
5. Mitra, J. and Basu, A. K., 2005. Therapeutic efficacy of Closantel against gastrointestinal nematodes in buffalo calves. *Indian Veterinary Journal.,* 82, 714-715.
6. Ogunsusi, R.A., 1978. Changes in blood values of sheep suffering from acute and chronic helminthiasis. *Research in Veterinary Science.,* 25, 298-301.
7. Owen, I.L., 1988. Field trials with Closantel and *Haemonchus contortus* in sheep in Papua New. *Australian Veterinary Journal.,* 65(9), 267-270.
8. Pandave, E.R., Deore, U.B., Zambare, P.R., Patil, A.B. and Ozarkar, P.S., 2004. Therapeutic management of Haemonchosis in sheep. *Indian Veterinary Medical Journal.,* 28, 279-280.
9. Prasad, V.V., 1999. *Veterinary pharmacology and toxicology (second edition).* Parabhani, India: Vahini Science Serials.
10. Rahman, W.A. and Collins, G.H., 1991. Changes in live weight gain and blood constituents in experimental infection of goats with a goat derived compared with a sheep derived stain of *Haemonchus contortus. Journal of Veterinary Parasitology.,* 38, 145-153.

11. Reddy, Y.R., Syaamasundar, N. and Virojirao, S.T., 2006. Effect of oral ivermectin on growth rate in sheep. *Indian Veterinary Journal.*, 83, 234
12. Sastry, G.A., 1983. *Veterinary pathology (sixth edition).* New Delhi, India: CBS Publishers and Distributors Pvt Ltd.
13. Snedecor, G.W. and Cochran, W.B., 1994. *Statistical methods (eight edition).* Calcutta, India: Oxford & IBH Publishing Co.
14. Srivastava, V.K., Kumar, P.N., Khanna, P.N. and Singh, M., 1995. Gastro-intestinal nematodiasis and drug resistance in sheep. *Indian Veterinary Journal.,* 72(1), 14–16.
15. Stoll, N.R., 1930. On Methods of counting Nematode Ova in Sheep Dung. *Parasitology.,* 22, 116-136.
16. Waghmare, S.P., Rode, A.M., Sapre, V.A. and Dakshinkar, N.P., 1993. Haematological studies in bufflaoe calves with natural gastrointestinal helminth infection. *Livestock Advisor.,* 18(12), 7-11.
17. Yadav, A. and Srivastava, A.K., 2005. Pharmacology and therapeutic efficacy of a potent antiparasitic drug-Ivermectin. *Intas Polivet.,* 6(2), 181-187.
18. Yazwinski, T.A., Greenway, T., Presson, B.L., Pote, L.M., Featherstone, H. and Williams, M., 1999. Antiparasitic efficacy of Ivermectin in naturally parasitized sheep. *International Journal of Parasitology.*, 29(5), 781-786.

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