



# EFFECT OF AEGLE MARMELOS AND ANDROGRAPHIS PANICULATA ON PERFORMANCE AND RELATIVE ORGAN WEIGHT IN AFLATOXICOSIS OF BROILER CHICKEN\*

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## Abstract

The present study was undertaken to find out the effect of *Aeglemarmelos* and *Andrographispaniculata* on performance and relative organ weight in aflatoxicosis of broiler chicken. Day old broiler chicken were divided into eight groups and fed with following diets standard feed (T1), standard feed with 100 ppb aflatoxin(AF) (T2), standard feed with 0.1 per cent *A. marmelos* powder and 0.1 per cent *A. paniculata* powder (T3), standard feed with 100ppb AF and 0.10 per cent *A. marmelos* powder (T4), standard feed with 100ppb AF and 0.10 per cent *A. paniculata* powder (T5), standard feed with 100 ppb AF and 0.20 per cent *A. marmelos* powder (T6), standard feed with 100ppb AF and 0.20 per cent *A. paniculata* powder (T7) and standard feed containing 100 ppb AF, 0.1 per cent *A. marmelos* powder and 0.1 per cent *A.paniculata* powder. The body weight of all groups were monitored on weekly intervals. Significant reduction in

body weight and body weight gain along with increase in feed conversion ratio was noticed in T2 group birds. Addition of plant powders at both concentrations were able to ameliorate the deleterious effects caused by 100 ppb AF. *Andrographispaniculata* and *Aeglemarmelos* was also able to ameliorate negative effects of 100 ppb AF on relative weight of spleen.

**Key words :** *Aeglemarmelos*, *Andrographispaniculata*, body weight gain, feed conversion ratio, relative weight, spleen

Aflatoxins are secondary metabolites produced by fungi like *Aspergillusflavus* and *A. parasiticus*. Hot and humid conditions favours the production of these toxins. Poultry are considered to be highly susceptible to aflatoxicosis. Aflatoxicosis is a serious threat to flourishing poultry industry in India. Subclinical aflatoxicosis is also a serious issue due to

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presence of residue in food materials like eggs and chicken. Various additives like toxin binders and hepatoprotective substances are added to feed to reduce the effect of aflatoxins in feed. *Andrographis paniculata* and *Aegle marmelos* are plants with hepatoprotective ability. The objective of this study was to evaluate the efficacy of *A. paniculata* and *A. marmelos* plants on counteracting the effects of aflatoxicosis in broiler chicken.

## Materials and Methods

### Aflatoxin production

*Aspergillus flavus* NRRL 6513 culture was subcultured every 15 days and maintained at room temperature to ensure availability of fresh spores. Maize was used as substrate for producing aflatoxins (Shotwell *et al.*, 1966). Aflatoxin B1 content was estimated as 63.77 ppm using TLC method at AFAQAL Namakkal.

### Plant material

*Aegle marmelos* mature leaves and *Andrographis paniculata* whole plants were collected locally and were authenticated from Department of Botany, St. Thomas College, Thrissur. The plant materials were dried under shade and powdered using a pulverizer. This was further finely powdered using mixer grinder and sieved to get fine powder. The fine plant powder was kept in air tight container for storage.

### Experimental protocol

The present experiment was approved by Institutional Animal Ethics Committee of College of Veterinary and Animal Sciences, Mannuthy vide no. IAEC/CVASMTY 6/17-18. Forty-eight numbers of day-old Vencobb 400 strain broiler chicks procured locally were randomly divided into eight groups of six birds each (Table 1). All the birds were maintained in well-ventilated area under cage system and fed *ad libitum* with one of the following diets from first day to 21<sup>st</sup> day.

### Statistical Analysis

Data on different parameters were analysed statistically using SPSS version 24.0.

## Results

### Body Weight

Mean ( $\pm$ SE) body weights of all treatment groups recorded at intervals of day old, 7 days, 14 days and 21 days are presented in Table 2. At 7<sup>th</sup> day, T4 group showed significant increase in body weight compared to other treatment groups. Broiler chicks of T2 group showed a significant reduction in body weight compared to other groups at 21 days of age except T5 when compared to the control. There was no significant variation in body weight among various groups at zero and 14<sup>th</sup> day of the experiment.

