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Short Communication

Comparative Efficacy of Ivermectin and Fipronil on Controlling Tick Infestation in Commercial Layers: A Randomized Controlled Trial

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Authors' Contributions
SK and AR conceived and designed the study, and wrote the article. SK executed the experimental work and collected the data. IS and MA statistically analyzed the data. MYA helped in preparation of manuscript.

Key words
Ivermectin, Fipronil, Commercial Layer, Tick Infestation.

ABSTRACT

To evaluate the effects of ticks on blood parameters and efficacy of different drugs on controlling tick's infestation in commercial layer, a double blind randomized controlled trial was conducted. For therapeutic trials, the 80 birds (n= 60 infested with ticks, n= 20 healthy birds) were selected and divided into four groups (A, B, C and D), each comprising of 20 birds. Group A and B were treated with Ivermectin @ 0.2mg/Kg orally for two days and Fipronil (Spray at once), respectively. Group C was kept as positive control whereas the ticks free birds were kept in group D. The results showed the significant decrease ($p<0.001$) in tick's count in both the groups (A and B) as compared to group C. The efficacy of Ivermectin and Fipronil, on 28th day was 93.93% and 77.83%, respectively. Hence, the results proved Ivermectin to be more effective than Fipronil. The 40 birds (n=20 tick infested birds, n=20 healthy birds) were selected for haematological study. The results showed a significant decrease ($p < 0.05$) in the values of PCV (%), Hb concentration (gm/dl) and RBCs during tick infestation.

The ectoparasites of poultry like ticks, lice and mites play an important role in the transmission of certain pathogens which cause heavy economic losses to poultry industry (Iqbal *et al*., 2003). They cause heavy morbidity by sucking blood and causing irritation to the birds which adversely affects the economical production of poultry (Phulan *et al*., 1984).

Ticks can transmit certain diseases like fatal anemia, spirochaetosis, tularaemia, aegyptianellosis and encephalitis resulting in heavy losses to the poultry industry. *Argus persicus* is an important ectoparasite of domestic and wild birds in the world; and play an important role in transmission of spirochaetal diseases in poultry (Buriro, 1979). It causes severe irritation to poultry which has an adverse effect on bird's growth and cause heavy economic losses in poultry industry (Shah *et al*., 2004). *Argas persicus* transmits *Borrelia anserina* which is the causative agent of fowl spirochaetosis (Rashid and Ali, 1991; Telmadarraiy *et al*., 2007).

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Among ectoparasites, fowl ticks may cause ruffled feathers, anemia, emaciation and low production. Heavy tick infestation may cause loss of blood leading to anemia and eventually death (Bergstrom *et al*., 1999). Larval forms of these ticks also cause paralysis.

The use of chemicals is the primary method to control tick infestation in poultry all over the world, but development of resistance against various chemicals, their non-availability and inconvenient dosage form have always posed a challenge for the veterinarians to select an acaricide (Khan *et al*., 2001). A variety of chemicals are being used for control purpose in poultry either by application to the birds or through spray in poultry houses. Among these, Deltamethrin, Ivermectin, Cypermethrin, Fipronil, Trichlorfon and Dichlorvos are commonly used.

In Pakistan, the poultry farmers are still using the old traditional techniques to control the tick's infestation. A little information is available regarding to control the tick's infestation. Keeping in view the importance of ticks in livestock sector the present project was designed to study the effect of ticks on different blood parameters and to evaluate the efficacy of Ivermectin and Fipronil on controlling ticks in commercial layer.

Materials and methods

A double blind randomized controlled trial was conducted on commercial layers present at Government Poultry Farm, Attock.

A total of 80 commercial layers (n=60 naturally infested with ticks and n=20 birds without having ticks) were selected from the flock having the same age and environment for haematological study and therapeutic trials. Each group (ticks infested and birds without having ticks) was kept in separate and clean pens under same environmental conditions.

