Effect of Use of Different Anthelmintics (Piperazine Citrate and Ivermectine) on Blood Profile of Infested Poultry (Commercial and Rural Layers)

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Abstract This research was conducted to describe the therapeutic effect of ivermectin and piperazine citrate on blood profile in commercial layer birds and rural poultry. Two experiments named 1 and 2 were performed representing commercial layer birds and rural poultry respectively. Each experiment was consisted of 4 groups of 15 birds each named A, B, C, D, (Experiment No 1) and W, X, Y and Z (Experiment No 2). To make the birds parasitic free, Albendazole @14mg /Kg were administered in all birds. In subgroups A, B, C, W, X and Y *Ascaridia galli* infection was inoculated orally @ dose rate of 2500 embryonated eggs per bird using crop tube. To confirm infestation 5 birds were euthanized from each treatment group at day 28th of post infection. Ivermectin @ dose rate of 200µg/kg was given in birds of treatment groups A and W, and Piperazine citrate @ dose rate of 32 mg/100 kg in birds of treatment groups C and Z. At day 10th (post treatment) six birds from each group were blood sampled to check blood profile. Blood analysis showed same ($P > 0.05$) effect of both anthelmintics on serum cholesterol, serum T3, serum creatinine, serum cortisol level, ESR and respiratory rate of infested birds whilst Piperazine citrate administration showed higher ($P < 0.05$) serum T4 level, and lower ($P < 0.05$) serum urea level in infested birds.

Keywords Infestation, Piperazine Citrate, Ivermectin, Blood Profile, Poultry

1. Introduction

Parasitic infections are considered a disaster for production performance of poultry especially rural poultry carry high parasitic burden [6] however, it is often neglected. Recently helminthosis is considered one of the most common injurious for poultry all over the world [15, 13].

Parasitism may prove fatal to young and weak poultry also fatal to human through transmission of zoonotic diseases [1].

Different anthelmintics drugs have varying broad spectrum activity against nematode worms and ectoparasites in poultry, and have been in use from the last four decades. Ivermectin is moderately well absorbed following oral administration and its dose ranges from 20 to 300 µg/kg body weight [7]. Different biologists have demonstrated relation of ivermectin and worms in different ways. Piperazine is a pharmacological analogue of a natural inhibitory neurohormone and is a drug of choice against helminthes. It has also been studied that the use of herbal growth promoters have positive effect on overall health status of birds and also helpful in controlling the intestinal parasites [11, 12]. However work on the effect of anthelmintics on blood profile and physiology of birds is very scant. Therefore the present project was designed to check the comparative effect of two vastly used prominent anthelmintic (Piperazine vs Piperazine citrate) on physiology and blood profile of poultry birds.

2. Materials and Methods

Experimental Protocol

A total of 120 birds (60 commercial layer white leg horn birds named group 1 and 60 rural poultry birds named group 2) were purchased from the farms and villages of about 7 to 9 week age and brought to the poultry shed of Department of Clinical Medicine and Surgery, University of Agriculture, Faisalabad. For 7 days birds were fed (commercial feed *ad libitum* to acclimatize. After seven days the two groups (n=120) were dewormed with albendazole @ 14 mg/kg to make the birds free from any parasitic infestation [5]. Dropping of all birds were collected (after a week) to confirm infestation free [16]. The parasitic free commercial layer birds (n=60) were divided in to 4 groups named A, B, C,

D (Experiment 1) and the rural poultry birds (n=60) were divided into four subgroups W, X, Y and Z (Experiment 2). Each group comprised of 15 birds. In groups A, B, C, W, X and Y *Ascaridia galli* infection was inoculated orally @ dose rate of 2500 embryonated eggs per bird in dilution with buffer solution with crop tube.

EXPERIMENT NO. 1

SUB GROUP	INFECTION
A	Infection + Ivermectin
B	Infection+Piperazine citrate
C	Infected unmedicated
D	Control (uninfected unmedicated)

EXPERIMENT NO. 2

SUB GROUP	INFECTION
W	Infection + Ivermectin
X	Infection+Piperazine citrate
Y	Infected unmedicated
Z	Control (Uninfected unmedicated)

Ivermectin = 200µg/Kg

Piperazine citrate = 32mg/Kg

Birds of groups C and Y were kept as positive control (infected) and groups D and Z were kept as absolute control (Uninfected unmedicated). At day 28th (post-infection), droppings were examined by applying direct smear method and centrifuge floatation technique. Then Ivotek^R (Star Labs) @ .75ml was administered each bird of group A and W and Digestion^R (UT D) @ dose rate of 2.5gm was given to birds of group B and X. Then at 38th day post infection (10th day post medication) blood samples were collected (six birds / group). These samples were collected from brachial vein of birds in 5 ml sterilized B. D. syringes. After collection of blood these syringes were kept in slanted position to obtain serum from the samples. The serum was collected in sterilized 0.5 ml serum cups. Serum cortisol level, T3 level, T4 level, creatinine level, cholesterol level, urea level and ESR level were determined as described by [16], [10], [4] and [9].

