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ASSESSMENT OF GROWTH PERFORMANCE IN BROILERS ROSS 308 DIETS SUPPLEMENTED WITH *Moringa oleifera*

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ABSTRACT: *Broiler farming is a lucrative business for Bhutanese farmers. However, Bhutan has not achieved self-sufficiency in broiler meat probably because of fewer farmers take up broiler farming, small flock size, health related issues and high cost of production. A study was conducted to assess the effect of supplementing Moringa oleifera on the growth performance of ROSS 308 broiler. A total of 90-day-old chicks were randomly assigned into three groups with three replication each (10 chicks per replicate): no M. oleifera was provided (control, T0); 1.5 % (15g per 1 kg feed) supplemented with M. oleifera (treatment 1, T1); and 2.0% (20g per 1 kg feed) supplemented with M. oleifera (treatment 2, T2). There were slight significant differences between the average daily weight gain of chickens till week 5 among the groups (p<.439). At week 6, chickens assigned into T1 (121.86 ± 26.48g) and T2 (116.25±40.25g) gained higher weight than those in T0 (109.76±16.73g) at p<.05. Furthermore, chickens assigned into T1 gained the highest body weight than those chickens in T2 and T0 (p<.01). Moreover, the dressing percentage of the chickens was found higher in T1 group (78.13±13.48%), followed by T2 (77.9±13.48%) and control group (77.5±1.12%) (p<.01). These results suggest that supplementation of M. oleifera (with 15 g per 1 kg feed has slight effect in weight gain, average daily gain and dressing percentage. However, is has significant effect on feed intake and feed conversion ratio of broiler chickens. Therefore, its practical implication in field is not recommended. Further research is needed on its use in drinking water and across different broiler breeds.*

Keywords: Broiler; Feed conversion ratio, Feed intake; Growth performance; *Moringa oleifera.*

1. INTRODUCTION

Livestock sector is one of the most important contributors to support human wellbeing (social and economic benefits). Likewise, livestock farming has an integral role in supporting Bhutanese farmer, especially in rural areas. It has potential to uplift poor farmers besides achieving national food and nutrition security. According to the vision of the Department of livestock, Bhutan aims to enhance livestock productivity towards the end of the 2040. Poultry farming both layer and broiler is one of the most important activity for Bhutanese because farmers get meat, eggs, feathers, manure and increased income (Tshering and Nidup 2007). Among livestock production, the Bhutanese government claims that the country is self-sufficient in egg (Dorji 2022).

Broiler farm was initially introduced in Tsirang in 2004 and later in 2006 in Samtse (Jamtsho et al. 2021) where largely the communities are Hindu. It is a very lucrative and profitable business for Bhutanese farmers as there is large demand for chicken meat within the country, for example, in 2020 about 49% of the broiler meat were imported from India (Jamtsho et al. 2021). The author suggest that Bhutan's inability to meet the demand for broiler meat maybe attributed to numerous factors such as, less farmers taking up broiler farming, small flock size, health-related issues and high cost of production (Wangchuk and Dorji 2008).

The Bhutanese farmers probably do not venture into broiler commercial farming due to their religious beliefs (Wangchuk and Dorji 2008) and also due to high cost of production incurred for feed.

In such cases feed additives can help improve feed efficiency as additives have high nutrient profile, enhance digestibility and helps in reducing stress. Therefore, feed additives could be used to improve the feed efficiency in broiler chickens, prevent diseases and to improve feed utilization (Pirgozliev et al. 2019) which would help reduce cost of production for farmers. The European Agency (2019) describes feed additives as products used in animal nutrition to improve animal's performance and their health as they enhance the flavor of feed and provide required nutrients to the animals without having impact on human health. The use of antibiotics in animal feed was banned or restricted in many countries (Maron et al. 2013) because it poses risk to human health, for example, some bacteria have developed resistance to antibiotics and also cause allergies, and induce cancers (sulfamethazine, oxytetracycline and furazolidone) (Treiber and Beranek 2021).

Studies have been conducted to explore alternate to feed additive that could reduce the cost of production, enhance health as well as growth rate of chickens. For example, natural growth promoter like organic acid, probiotic, immune stimulants and phytogenic plant powder extract which assists in animal's growth performance could decrease the production cost and is an alternative to antibiotics. Researchers have conducted experiments on various plants that can be used as feed additives in improving the feed efficiency in livestock animals. A drum stick tree (*Moringa oleifera*) can be used as feed additive because it contains anti-microbial properties like anti-inflammatory, antioxidant, anticoccidial and also helps to improve weight gain of poultry (Avilés-Gaxiola et al. 2021).

