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The Impact of Supplementing Vanaraja Birds Diet with Turmeric (*Curcuma longa*) Powder on Production and Reproduction Performance

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ABSTRACT

Background: Vanaraja birds, valued for their robust traits in poultry farming require optimized and tailored nutrition for peak performance and optimal results. Turmeric, renowned for its health-promoting properties could potentially enhance their productivity and reproductive outcomes. Yet, research into the specific effects of turmeric supplementation on Vanaraja birds is limited prompting further study to explore its potential benefits for improved growth rates, feed conversion efficiency, egg production and hatchability.

Methods: The study was conducted at the poultry unit of the Department of Livestock Production and Management, which is a division of Nagaland University's School of Agricultural Sciences. The trial was conducted for 365 days and the birds were reared in cages. The birds were divided into four dietary groups: T_1 (control), T_2 (0.5% turmeric powder), T_3 (0.75% turmeric powder) and T_4 (1.5% turmeric powder) with 30 birds in each group. Each dietary group had five replications.

Result: Final body weight was significantly higher in T_4. Feed intake was significantly lower in the groups treated with turmeric. Feed conversion efficiency (FCE) was higher in the control group. Furthermore, the groups fed with turmeric had greater rates of liveability. But there were no appreciable differences between the groups in terms of age at sexual maturity, egg weight at first egg, clutch size, hen day egg and hen house egg production. At onset of egg production groups treated with turmeric supplements showed noticeably higher body weight and overall egg production. Net profit per bird and net profit per kilogram of weight gain were higher in Group T_3. Therefore, based on studies it is advised to incorporate turmeric powder into chicken feed at concentrations of 0.75 and 1.5% in order to enhance both production and reproductive performance.

Key words: Body weight, Clutch size, Feed efficiency, Net profit, Turmeric powder.

INTRODUCTION

Any nation's economic development is significantly influenced by the poultry industry (Tarhyel *et al*., 2012). With a 65.48 billion egg production annually, the nation comes in third place in the world for egg production next to China and the United States (Mehta and Nambiar, 2013). According to Pawariya and Jheeba (2015), the poultry industry in India employs more than five million people. According to Docic and Bilkei (2003), the intake of feed, body weight increase, utilization and enhancement of microbial fermentation in the colon were all positively impacted by the plant extract used in place of antibiotics. Turmeric and ginger can be used as natural growth promoters instead of conventional artificial ones as antibiotics (Demir *et al*., 2003, Basak, 2015). Essential fatty acids (2.4-4%), crude ash (4.7-8.2 grams), crude protein (6.3%), crude fat (5.1%) and carbs (69.4%) are all present in turmeric (Kermanshahi and Riasi, 2006). It also includes 7.79% crude fiber (Silva *et al*., 2018), 7.97% curcumin (Saraswati *et al*., 2013b) and about 13.1% moisture (Chattopadhyay *et al*., 2004). Turmeric has been shown to improve hematological and biochemical markers, increase antioxidant activity in organs like the spleen, boost antibody levels after vaccination, reduce heat stress and lower the amount of potentially harmful bacteria like Escherichia coli in the ileal fluid of farm-raised laying hens (Guil-Guerrero *et al*., 2017). Further, turmeric has been shown to possess anticancer, antidiabetic, antifertility, anti-inflammatory, antimicrobial and antioxidant properties (Sirisidthi *et al*., 2016). According to Olarotimi (2018), turmeric has a bioactive component that may have improved development by improving digestion, metabolism and nutrient use. Few researches have been done on the benefits of supplementing birds with turmeric powder, particularly laying hens (Radwan *et al*., 2008). The research "The Impact of Supplementing Vanaraja Birds diet with Turmeric (*Curcuma longa*) Powder on Production and

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Reproduction performance" was proposed considering the health benefits of turmeric in order to determine its impact on the general performance of Vanaraja birds.

MATERIALS AND METHODS

An experiment was conducted using 120 Vanaraja pullets of the same age of two months old at the poultry unit of the Department of Livestock Production and Management, Nagaland University's School of Agricultural Sciences. The farm is situated at a height of 310 meters above mean sea level in latitude 25.60N and longitude 93.200E to 95.150E. The yearly rainfall ranged from 175 to 250 cm on average. The pullets were divided into four groups randomly, each containing thirty pullets with five duplicates of six birds each. Standard grower diet was given to the birds for the first eighteen weeks of their lives, after which they were given layer feed supplemented with varying amounts of turmeric powder until they were fifty-two weeks old. As the control group, group T_1 was given only the basal diet, whereas groups T_2, T_3 and T_4 received the same basal diet as group T_1, but supplemented with turmeric powder @ 0.5 (T_2), 0.75 (T_3) and 1.5 (T_4) per cent of ration, respectively. When the pullets first arrived, their initial body weight was noted. From then on, it was noted every fortnightly. The ratio of the total weight gain to the amount of feed consumed was used to compute the FCE. Subtracting the mortality percentage from 100 gives the liveability percentage. As soon as the birds reach sexual maturity, egg production commences. Age at first egg was considered sexual maturity. A bird's body weight was measured on the day when it laid its first egg. The age at first egg was determined by calculating the number of days from the day of birth to that day and the weight of the egg was determined using a 500 g digital weighing scale. A clutch is a collection of eggs laid by a hen on successive days, separated by at least one day of rest. The overall egg production was calculated by recording the number of eggs produced each day and the persistence of laying was determined by computing the hen day egg production (HDEP) and hen housed egg production (HHEP). The formula for HDEP is as follow:

$$\text{HDEP} = \frac{\text{Total number of eggs laid in a given period}}{\text{Total number of hen-days in that period}} \times 100$$

and HHEP is calculated as:

$$\text{HHEP} = \frac{\text{Total eggs laid within a certain period}}{\text{Number of hens housed at the beginning of the laying period}}$$

The economics of feeding turmeric powder were determined using the total cost of inputs, which includes the price of chicks, feed, labour, medications, test materials and other miscellaneous cost, as well as the total return per bird. Statistical analysis was performed on the collected experimental data using ANOVA to obtain significant findings in compliance with the completely randomized design approach as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Production performance

Body weight

Initial body weights of the Vanaraja birds in the T_1, T_2, T_3 and T_4 treatment groups were 1365.32, 1366.60, 1366.12 and 1364.40, respectively, at the beginning of the investigation (Table 1). By the 22nd fortnight, there was a notable difference in body weight among the treatment groups, with T_4 showing significantly higher body weight compared to T_1, which exhibited the lowest body weight. This finding is in line with earlier research by Sulastri and Basri (2019), which also discovered that feeding laying hens turmeric powder increased the birds' body weight significantly. Studies by Amosu *et al*. (2020) also found that different levels of turmeric inclusion had significant effect on net weight change of the goats.

Gain in body weight

Overall total body weight gain for different treatment groups *i.e.* T_1, T_2, T_3 and T_4 was 1538.12, 1549.52, 1568.53 and 1562.65 respectively (Table 1). The treatment groups did not significantly vary in terms of total mean body weight gain. These results align with those reported by Ooi *et al*. (2018) and Saraswati *et al*. (2013a).

Feed intake

The total feed consumption for groups T_1, T_2, T_3 and T_4 during the trial period was 38145.82 g, 38079.12 g, 38016.42 g

Table 1: Production performance of Vanaraja birds in different treatment groups.

Parameters	Fortnight	Treatments			
		T_1	T_2	T_3	T_4
Body wt (g/bird/fortnight)	Onset	1365.32	1366.60	1366.12	1364.40
	22nd	2903.45^{d}± 0.50	2916.13^{c}±0.34	2934.66^{b}±0.52	2948.06^{a}±0.63
Gain in body wt (g/bird/fortnight)	Total	1538.12	1549.52	1568.53	1562.65
	Overall mean	69.91±18.88	70.43±19.17	71.29±19.16	71.02±18.77
Feed intake (g/bird/fortnight)	Total	38145.82	38079.12	38046.42	38022.04
	Overall mean	1733.95^{a}±10.62	1730.86^{b}±10.97	1729.38^{bc}±11.0	1728.27^{c}±11.95
FCE	Overall mean	63.113^{d}±10.10	99.942^{a}±29.38	72.895^{c}±15.28	75.668^{b}±18.91
Liveability (%)	22nd	88.89	88.89	96.30	92.86

Where a, b, c, d = Means bearing different superscripts within the column differ significantly (P<0.05).

and 38022.04 g per bird, respectively (Table 1).The groups supplemented with Turmeric had significantly lower feed intake than the control group. Changes in taste and smell, particularly the potent smell of turmeric, may be the cause of decreased feed intake. This is consistent with earlier research by Riasi *et al*. (2012) and Rahardja *et al*. (2015), which found that laying hens fed turmeric at doses of 1.5 to 2 g and 4 g per kg of feed, respectively, consumed less feed. Zadeh *et al*. (2022), on the other hand, discovered no significant effect of turmeric supplementation on feed intake.

Feed conversion efficiency

By the end of the 22nd fortnight, the average feed conversion efficiency of Vanaraja birds was recorded as follows: 63.11 ± 10.10, 99.942 ± 29.39, 72.895 ± 15.28 and 75.66±18.91 for T_1, T_2, T_3 and T_4, respectively, (Table 1). Supplementation of turmeric powder had significant difference in feed conversion efficiency among the different treatment groups. The control group exhibited a superior overall mean feed conversion efficiency compared to the turmeric supplemented groups. This could not be ascribed to the addition of turmeric in the diet and as such it might be due to other stress factors. Consistent with these observations, Kanagaraju *et al*. (2017) similarly found a significant impact of turmeric supplementation on feed conversion efficiency in layer birds.