**Table 1.** Experimental protocol

Groups	Feed
T1	Standard feed
T2	Standard feed with 100 ppb AF
T3	Standard feed with 0.1% <i>A. marmelos</i> powder and 0.1% <i>A. paniculata</i> powder
T4	Standard feed with 100ppb AF and 0.10% <i>A. marmelos</i> powder
T5	Standard feed with 100ppb AF and 0.10% <i>A. Paniculata</i> powder
T6	Standard feed with 100 ppb AF and 0.20% <i>A. marmelos</i> powder
T7	Standard feed with 100 ppb AF and 0.20% <i>A. Paniculata</i> powder
T8	Standard feed containing 100 ppb AF 0.1% <i>A. marmelos</i> powder and 0.1% <i>A. paniculata</i> powder

The response of the broiler chicken to all the treatments were measured in terms of body weight, body weight gain, feed conversion ratio (FCR) and relative weight of organs.

**Table 2.** Mean ( $\pm$ SE) bodyweight (g) of broiler birds

Groups	0 <sup>th</sup> day	7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>st</sup> day
T1	48.33 $\pm$ 0.99	142.67 $\pm$ 2.96 <sup>ab</sup>	348.50 $\pm$ 14.90	727.67 $\pm$ 14.21 <sup>a</sup>
T2	47.50 $\pm$ 0.56	136.33 $\pm$ 3.17 <sup>b</sup>	312.17 $\pm$ 14.30	628.17 $\pm$ 10.38 <sup>b</sup>
T3	48.50 $\pm$ 0.67	139.17 $\pm$ 2.60 <sup>b</sup>	336.50 $\pm$ 11.64	690.33 $\pm$ 17.06 <sup>a</sup>
T4	47.50 $\pm$ 0.56	152.33 $\pm$ 4.99 <sup>a</sup>	355.33 $\pm$ 13.02	741.67 $\pm$ 24.31 <sup>a</sup>
T5	47.17 $\pm$ 0.87	141.67 $\pm$ 4.43 <sup>ab</sup>	331.50 $\pm$ 15.86	701.50 $\pm$ 19.57 <sup>a</sup>
T6	47.00 $\pm$ 1.46	141.17 $\pm$ 3.18 <sup>b</sup>	334.83 $\pm$ 15.68	694.17 $\pm$ 18.05 <sup>a</sup>
T7	48.50 $\pm$ 0.56	139 $\pm$ 3.85 <sup>b</sup>	323.00 $\pm$ 9.81	690.00 $\pm$ 23.28 <sup>a</sup>
T8	47.50 $\pm$ 0.72	131.83 $\pm$ 2.44 <sup>b</sup>	317.50 $\pm$ 11.65	693.83 $\pm$ 9.92 <sup>a</sup>

Means bearing the same superscript within the same column do not differ significantly at the ( $P \leq 0.05$ )

### Body Weight Gain

Mean ( $\pm$ SE) body weight gains of control and treatment birds recorded at weekly intervals and overall bodyweight gain are presented in Table 3. Overall body weight gain at 21 days showed a significant ( $P < 0.05$ ) reduction among T2 birds when compared to rest of the groups. The body weight gain at 1<sup>st</sup> wk was significantly increased in T4 compared to T1. Body weight gain during 2<sup>nd</sup> and 3<sup>rd</sup> wk did not show any significant variation between groups.

### Feed conversion ratio

Weekly mean ( $\pm$ SE) FCR and overall

FCR of all treatment birds are presented in Table 4. Overall FCR showed a significant ( $P < 0.05$ ) increase among T2 birds when compared to rest all groups. During 1<sup>st</sup> wk FCR of T4 was significantly less compared to T2, T3, T7 and T8. Feed conversion ratio at 2<sup>nd</sup> and 3<sup>rd</sup> wk did not show any significant variation between groups.

### Relative Organ Weight

Mean ( $\pm$ SE) relative weight of liver, kidney, spleen, bursa of Fabricius, thymus, heart, proventriculus, gizzard and intestine of all treatment groups recorded at sacrifice are presented in Table 5.

