Asian J. Med. Biol. Res. 2021, 7 (1), 64-68; doi: 10.3329/ajmbr.v7i1.53310

Asian Journal of Medical and Biological Research
ISSN 2411-4472 (Print) 2412-5571 (Online)
www.ebupress.com/journal/ajmbr

Article

Dietary supplementation effects of the levels of Neem (*Azadirachta indica*) leaf extracts as phytogenic feed additive on the growth performance in broiler chicks

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Received: 01 March 2021/Accepted: 21 March 2021/ Published: 31 March 2021

Abstract: The effects that Neem leaf extract on overall growth, feed conversion ratio (FCR), dressed weight and organs weight of broiler chickens to justify its inclusion in the diet of growing broiler chickens. 120 day old chicks divided into four treatment groups T1, T2, T3 and T4 of thirty (30) birds each were administered clean drinking water with 3gm, 4gm, 5gm and 0g neem extract respectively. Impacts of neem extract treatments on growth indices suggested that Neem extract favored growth with final body weight range of 1709gm and 1763gm. Organ weights showed no deviation from standard values for healthy broiler birds. Highest growth was observed in group T3 (1763.6±141.37gm) followed by T1, T2 and lowest was in T4 group (1565.4±161.25gm). Birds on 5gm of Neem extract in their drinking water out performed birds in other treatments in assessed growth rate indices. We therefore conclude that 5gm of Neem extract in their drinking water growing broiler birds encourages healthy growth and may serve as supplements for antibiotics, especially when birds are raised in areas with minimal access to veterinary service.

Keywords: *Azadirachta indica*; broiler; growth performance; neem leaf extracts

1. Introduction

The production of healthy birds with quality meat and eggs without harmful residues, within a short time interval is the major concern to modern poultry farmers. The use of synthetic drugs as antibiotics and growth promoters has high cost implications, and sometimes, with attending adverse side effect on birds health, prolonged withdrawal period and risk of accumulation in tissues and egg which could have harmful effects on human health (Jawad *et al.*, 2014; Sarker *et al.*, 2018). As a result, consumers of poultry products are demanding for drug residues free meat and egg (Talukder *et al.*, 2017). This has triggered the search for alternatives means to produce birds at reduced cost using natural growth and health promoters (Sarker *et al.*, 2020).

So, researchers are now concentrating efforts on the use of ancient medicinal system to find beneficial herbs and plants, which can be safely used to increase production. Medicinal plants are cheap and renewable sources of pharmacologically active substances and are known to produce certain chemicals that are naturally toxic to bacteria (Islam *et al.*, 2018).

Herbs and spices have always been helpful to cure diseases. In modern animal feeding, they are forgotten because of use of antibiotic growth promoters (AGP). But due to the prohibition of most of AGP, plant extracts have gained interest in animal feed strategies (Noman *et al.,* 2015). The risk of the presence of antibiotic residues in milk and meat and their harmful effects on human health have led to their prohibition for use in animal feed in the European Union (Cardozo *et al.,* 2004). Generally, plant extracts have no problem of drug resistance. Herbs normally used are picorhiza, garlic, cloves, slippery elm, neem fruit and leaves, sophora flavescens, nutmeg, cinnamon, ginger, peppermint, sage, thyme, mustard and fenugreek. These plants are used as digestive stimulants, antidiarrhoic, antiseptic, antiinflammatory, antiparasitic and appetite stimulants in human beings as well as animals (Agarwal, 2002).

Herbal plants are traditionally used in therapeutic treatment for centuries. Natural medicinal products from herbs and spices have also been introduced as feed additives in poultry diets (Guo, 2003).

Neem (*Azadirachta indica*) tree in totality has been a village dispensary and a qualified plant by itself. Neem leaf and its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, anti-hyperglycemic, anti-ulcer, anit-malarial, anti-fungal and antihelmentic, antioxidant, antimutagenic and anticarcinogenic properties (Agarwal, 2002; Subapriya and Nagini, 2005; Paul *et al.,* 2020). Some bioactive components of neem leaf are azadirachtin, meliantriol, nimbin, nimbidin, and salanin. Nimbin and nimbidin have been found to have antiviral activity.