The application of *M. oleifera* in chicken feed is to improve the production performance and health status which has been limited due lack of knowledge among the farmers of Bhutan, despite several research findings on the potential use of *M. oleifera* and its medicinal importance for the health of broilers. Therefore, the study aims to assess the effect of *M. oleifera* as a natural feed supplement on broiler performance, which would reduce the production cost and also improve the performance of broiler.

2. MATERIALS AND METHODS

2.1 Study area

The study was carried out in Norbugang Gewog of Samtse Dzongkhag which is one of the largest Gewogs with approximate area of 115.09 km². The Gewog is bordered by Dungtoe to the northeast, Namgaychholing Gewog to the northwest, Sangngacholing and Ugyentse Gewog to west and Samtse and Dorokha geowg to the east and West Bengal of India to the south. The Gewog falls under subtropical climatic condition with annual temperature ranging from 21°C-30°C and annual rainfall of 1500-4000 mm.

2.2 Experimental design

A completely randomized design was used to conduct the feeding trail. A total of 90 ROSS 308-day old chick (DOCs) was purchased from the National Poultry Research and Development Center (NPRDC), Sarpang. The DOCs were randomly assigned into three groups with three replications each (10 chicks per replication): no additive was supplemented (T0), 1.5% (15 g in 1 kg feed) *M. oleifera* powder was provided (T1) and 2.0% (20 g in 1 kg feed) *M. oleifera* was provided (T2) based on Tijani et al. (2016) study.

Tijani et al. (2016) reported that the inclusion of 1.5% *M. oleifera* in broiler feed had positive effect on the growth performance than the 2.0% *M. oleifera*, however, Abdul-Lateef Ali et al. (2017) demonstrated that inclusion of 2.0% of *M. oleifera* in broiler feed yield higher growth. So, this study was conducted also like to confirm the previous studies claim. The feeding trial was conducted for 42 days from (November 28, 2023 to January 2, 2024). All the chickens were provided with identification (using leg band).

2.3 Shed preparation

A poultry shed (18 m × 7 m) owned by a local farmer was used for the feeding trail. The shed was washed with water and disinfected using potassium permanganate, and then was left to dry for 14 days. On day 15, dry and clean saw dust was spread over the shed floor (5 inches depth) and newspapers were spread over the sawdust for 7 days to prevent chicks from eating litter materials, which was removed after 7 days. Nine compartments (2m x 0.7 m) were designed and constructed in a shed, and a brooder and lighting system was installed in each compartment. For brooding, space was constructed on $1/4^{th}$ of the shade where brooder bulbs were installed and double layers of newspaper was spread over the saw dust for 7 days of experiment. The shed was kept warm by turning on the power eight hours before the arrival of DOCs.

2.4 *M. oleifera* preparation

The matured leaves of *M. oleifera* weighing 10.5 kg were collected from the nearby villages, washed thoroughly under running tap water and left to dry for seven days. The dried leaves were crushed into powder using a grinder after removing the twigs. The *M. oleifera* powder (4.63 kg) was stored in a cleaned and sanitized container to avoid contamination.

2.5 Data collection

The weight of each chick was weighed on weekly basis using an electric weighing balance. The average daily gain by chicken were estimated by subtracting final body weight from the initial body weight and divided by the number of days reared. The feed conversion indicates the efficiency of amount of feed that has been converted in live body weight gain (Hwa et al. 2023). The feed provided to the chickens per pen and feed left (before next feeding) was collected and weighed using the weighing balance. Feed consumed by a chicken were estimated as the feed provided minus feed left and divided by the total number of chickens. The feed conversion ratio was calculated as feed consumed by chicken by weight gain (Hwa et al. 2023).

On day 42, three chickens from each replication were randomly selected, weighed and slaughtered. The dressed carcass weight was measured after removing the visceral organs using digital weighing balance. The carcass yield was estimated as live body weight minus dressed carcass. The dressing percentage were calculated as carcass weight by live body weight (Jay et al. 2020).

2.6 Data analysis

The data were entered into Microsoft Excel version 2016 and was exported to International Business Machines Statistical Package for the Social Sciences 3.0 for further analysis. The Shapiro-Wilk test was used to determine whether the data was normally distributed. One way analysis of variance was used to compare among the groups for weight gain, feed intake, feed conversion ratio, average daily gain and dressing percentage. Tukey and Honest Significant Difference post hoc test was done for pair wise comparison.