Statistical Analysis: The data thus collected was subjected to statistical analysis for the interpretation of results using analysis of variance technique with completely randomized design. Treatment means were compared by Duncan Multiple Range test [17].

3. Results and Discussion

Piperazine citrate and Ivermectin administration did not show any significant change ($P > 0.05$) on serum cholesterol level in commercial as well as backyard layers (Table 1). The results are contrary to [2] who noticed a rise in cholesterol level by administration of piperazine citrate in broiler chickens. On the other hand some scientists have observed

the decrease in cholesterol level in poultry by ginger and black pepper along with their anthelmintic activity [19]. Serum T3 level was not affected significantly ($P > 0.05$) due to anthelmintic treatment groups (Table 2) however mean value of serum T3 hormone was significantly higher ($P < 0.05$) in commercial layers which might be due to species variation. Administration of anthelmintic whilst treating the infestation caused significant effect ($P < 0.05$) on T4 hormone level (Table 3) in commercial and rural poultry. Highest T4 level was observed in birds not infected nor medicated whilst that of lowest observed in birds infested with worms but not medicated in both types of layers (commercial and rural). However, piperazine citrate administration showed better level of T4 hormone in infested birds (commercial and rural) as compared to Ivermectin. This might be due to better anthelmintic ability of piperazine citrate against nematodes as compared to ivermectin. The results show that the fluctuation in the value of T4 is much higher in commercial poultry layer as compared to backyard poultry. This might be due to genetic makeup of the commercial poultry that it shows quick response to the environmental and other physical changes. Differences in serum creatinine level among treated and untreated groups were found to be non-significant ($P > 0.05$) (Table 4). Use of anthelmintics (piperazine citrate and ivermectin) showed non-significant effect on serum creatinine level in commercial and rural layers. It was observed that whilst treating infestation by administering anthelmintics (piperazine and ivermectin), serum urea level affected significantly (Table 5). Highest serum urea level was observed in birds infested but not treated with anthelmintics however birds infested with *A. galli* and afterward treated with piperazine citrate showed lowest serum urea level in commercial layer. This disparity might be due to more response of commercial layer to piperazine citrate in fight against *A. galli* as compared to rural poultry birds. Serum cortisol level in rural and commercial birds was not significantly affected by anthelmintics (Table 6) however cortisol level was significantly more in commercial layers. Possible reason might be natural resistance developed in backyard poultry against worms leading to less stress which resulted less cortisol level.

Comparative therapeutic effect of both anthelmintics (Piperazine and Ivermectin) was not significant (Table 7). This result is contrary to [20] who found better efficacy of piperazine than ivermectin as anthelmintic. However, infection rate (ESR) was significantly higher in birds of group infected but not treated with anthelmintic ($P > 0.05$). ESR level was high in birds which were infested but not given any anthelmintic therapy in both types of layers (commercial and rural). These findings are compatible to that of [8] and [18] who reported that ESR values decreases in anthelmintics treated groups.

Respiratory rate was significantly higher in birds of group C (commercial layers infected but not treated) and group Y (rural layers infected but not treated). This may be due to the worm burden which causes increase in respiratory rate.

However, comparative therapeutic effect of piperazine citrate and ivermectin on respiratory rate of birds was not differed significantly which revealed that both drugs have similar positive effect on respiration rate of birds during infestation (Table 8).

[3] Reported that pathological catabolic processes that have been contributed due to the effect of *A. galli* infestation on the middle part of small intestine may cause disturbance of blood profile of birds due to disruption in absorption of nutrients. However administration of the piperazine in the birds caused removal of *A. galli* ultimately restored the capacity of the small intestinal.

The present findings indicates that treatment with both drugs (Piperazine citrate and Ivermectin) have comparable results in terms of haemato-biochemical profile though the treatment however, especially piperazine citrate resulted in remarkable improvement on blood profile of infested commercial layer birds without any side effect. This result also illustrates that the blood profile changes occur in short time after infection in commercial poultry as compared to backyard poultry and simultaneously the positive effect of drug in restoring the blood profile parameters occur earlier in the commercial layer as compared with the backyard poultry.

Table 1. Effect of Piperazine citrate and Ivermectin on plasma cholesterol level in infested commercial and rural layers

Group	Layer						Mean		
	Commercial			Desi					
1	138.33	±	0.33	139.33	±	1.33	138.83	±	0.65A
2	138.00	±	0.00	142.00	±	3.06	140.00	±	1.63A
3	138.33	±	0.33	137.67	±	0.88	138.00	±	0.45A
4	137.00	±	1.00	137.33	±	4.06	137.17	±	1.87A
Mean	137.92	±	0.29A	139.08	±	1.26A			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$).