Therefore, this research was performed to evaluate the effects of Neem Leaf Extract (NLE) as a growth enhancer in broiler diets.

2. Materials and Methods

2.1. Experimental bird

A total of one hundred and twenty (120) day old chicks (Cobb 500) were bought, on arrival, the chicks were counted, de-boxed, weighed. The chicks were brooded and acclimatized for one week, during which they were fed with commercial chick starter feed and cool clean drinking water.

2.2. Experimental design

At arrival of the birds, they were housed in the brooding house that had been prepared by cleaning, washing and disinfecting. Brooders were set up in good working condition. The floor was well littered with wood shavings and the walls covered with dark water-proof materials. At the completion of the brooding period, the birds were divided into four (4) major groups tagged T1, T2, T3 and T4 of thirty (30) birds each. Treatment 4 (T4) was the control and the birds in the T4 were administered clean drinking water without neem extract (0% neem extract). Treatments 1, 2 and 3 (T1, T2 and T3) were administered neem extracts (NE) at different concentrations of 3gm, 4gm and 5gm per liter of water respectively.

2.3. Collection of neem leaves and preparation of fresh neem extract

Mature disease free neem leaves were collected. 3gm for T1, 4gm for T2 and 5gm for T3 of neem leaves were weighed, washed blended with one (1) litre of water and with a sieve the leaf particles were removed for each treatment. For every quantity of drinking water measured, one (1) litre of neem extract was added and administered to the bird's upto 35 days. The, neem extracts was prepared on daily basis.

2.4. Data collection and recording

At the end of the experimental period, five (5) birds per treatment were randomly selected and bled by severing the jugular vein. Vital organs (Gizzards, lungs, liver, spleen, kidney, proventriculus, crop and heart) of the slaughtered birds were weighed using electronic weighing machine and records were taken for organ weight determination.

2.5. Data analysis

The data were analyzed statistically between the control and the treatment groups of chickens, between replicates of treatment and between treatment by variance (ANOVA) and means were compared employing Duncan's Multiple Range Test by SPSS IBM 20.

3. Results and Discussion

In this research we evaluate the effects that neem leaf extract on growth performance and organs weight of broiler chickens to justify its inclusion in the diet of growing broiler chickens. 120 day old chicks divided into

four treatment groups T1, T2, T3 and T4 of thirty (30) birds each were administered clean drinking water with 3gm, 4gm, 5gm and 0gm neem extract respectively.
The effects of feeding different concentration of dietary neem on daily body weight gain are shown in Table 1. All groups had initial body weight 91.32±0.78gm. No mortality was detected in all treatment groups throughout the study period. Feed Conversion Ratio (FCR) is shown in Table 2, where significant variation was evident in T_1. Dressed weights of birds are shown in Table 3. No significance variation was found in offal's weight (Table 4).

3.1. Growth performance

Daily body weight gain was collected in record log book. In Table 1, average weight gain from day 7 to day 35 is shown with 7 days interval. Best weight gained was observed in T_3 group at day 35 followed by T_1, T_2 and lowest in T_4.

Table 1. Live body weight of birds from day 7 to day 35.

Groups	Body weight gain (gm)				
	Day 7	Day 14	Day 21	Day 28	Day 35
T_1	90.4±4.07 [a]	310.5±22.82[a]	704.2±45.22[ab]	1330.5±72.34[b]	1754.3±109.34[a]
T_2	91.5±6.01 [a]	331.5±21.93[a]	710.2±51.20[ab]	1327.2±85.46[ab]	1709.2±119.47[a]
T_3	91.1±5.23 [a]	324.2±25.01[a]	710.6±60.20[ab]	1346.0±83.54[b]	1763.6±141.37[a]
T_4	92.2±4.05 [a]	309.4±23.33[a]	653.1±49.10[a]	1169.0±87.76[a]	1565.4±161.25[a]

Values with different superscripts in the same row differ significantly (P<0.05).