3. RESULTS AND DISCUSSION

3.1 Nutrient composition of *M. oleifera*

A proximate analysis (Kjeldahl Nitrogen Analysis) revealed that *M. oleifera* have

23.3% of minerals content (potassium, zinc, magnesium, iron and copper), 8.5% of crude fiber and 52.67% of crude protein, which is very high compared to the 27.1% and 14.1% of crude protein found in study by Navaratne et al. 2019; Mahima et al. 2014). Due to high minerals and protein content in *M. oleifera* it can help replace medicine addressing iron deficiency and can be a good protein supplement for animals as well as humans (Islam et al., 2021). The variation in nutrient content of *M. oleifera* might varied based on climatic conditions and among cultivators (Kashyap et al. 2022).

3.2 Body weight

There were slight differences in body weight of chickens among the groups ($p < .05$) at the end of the feeding trial (i.e. 42 days). First week of assigning the chicks into groups, the mean chicks' body weight was slightly higher for those chicks supplemented with *M. oleifera* (T2, 826.59 ± 130.42 g; T1, 883.1 ± 80.9 g) than those not provided with *M. oleifera* (844.23±130.45 g) $p < .05$ (Table 4.1). The results coincides with Sharma et al. (2014) finding where body weight of broiler is adversely affected when supplemented with *M. oleifera*. Nevertheless at the end of the feeding trial, chickens supplemented with 1.5% *M. oleifera* (T1) gained slightly more weight than the 2.0% *M. oleifera* (T2) and not provided (control), which was in line with Tijani et al. (2016) findings who reported that body weight gain of broiler was high when fed with 1.5% *M. oleifera* powder.

3.3 Feed intake

There were significant differences in feed intake by chickens among the groups at $p < .05$ (Table 2). On week three of the feeding trial, chickens supplemented with *M. oleifera* (T1, 726±38.11 g; T2, 679.26±11.81g) enhanced feed intake than those chickens not supplemented with it (574.66±0.00 g). Likewise, from week four to six, chickens assigned into T1 consumed more feed than the rest (Table 2). The total highest feed consumption per chickens was observed in T1 and followed by T2 and then control. The present results is in contrast to Sharma et al. (2014) findings which reported supplementation of *M. oleifera* reduced feed intake in broilers. These authors reported that feed intake in broilers supplemented with *M. oleifera* is attributed to change in taste and palatability due to presence of anti-nutritional factor like tannin and saponin. This could be due to difference in processing methods of the *M. oleifera* powder like drying in sun or oven and use of different grinding machines and differences in practice under which chickens were reared. When the processing methods of washing, drying and grinding are not carried out properly, traces of anti-nutritional factors like saponin and tannin would be present and makes the feed unpalatable for the animals (Soni et al., 2022).

Table 1: Body weight of chickens assigned into different groups (mean ± standard deviation).

Age	**Control** (g)	**T1**(g)	**T2** (g)	***p*-value**
Week3	844.2±130.41	883.1±80.93	826.5±130.41	0.16
Week 4	1316.9±182.82	1417.2±191.82	1365.3±192.73	0.13
Week 5	1977±268.92	2006.5±262.94	1904.4±295	0.34
Week 6	2745.3±345.41	2859.5±380.23	2718.1±462.44	0.35

Table 1: Feed intake in grams among different groups (mean ± standard deviation).

Age	**Control** (g)	**T1** (g)	**T2** (g)	***p*-Value**
Week 3	574.66±0	726±38.11	679.26±11.81	0.00
Week 4	805.16±0	913.53±13.69	946.66±36.51	0.00
Week 5	1117.29±0	1278.8±34.89	1206.16±62.44	0.00
Week 6	1232.83±0	1582±37.48	1530±87.74	0.00

3.4 Feed Conversion Ratio

At the beginning of the experiment (week 3), there was a significant difference in feed conversion ratio (FCR) among the groups (T1, 0.68±0.20; T2, 0.83±0.10; T0, 0.84±0.17) at $p<.05$. Significant differences were observed in FCR among the groups in week 4 and 5 and week 6 at $p<.05$ as shown in table 3. The FCR indicates how efficiently broiler convert feed into body weight. A lower FCR indicates less feed is required to produce a unit of a body weight and greater FCR indicates more feed is required to produce a unit of body weight (Hwa et al. 2023). The overall analysis underscores the effectiveness of *M. oleifera* in promoting broiler growth as it has lower FCR values compared to not supplement.