Blood sample (1 ml) was collected from 40 birds (20 tick infested birds and 20 healthy birds free from ticks) directly from brachial vein in a sterilized plastic bottles coated with EDTA@1 mg/ml of blood to measure haemoglobin (Hb = gm/dl), packed cell volume (PCV %), total erythrocyte count (TEC) and total leukocyte count (TLC) using haematological analyzer.

For chemotherapy, 80 birds (60 infested with ticks, 20 healthy birds) were selected and divided into four groups; A, B, C and D, each comprising of twenty birds. The birds in group A were treated with Ivermectin @ 0.2mg/Kg, orally for two days. Group B was treated with Fipronil (Spray) at once. Group C was kept as positive control, whereas the healthy birds were kept in group D as negative control.

Ticks on the body of each bird were counted on day 0, 1st, 7th, 14th, 21st and 28th during night time as recommended by Ramadan (2009). The efficacy of the acaricides was evaluated by controlled method (Moskey and Harwood, 1941) on the basis of reduction in number of ticks on different days after the treatment.

The formula for calculating the efficacies of the acaricide was described as under (Khan *et al*., 2001):

$$\text{Percentage efficacy} = \frac{\text{Avg. No. of ticks before treatment} - \text{Avg. No. of ticks after treatment}}{\text{Average No. of ticks before treatment}} \times 100$$

Statistical analysis

The data regarding ticks count on different days in groups A, B and C was analyzed using Mixed-Design ANOVA (Repeated measures with a between subject factor) and subsequently with pairwise comparison and Tukeys post hoc test. Type of acaricide (groups) was the between-subjects factor and time (six different time points from day 0 to 28) was the within-subjects factor. For pairwise comparisons the SPSS syntax was costumed and commands for the group and time interaction were added. Since the assumption of sphericity was compromised, therefore the values for F statistics and degrees of freedom (df) produced by Greenhouse-Geisser test were considered. The data regarding haematological parameters was analyzed using independent student *t*-test. All the analysis was done by using Statistical Package for Social Sciences (SPSS) Version 24.0. Probability level (p) of ≤ 0.05 was considered significant.

The study was approved by the ethical committee of Poultry Research Institute, Rawalpindi and the care was taken to us the minimum number of animals.

Table I.- Ticks count at different days before and after the treatment.

Ticks count (Mean±S.D)	Groups		
	A	B	C
0 day	17.30±4.99	20.30±4.91	18.20±5.63
1st day	16.45±4.87	16.00±4.65	18.70±5.42
7th day	12.60±4.43 [a]	11.00±3.45 [a]	21.60±5.07
14th day	7.50±3.41 [a]	6.10±2.77 [a]	24.05±5.01
21st day	1.90±1.80 [a]	2.65±1.81 [a]	27.15±4.88
28th day	1.05±0.88 [a]	4.50±1.93 [ab]	29.10±4.47

[a]Mixed Designed ANOVA showed significant decrease in tick burdens as $p < 0.05$. [b]The difference was significant ($p = 0.001$) also between group A and group B.

Results and discussion

Table I shows the effect of Ivermectin and Fipronil (Spray) on ticks counted on birds. The Mixed-Design ANOVA model showed that there was a significant difference in tick burden across the six time points [$F(1.5, 88) = 189.9$, $p < 0.001$] and between groups [$F(2, 57) = 81.3$, $p < 0.001$] as well. There was also a significant interaction between time and group [$F(3.1, 88) = 272$, $p < 0.001$]. Following up this interaction indicated that there was no significant difference between groups at baseline and the negative control group did not change over time. However, the mean scores of the treatment groups decreased over time, more so for those in the group A. This indicates that the changes in tick counts/burdens overtime are not equivalent across the groups. Although, there was significant decrease ($p < 0.001$) in tick burden in group A and B as compared to group C, the difference was insignificant between group A and group B; as shown in Figure 1. Since the interaction between time and group was significantly different therefore it would be useless, rather misleading, to interpret the significance between and within subject effects. The pair-wise comparisons of treatment groups at each time point revealed that there was a significant decrease ($p < 0.001$) in tick burden in group A and B as compared to group C on day 7, 14, 21 and 28, whereas tick burdens were significantly lower ($p = 0.001$) in group A than group B on day 28.