The significant effect of NLP on FCR of broiler was in close agreement with Khatun *et al.,* (2013); Neem, nishyinda, tulsi and turmeric extract (Alam *et al.,* 2014); Neem leaf and ginger extract (Rahman *et al.,* 2015); Neem, turmeric and papaya leaf extract (Mahejabin *et al.,* 2015). Growth effects of neem and antibiotic treatment without significant difference in the present study could be explained by the findings of Ansari *et al*. (2012), who reported that the growth properties of NLE depend on the concentration and dose-response relationship

3.1.1. FCR of birds

FCR was calculated in day 35 where best FCR was found in T3 group at 35th day, followed by T1, T1 and lees feed conversion was observed in T4 group.

Table 2. Feed Conversion Ratio (FCR) of birds at day 35.

Groups	Feed Conversion Ratio (FCR)
T_1	1.68
T_2	1.70
T_3	1.65
T_4	1.87

Significant (P<0.05) difference were revealed for FCR in all the treatments from 7 days to 35 days of age. Poor FCR was observed in control group and better FCR was observed in T3 group.
The observation of FCR in our study is also consistent with the previous data Pagrut *et al.* (2018). Neem leaves have individual bioactive compounds that can be attributed to the antimicrobial and antiprotozoal properties which can limit the growth and colonization of pathogenic and nonpathogenic bacterial species in chickens gastrointestinal tract (Shivarkar *et al.,* 2018). Thus, poultry gut could lead to greater digestion efficiency and feed utilization that resulted in improved FCR.

3.1.2. Dressed weight

After dressing of each bird at day 35, they were individually weighted. Among the groups T_3 and T_1 obtained highest dressed weight followed by T_2 and lowest dressed weight was in T_4 group (Table 3).

Table 3. Dressed weight of birds after dressing at day 35.

Group	Weight of dressed birds (g)
T_1	1110.43±102.17 [ab]
T_2	1077.38±111.32 [a]
T_3	1147.10±112.54 [ab]
T_4	987.63±117.32[ab]

*Different letters denotes significant variation among the groups

The dressing percentage was upgraded in birds fed on neem and antibiotics, which is in line with the findings of Ansari *et al.* (2012), who found better dressing percentages in birds fed with herbal plant diets than control. In contrast, Paul *et al.* (2020) found no effects of neem extracts on carcass characteristics.

3.2. Offal's weight of birds

Individual bird's liver, gizzard, hear, spleen and pancreas weight was taken and no statistical significance was observed ($P<0.05$) as shown in Table 4.

Table 4. Offal's weight of birds after dressing at day 35.

Groups	Offal's weight of birds (gm.)				
	Liver	Gizzard	Heart	Spleen	Pancreas
T_1	49.64±0.63 [a]	9.17±1.02[a]	20.55±2.66[a]	3.58±0.31 [ab]	2.54±0.33[a]
T_2	57.66±0.65 [c]	9.62±1.03[a]	22.31±2.57[ab]	3.36±0.32 [ab]	2.59±0.23[a]
T_3	53.61±0.64 [a]	10.01±1.03[a]	20.34±2.57[a]	3.32±0.32[a]	2.52±0.15[a]
T_4	48.52±0.67 [b]	10.42±1.02[a]	19.37±2.52[a]	3.53±0.31 [ab]	2.32±0.21[a]

*Different letters denotes significant variation among the groups

The results indicated no significant differences ($P<0.05$) between all treatment groups in offal's (liver, gizzard, heart, spleen and pancreas) weight of bird.

4. Conclusions

This study has shown that neem extract inclusion in water for growing broiler birds has no detrimental effect on birds which implies that their consumable products will pose no health hazard to consumers. Judging from the results of this present work corroborated with the works of other scholars in the field it is recommended that a safe level of neem extract will do no harm and can be incorporated. We therefore conclude that 3 gm of Neem extract in their drinking water growing broiler birds encourages healthy growth and may serve as supplements for antibiotics, especially when birds are raised in areas with minimal access to veterinary service.

Conflict of interest

None to declare.

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