**Table 3.** Mean ( $\pm$ SE) bodyweight gain (g) of broiler birds

Groups	1 <sup>st</sup> wk	2 <sup>nd</sup> wk	3 <sup>rd</sup> wk	Overall
T1	94.33 $\pm$ 3.12 <sup>ab</sup>	205.83 $\pm$ 16.74	380.83 $\pm$ 18.41	681.00 $\pm$ 13.92 <sup>a</sup>
T2	88.83 $\pm$ 3.40 <sup>b</sup>	175.83 $\pm$ 15.59	316.00 $\pm$ 14.44	580.67 $\pm$ 10.46 <sup>b</sup>
T3	90.67 $\pm$ 2.70 <sup>b</sup>	197.33 $\pm$ 11.65	353.83 $\pm$ 12.90	641.83 $\pm$ 16.89 <sup>a</sup>
T4	104.83 $\pm$ 4.72 <sup>a</sup>	203.00 $\pm$ 12.52	386.33 $\pm$ 33.34	694.17 $\pm$ 24.54 <sup>a</sup>
T5	94.50 $\pm$ 4.12 <sup>ab</sup>	189.83 $\pm$ 17.48	370.00 $\pm$ 14.36	654.33 $\pm$ 19.43 <sup>a</sup>
T6	94.17 $\pm$ 3.28 <sup>ab</sup>	193.67 $\pm$ 17.00	359.33 $\pm$ 21.97	647.17 $\pm$ 17.15 <sup>a</sup>
T7	90.50 $\pm$ 3.71 <sup>b</sup>	184.00 $\pm$ 10.91	367.00 $\pm$ 18.15	641.50 $\pm$ 23.70 <sup>a</sup>
T8	84.33 $\pm$ 2.67 <sup>b</sup>	185.67 $\pm$ 11.97	367.33 $\pm$ 13.29	646.33 $\pm$ 10.12 <sup>a</sup>

Means bearing the same superscript within the same column do not differ significantly at the ( $P \leq 0.05$ )

**Table 4.** Mean ( $\pm$ SE) FCR of broiler birds

Groups	1 <sup>st</sup> wk	2 <sup>nd</sup> wk	3 <sup>rd</sup> wk	Overall
T1	2.13 $\pm$ 0.08 <sup>ab</sup>	2.02 $\pm$ 0.20	1.73 $\pm$ 0.08	1.84 $\pm$ 0.04 <sup>b</sup>
T2	2.27 $\pm$ 0.08 <sup>a</sup>	2.37 $\pm$ 0.22	2.08 $\pm$ 0.09	2.16 $\pm$ 0.04 <sup>a</sup>
T3	2.22 $\pm$ 0.07 <sup>a</sup>	2.07 $\pm$ 0.14	1.85 $\pm$ 0.07	1.95 $\pm$ 0.05 <sup>b</sup>
T4	1.93 $\pm$ 0.08 <sup>b</sup>	2.01 $\pm$ 0.14	1.75 $\pm$ 0.15	1.81 $\pm$ 0.07 <sup>b</sup>
T5	2.14 $\pm$ 0.09 <sup>ab</sup>	2.20 $\pm$ 0.22	1.77 $\pm$ 0.07	1.92 $\pm$ 0.05 <sup>b</sup>
T6	2.14 $\pm$ 0.07 <sup>ab</sup>	2.15 $\pm$ 0.19	1.84 $\pm$ 0.11	1.94 $\pm$ 0.05 <sup>b</sup>
T7	2.23 $\pm$ 0.10 <sup>a</sup>	2.21 $\pm$ 0.14	1.80 $\pm$ 0.10	1.96 $\pm$ 0.08 <sup>b</sup>
T8	2.38 $\pm$ 0.07 <sup>a</sup>	2.20 $\pm$ 0.13	1.74 $\pm$ 0.06	1.94 $\pm$ 0.03 <sup>b</sup>

Means bearing the same superscript within the same column do not differ significantly at the ( $P \leq 0.05$ )