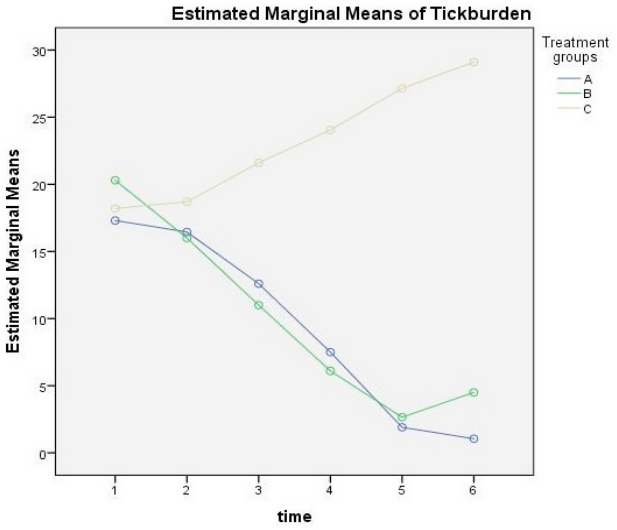

Fig. 1. Estimated marginal mean of tick burden.

A variety of acaricides are used for the control of tick infestation in poultry either by application to the birds or poultry houses. Smith (1952) reported that during the fifties, several authors reported some new insecticides, at that time, sprays of lindane, chlordane, toxaphene, dieldrin, and aldrin provided some control of the fowl tick. The results of this study (Table II) showed that the efficacy of Ivermectin at day 1st, 7th, 14th, 21st and 28th (post-treatment) was 4.91%, 27.16%, 56.64%, 89.01% and 93.93%, respectively whereas the efficacy of Fipronil was 21.18%, 45.81%, 69.95%, 86.94% and 77.83%, respectively. The study showed that the efficacy of Ivermectin was highest (93.93%) on 28th day (Post-treatment). These results corroborate with the finding of Khan *et al*. (2001), who also reported 82.96% efficacy of Ivermectin on 28th day after treatment. Miller (1989) also found out that Ivermectin was as an effective drug against ticks in broiler chicken. The results of the study also revealed that the maximum efficacy of Fipronil was 86.94% on 21st day (post treatment) which shows that Fipronil provides the protection against tick infestation for a period of 21 days only and after that its effect starts diminishing.

Table II.- Comparative efficacy of ivermectin and fipronil at various days of treatment.

Efficacy (%)	Drugs	
	Ivermectin	Fipronil
1st day	4.91	21.18
7th day	27.16	45.81
14th day	56.64	69.95
21st day	89.01	86.94
28th day	93.93	77.83

Table III shows the effects of tick infestation on various blood parameters. A significant decrease ($p<0.05$) was observed in the values of PCV (%), Hb (gm/dl) and RBCs ($\times10^6$/cmm) while WBCs ($\times10^3$/cmm) were significantly increased in ticks infested birds. The results of this study are in close agreement with the findings of Campbell (2004), Rick (2004) and Al-Saffar and Al-Mawla (2008) who also found a significant decrease in the values of PCV (%), Hb concentration (gm/dl) and RBCs during tick infestation. The results of the present study revealed that the birds were anaemic and dehydrated as compared to non-infested birds due to heavy infestation of ticks. Khan (2001) reported that a single tick of *Argas persicus* sucked huge quantity of blood daily and thus a heavy blood loss leads to anemia. Present study findings are also correlated with the findings of Campbell (2004) who reported that heavy infestation of fowl ticks caused loss of blood leading to anemia. The results of this study also showed a significant increase ($p<0.05$) in WBCs (leukocytes), that is similar with the findings of Campbell (2004) and Al-Saffar and Al-Mawla (2008) who also reported leukocytosis. This increase in leukocytes was due to the inflammation which occurred during parasitic infestation (Campbell, 2004).