3.5 Average daily body weight gain

The average daily gain in broilers shows significant difference in treatments supplemented with *M. oleifera* powder (T1 and T2) compared to that of those groups not supplemented. In week 3, there was no differences among different groups at $p<.05$ (Table 4.4). At week 5, those chickens not supplemented with *M. oleifera* gained more body weight (94.30±20.29 g) than those provided with it (T1, 84.18±16.56 g; T2, 77.56±24.09 g) and it might be due to palatability of feed or external stress (e.g. weather condition). However, at week 6, chickens fed with 1.5% *M. oleifera* gained slightly more body weight than the rest (T2, 116.25g; control, 109.76 g). The results is in agreement to Abdul-Lateef Ali et al. (2017) findings that the *M. oleifera* increase average daily weight gain in chickens but with no differences.

3.6 Dressing percentage

There were slight significant differences in average live weight, carcass weight and dressing percentage of broiler chicken subjected to different treatments ($p>.05$).

Table 2: Feed conversion ratio (mean ± standard deviation).

Age	Control (g)	Treatment 1	Treatment 2	*p*-Value
Week 3	0.84±0.17	0.68±0.20	0.83±0.10	0.00
Week 4	0.71±0.11	0.62±0.11	0.65±0.11	0.02
Week 5	0.65±.13	0.57±0.09	0.65±0.12	0.02
Week 6	0.58±0.16	0.45±0.06	0.56±0.10	0.00

Table 4: Average daily gain of chickens in different groups (mean± standard deviation).

Age	Control	Treatment 1	Treatment 2	p-Value
Week 3 (g)	57.62±11.70	61.34±10.01	58.68±12.64	0.43
Week 4 (g)	67.52±15.96	76.29±18.83	76.39±20.54	0.11
Week 5 (g)	94.30±20.69	84.18±16.56	77.56±24.09	0.00
Week 6 (g)	109.7±16.73	121.8±26.48	116.2±40.25	0.28

Table 5: Dressing percentage of chickens fed with different diet (mean ± standard deviation).

Description	Control (g)	T 1 (g)	T 2 (g)	p-Value
Average live weight	3113.3±152.9	3055±260.0	3096.6±201.6	0.0885
Average eviscerated weight	2414.1±123.3	2360.8±301.8	2437.5±114.7	0.795
Dressing percent	77.5±1.12	78.8±4.37	77.79±13.48	0.959

The chickens assigned into T1 gained higher average live weight (3055 ± 260.01g), followed by T2 (3096.66 ± 201.68 g) and control group (3113.33 ± 152.9 g). Similarly, average eviscerated weight was observed the highest in chickens assigned into T1 (2360.83±301.8 g) than in T2 (2437.50 ± 114.79 g) and control (2414.16 ± 123.3 g). Also, the dressing percentage was found the highest in T1 (78.88±4.37%) followed by T2 (77.97 ± 13.48%), and the least in control group (77.54 ± 1.12%). On the contradictory, Eval et al. (2019) reported that the dressing percentage in broiler when fed with 1.5% of *M. oleifera* decreases. However, the current finding correlates with Tijani et al. (2016) who reported *M. oleifera* can be added up to 1.5% in diet of broiler.

4. CONCLUSION AND RECOMMENDATIONS

The study assessed the growth performance in broilers (ROSS 308) diets supplemented with *M. oleifera* powder. A total of 90 broilers were subjected into three groups: control (no supplement), T1 (supplemented with 1.5% of *M. oleifera* powder) and T2 with 2.0 % of *M. oleifera*. Based on the results, chickens feed with 1.5% of *M. oleifera* achieved the highest mean weight gain (2405.78 ± 503.27g) than the chickens feed with 2.0% *M. oleifera* (2291.33 ± 677.5 g) and not supplemented (2304.5 ± 455.63 g). In addition, chickens in 1.5% *M. oleifera* also consumed slightly more feed and the FCR was also the lowest compared to the rest. There were no significant differences in average daily gain and dressing percentage in chickens assigned into different groups. However, average weight gain was slightly higher in chickens assigned into T1 (85.91g) and also the dressing percentage was found high in T1 (77.97 ± 13.48 %).

In summary, supplementing *M. oleifera* in broiler diet has slight effect on the weight gain, average daily gain and dressing percentage but has significant effect in feed intake and FCR. However, practical application of supplementing *M. oleifera* in broiler diet is not recommended. Based on the current findings, it is recommended that further investigation into benefits of supplementing *M. oleifera* in water be carried out as it is found to boost the growth performance of chickens irrespective of concentration (Portugaliza and Fernandez 2012). Further, the study can be expanded to different breeds of broilers to explore its potential.

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