**Table 5.** Mean ( $\pm$ SE) relative weight of organs of broiler birds

Groups	Liver	Kidney	Spleen	Bursa	Thymus	Proventriculus	Gizzard	Intestine	Heart
T1	2.53 $\pm$ 0.04	0.43 $\pm$ 0.04 <sup>c</sup>	0.11 $\pm$ 0.01 <sup>b</sup>	0.22 $\pm$ 0.04	0.34 $\pm$ 0.08	0.56 $\pm$ 0.02	3.79 $\pm$ 0.24	7.76 $\pm$ 0.33 <sup>c</sup>	0.45 $\pm$ 0.01 <sup>d</sup>
T2	2.57 $\pm$ 0.13	0.57 $\pm$ 0.05 <sup>ab</sup>	0.14 $\pm$ 0.01 <sup>a</sup>	0.28 $\pm$ 0.03	0.49 $\pm$ 0.06	0.66 $\pm$ 0.02	4.61 $\pm$ 0.24	9.75 $\pm$ 0.43 <sup>ab</sup>	0.58 $\pm$ 0.03 <sup>ab</sup>
T3	2.60 $\pm$ 0.11	0.43 $\pm$ 0.02 <sup>c</sup>	0.07 $\pm$ 0.01 <sup>c</sup>	0.23 $\pm$ 0.02	0.45 $\pm$ 0.05	0.61 $\pm$ 0.05	4.05 $\pm$ 0.22	8.47 $\pm$ 0.47 <sup>bc</sup>	0.45 $\pm$ 0.01 <sup>d</sup>
T4	2.68 $\pm$ 0.23	0.51 $\pm$ 0.04 <sup>bc</sup>	0.12 $\pm$ 0.00 <sup>ab</sup>	0.25 $\pm$ 0.03	0.50 $\pm$ 0.06	0.60 $\pm$ 0.04	4.45 $\pm$ 0.35	10.86 $\pm$ 0.74 <sup>a</sup>	0.54 $\pm$ 0.02 <sup>bcd</sup>
T5	2.90 $\pm$ 0.16	0.66 $\pm$ 0.06 <sup>a</sup>	0.13 $\pm$ 0.01 <sup>ab</sup>	0.27 $\pm$ 0.04	0.38 $\pm$ 0.03	0.66 $\pm$ 0.05	4.50 $\pm$ 0.26	9.37 $\pm$ 0.30 <sup>b</sup>	0.56 $\pm$ 0.02 <sup>bc</sup>
T6	2.66 $\pm$ 0.05	0.40 $\pm$ 0.02 <sup>c</sup>	0.08 $\pm$ 0.00 <sup>c</sup>	0.25 $\pm$ 0.02	0.34 $\pm$ 0.05	0.70 $\pm$ 0.03	4.24 $\pm$ 0.19	8.80 $\pm$ 0.34 <sup>bc</sup>	0.49 $\pm$ 0.03 <sup>cd</sup>
T7	2.83 $\pm$ 0.08	0.43 $\pm$ 0.03 <sup>c</sup>	0.11 $\pm$ 0.01 <sup>b</sup>	0.21 $\pm$ 0.02	0.37 $\pm$ 0.04	0.64 $\pm$ 0.03	4.12 $\pm$ 0.26	8.85 $\pm$ 0.39 <sup>bc</sup>	0.50 $\pm$ 0.04 <sup>bcd</sup>
T8	2.87 $\pm$ 0.16	0.42 $\pm$ 0.01 <sup>c</sup>	0.13 $\pm$ 0.01 <sup>ab</sup>	0.30 $\pm$ 0.03	0.43 $\pm$ 0.04	0.70 $\pm$ 0.05	4.79 $\pm$ 0.16	9.87 $\pm$ 0.59 <sup>ab</sup>	0.67 $\pm$ 0.04 <sup>a</sup>

Means bearing the same superscript within the same column do not differ significantly at the ( $P \leq 0.05$ )