Table III.- Effects of ticks Infestation on different blood parameters.

Parameters	Normal values (n=20)	Infested birds values (n=20)
WBCs ($\times10^3$/cmm)	18.60±0.75*	27.15±0.62*
RBCs ($\times10^6$/cmm)	2.67±0.25*	1.95±0.31
Hb (gm/dl)	8.30±0.67*	6.95±0.26*
PCV (%)	33.54±2.69*	22.34±3.14*

*Independent student *t*-test shows significant difference as $P<0.05$.

Conclusion

The study concluded that both the drugs; Ivermectin and Fipronil are effective against ticks control in commercial layer. Moreover, Fipronil lowers the burden of ticks a bit earlier as compared to Ivermectin while Ivermectin has an advantage over Fipronil that it gives protection for a longer period of time.

Statement of conflict of interest

Authors have declared no conflict of interest.

References

Al-Saffar, T.M. and Al-Mawla, E.D., 2008. *Iraqi J. Vet. Sci.*, **22**: 95-100.

Bergstrom, S., Haemig, P.D. and Olsen, B., 1999. *Int. J. Parasitol.*, **29**: 1359–1361. https://doi.org/10.1016/

S0020-7519(99)00088-0

Buriro, S.N., 1979. Role of Argas (Persicargas) persicus in transmission of spirochaetosis. *Pakistan J. Zool.,* **11**: 221-224

Campbell, T.W., 2004. *Avian hematology and cytology*. 2nd ed, Iwoa State Press, Blackwell Publishing Company, pp. 12.

Iqbal, Z., Khan, M.N. and Jabbar, A., 2003. *An illustrated text book of veterinary entomology.* University of Agriculture Faisalabad, Pakistan, pp. 124-141.

Khan, L.A., 2001. *Studies on the prevalence, economic losses and chemotherapy of tick infestation on commercial layers*. M. Sc. thesis. Faculty of Veterinary Parasitology, University of Agriculture, Faisalabad, Pakistan.

Khan, L.A., Kham, M.N., Iqbal, Z. and Qudoos, A., 2001. *Pakistan J. agric. Sci.,* **38**: 29-31.

Miller, R.A., 1989. *Use of ivermectin to control the lesser mealworm (Coleoptera: Tenebrionidae) in a simulated poultry broiler house*. Poultry Science Association Inc.

Moskey, H.E. and Harwood, P.D., 1941. *Am. J. Vet. Res.,* **2**: 55-59.

Phulan, M.S., Bhatti W.M. and Buriro, S.N., 1984. *Pakistan Vet. J.,* **4**: 174–175.

Ramadan, M.Y., 2009. *Acaricidal and immunological studies on fowl tick* Argas persicus *infecting commercial balady chickens flock*. 3rd Int. Sci. Conf.

Rashid, J. and Ali, A., 1991. Comparative study of pathogenicity of experimentally produced Borrelia anserina infection in commercial and desi chicks. *Pakistan J. Zool.,* **23**: 361–2

Rick, L.C., 2004. *Elsevier M. Veterinary clinical pathology* Secrets 2nd ed, Elesier Mosby Missouri, pp. 282-301.

Shah, A.H., Khan, M.N., Iqbal, Z. and Sajid, M.S., 2004. *Int. J. Agric. Biol.,* **6**: 1162-1165.

Smith, C. L., 1952. *J. econ. Ent.,* **45**: 748.

Telmadarraiy, Z., Nasirian, H., Vatandoost, H., Abuolhassani, M., Tavakoli, M., Zarei, Z., Banafshi, O., Rafinejad, J., Salarielac, S. and Faghihi, F., 2007. *Pak. J. biol. Sci.,* **23**: 4315-4318.