Table 2. Effect of Piperazine citrate and Ivermectin on plasma T3 Hormone level in infested commercial and rural layers

Group	Layer						Mean		
	Commercial			Desi					
1	2.50	±	0.15	2.40	±	0.12	2.45	±	0.09A
2	2.60	±	0.25	2.47	±	0.13	2.54	±	0.13A
3	2.40	±	0.06	2.20	±	0.10	2.30	±	0.07A
4	2.63	±	0.03	2.27	±	0.09	2.45	±	0.09A
Mean	2.53	±	0.07A	2.33	±	0.06B			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$).

Table 3. Effect of Piperazine citrate and Ivermectin on plasma T4 Hormone level in infested commercial and rural layers

Group	Layer						Mean		
	Commercial			Desi					
1	3.53	±	0.20bc	3.17	±	0.03cd	3.35	±	0.12BC
2	3.77	±	0.15ab	3.20	±	0.12cd	3.48	±	0.15AB
3	3.13	±	0.07d	3.10	±	0.06d	3.12	±	0.04C
4	4.10	±	0.15a	3.27	±	0.18cd	3.68	±	0.21A
Mean	3.63	±	0.12A	3.18	±	0.05B			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$). Small letters represent comparison among interaction means and capital letters are used for overall mean.

Table 4. Analysis of variance table for Creatinine

Group	Layer						Mean		
	Commercial			Desi					
1	0.69	±	0.04	0.72	±	0.03	0.71	±	0.02AB
2	0.69	±	0.02	0.65	±	0.02	0.67	±	0.01B
3	0.75	±	0.04	0.78	±	0.06	0.77	±	0.03A
4	0.69	±	0.02	0.62	±	0.01	0.66	±	0.02B
Mean	0.71	±	0.02A	0.69	±	0.02A			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$).

Table 5. Analysis of variance table for Urea

Group	Layer						Mean		
	Commercial			Desi					
1	42.00	±	1.15bc	40.00	±	0.58bc	41.00	±	0.73B
2	39.33	±	0.67c	40.00	±	1.15bc	39.67	±	0.61B
3	51.00	±	2.08a	41.00	±	2.08bc	46.00	±	2.59A
4	43.33	±	0.67b	41.33	±	1.20bc	42.33	±	0.76B
Mean	43.92	±	1.42A	40.58	±	0.61B			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$). Small letters represent comparison among interaction means and capital letters are used for overall mean.

Table 6. Analysis of variance table for Cortisol

Group	Layer							Mean	
	Commercial			Desi					
1	8.03	±	0.74	7.70	±	0.44	7.87	±	0.39B
2	8.67	±	0.37	7.00	±	0.40	7.83	±	0.45B
3	9.23	±	0.22	8.57	±	0.23	8.90	±	0.21A
4	7.87	±	0.24	7.87	±	0.35	7.87	±	0.19B
Mean	8.45	±	0.25A	7.78	±	0.23B			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$).

Table 7. Analysis of variance table for ESR

Group	Layer						Mean		
	Commercial			Desi					
1	3.43	±	0.09	3.63	±	0.09	3.53	±	0.07B
2	3.63	±	0.09	3.37	±	0.12	3.50	±	0.09B
3	4.83	±	0.56	4.03	±	0.09	4.43	±	0.31A
4	3.53	±	0.18	3.50	±	0.15	3.52	±	0.10B
Mean	3.86	±	0.21A	3.63	±	0.09A			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$).

Table 8. Analysis of variance table for Respiratory rate

Group	Layer							Mean	
	Commercial			Desi					
1	69.67	±	0.33	70.67	±	0.33	70.17	±	0.31B
2	70.33	±	0.33	70.00	±	1.15	70.17	±	0.54B
3	73.33	±	0.67	72.67	±	0.67	73.00	±	0.45A
4	70.33	±	0.33	70.33	±	0.33	70.33	±	0.21B
Mean	70.92	±	0.47A	70.92	±	0.43A			

Means sharing similar letter in a row or in a column are statistically non-significant ($P>0.05$).

4. Conclusions

Helminthes are very important which have negative impact on poultry health. Different herbal and synthetic elements have been used for control of these helminthes. All the physiological, hematological and hormonal changes which occur as the result of helminthosis are more prominent in commercial poultry than the backyard poultry. However, birds treated with Piperazine citrate showed beneficial effect o physiological, hematological and hormonal profile as compared to those treated with ivermectin. On the basis of the results of the present study it is concluded that Piperazine is comparatively a better drug than ivermectin to control worm infestation.

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