## Discussion

Body weight of broiler chicks fed with AF only showed a significant reduction compared to all the other groups at 21 days of age. The body weight did not show any statistically significant between groups at 14 days of age. Overall body weight gain was significantly decreased and FCR was significantly increased in T2 group compared to T1. Oguzet *al.*, 2000 observed that body weight gains of broiler chicks were significantly decreased when fed diet containing 100 ppb AF in a study conducted among 576 Ross broiler chicks due to listlessness, anorexia along with AF inhibition of protein synthesis and lipogenesis. Denli and Okan, 2006 noted significantly reduced body weight gain and feed efficiency among Ross 308 male broiler

chickens fed with AFB1 alone in the diet at levels of 40 ppb and 80 ppb in feed for 42 days. Tessariet *al.*, 2007 observed that AFB1 at levels of 50 and 200 ppb adversely affected body weight of commercial broiler lineage Hybro-PG chicks in a 41 day study. Disruption of lipid and protein metabolism induced by AF was reported as the cause. Ram *et al.*, 2010 observed the influence of AFB1 at 50, 100, 150, 200, 250 and 300 ppb levels on performance of broiler chicken and noted that with higher levels of AF in the feed, the body weight of broilers were reduced. Dhanapalet *al.*, 2014 noted reduced body weight gain and increased feed conversion ratio among Ross 308 broiler chicks fed with 1ppm AF in a 42 days study. They attributed these effects to anorexia and inhibitory effect of AF on protein synthesis and lipogenesis. The reduction in body weight,

body weight gain and increased FCR among T2 group of broiler chicks in the present study could be due to hepatotoxic effect of AF leading to defective protein and nucleic acid synthesis (Indu, 2009)

Body weight gain and FCR of broiler chicks of T4, T5, T6, T7 and T8 groups were similar to that of control group (T1 group). The broiler chicks of T3 group also had performance measures similar to that of T1. The changes in dose rate of *A. paniculata* and *A. marmelos* powders did not have any specific effect. The ability of *A. marmelo* to improve body weight was observed by Kamalakkanan *et al.* (2003) in diabetic rats due to the ability of *A. marmelos* to reduce hyperglycemia. Sapkota *et al.*, 2005 observed partial ameliorative potential of *A. paniculata* on the ready to cook yield of broiler chicks credited to the restorative effect of the plant on the bio system. The beneficial effects of plant materials in this study could be attributed to the biological effects of alkaloids, tannins and flavonoids present in both the plants.

The relative weight of spleen in control group (T1) was 0.11 per cent which was significantly increased to 0.14 per cent in the T2 group. Aflatoxin exposure did not elicit any consistent effect on the relative weight of liver, kidney, bursa of Fabricius, thymus, proventriculus, gizzard, intestine and heart. Huff *et al.*, 1986 reported similar increase in relative weight of spleen among broilers exposed to 2.5 ppm of AF and explained that as a physiological response of the organ to obtain equilibrium between toxic injury and elimination of toxin. They also reported inconsistent effect of AF on the relative weight of pancreas and bursa of Fabricius due to variation in toxin susceptibility between tissues. Rasouli-Hiqet *et al.*, 2017 observed that relative weights of heart and testes were significantly lowered but relative weight of liver was increased due to AF. They also observed that relative weight of bursa of Fabricius was not affected due to AF exposure. Significant increase in relative spleen weight among T2 group of birds could be due to primary response to toxin being principle peripheral immune organ (Penget *et al.*, 2014)

Relative weight of spleen among broiler chicks of groups T3, T4, T5, T6, T7 and

T8 were statistically similar to that of T1. The present study revealed that *A. marmelos* and *A. paniculata* were able to nullify negative effects of 100 ppb AF on relative weight of spleen. The effect on relative weight of spleen was not dose dependent. Baliga *et al.*, 2013 observed protective effect of *A. marmelos* leaf extract on spleen and attributed it to the ability of plant to stimulate antioxidant enzymes. Thakur *et al.*, 2014 reported the protective effects of *A. paniculata* extract on relative weight of spleen due to biological effects of andrographolide. The positive effect of plant materials in this study could be attributed to the antioxidant effect of these plants (Kuttan and Sabu, 2004, Singh *et al.*, 2009)

## SUMMARY

This study revealed that deleterious effect of AF on body weight, body weight gain, FCR and relative weight of spleen can be cured by inclusion of *Aegle marmelos* and *Andrographis paniculata* in the diet. The dose rates of these plant materials do not have any significant effect on the ameliorative effect on relative weight of liver, kidney, intestine, bursa of Fabricius, thymus, proventriculus and gizzard.

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