Mortality/liveability

The mortality rate of Vanaraja birds across the experiment for the various treatment groups T_1, T_2, T_3 and T_4 was 11.11, 11.11, 3.7 and 7.14 respectively. Hence, liveability percentage was recorded as 88.89, 88.89, 96.3 and 92.86, respectively. The groups of birds that were supplemented with turmeric powder at 0.75% and 1.5% showed higher rates of bird survival. The mortality rate for Vanaraja birds was within the range given by Singh *et al*. (2018).

Reproductive performance

Age at sexual maturity, body weight and egg weight at onset of egg production

The age at sexual maturity for the various treatment groups *i.e.* T_1, T_2, T_3 and T_4 was documented as 176.62±7.04, 179.46 ± 2.11, 176.7±0.66 and 176.5±1.20 days, respectively (Table 2). The body weight at the onset of egg production for these groups was recorded as 2553.20±1.52, 2561.60 ±1.46, 2580.00±0.31 and 2582.00±3.39 g per bird, respectively. Additionally the egg weight at onset of egg production was found to be 52.16±0.06, 52.20±0.04, 52.29±0.04 and 52.21±0.04 g/egg.

The age at sexual maturity and the egg weight at the start of egg production were not significantly affected by adding turmeric to the diet of laying hens since the values were similar in all groups. Contarary to the findings by Saraswati and Tana (2016) and Awadein *et al*. (2010), which found that adding herbal feed additives like fenugreek and turmeric could either delay or accelerate the laying hens' sexual maturation.

Age at sexual maturity (days) of Vanaraja bird found to be well within the range of 172 to 185, 164.79, 197.70, 181.53±1.29 and 172.36±2.23 as reported by Singh *et al*. (2018). According to Niranjan *et al*. (2008) and Chakrabarti *et al*. (2020), the egg weight at 280 days was also recorded as 55.87 g and 55.85±5.53 g, respectively.

Body weight at the onset of egg production was significantly increased in T_4 and lowest in T_1. The increase in body weight could be due to the positive effect of turmeric as reported by Khodadadi *et al*. (2021).

Total egg production, clutch size, hen house and hen day egg production

From the beginning of laying until the end of the 365-day trial, the egg production per bird varied among the treatment groups (Table 2). T_1 had 149.86 ± 0.25 eggs, T_2 had 157.06 ±1.03 eggs, T_3 had 169.73 ± 1.34 eggs and T_4 had 156.43± 1.54 eggs. T_3 exhibited significantly higher egg production while T_1 produces the lowest. . These results are consistent with those of Park *et al*. (2012) and Azouz *et al*. (2019), who also observed a significant effect of turmeric powder on laying birds' ability to produce eggs.

The clutch sizes were observed to be 5.32±0.29, 5.59±0.25, 5.83±0.44 and 5.53±0.13 numbers respectively, for different treatment groups. While the hen house egg production for the different treatment groups T_1, T_2, T_3 and T_4 was 19.55±0.44, 19.63±1.06, 21.21±0.57 and 19.55±0.68 numbers, respectively. For the various treatment groups, the hen day egg production percentages were 66.27±0.93, 69.31±0.89, 69.91±0.44 and 68.34±0.77, respectively.

Table 2: Reproductive performance of Vanaraja birds in different treatment groups.

Parameters	Treatment groups			
	T_1	T_2	T_3	T_4
Age at sexual maturity (days)	176.62± 7.045	179.46± 2.117	176.70± 0.669	176.50± 1.209
Body wt at onset of egg production (g/bird)	2553.20c ±1.52	2561.60b ±1.46	2580.00a± 0.31	2582.00a± 3.39
Egg wt at onset of egg production (g/egg)	52.16± 0.06	52.20± 0.04	52.29± 0.04	52.21± 0.04
Total egg production (Nos)	149.86c± 0.26	157.06b± 1.03	169.73a± 1.34	156.43b± 1.54
Clutch size (Nos)	5.32± 0.29	5.59± 0.25	5.83± 0.44	5.53± 0.13
Hen house egg production (days)	19.55± 0.44	19.63± 1.06	21.21±0.57	19.55± 0.68
Hen day egg production (%)	66.27± 0.93	69.31± 0.89	69.91± 0.44	68.34± 0.77

Where a, b, c = Means bearing different superscripts within the column differ significantly (P<0.05).

Table 3: Economics of Vanaraja production in different treatment groups (`/bird).

Items	Treatment groups			
	T_1	T_2	T_3	T_4
Cost of Vanaraja chick	40.00	40.00	40.00	40.00
Cost of feed	1258.00	1256.60	1255.51	1254.72
Cost of turmeric powder	-	28.55	42.75	85.50
Cost of medicine	10.33	10.33	10.33	10.33
Cost of labour	85.40	85.40	85.40	85.40
Miscellaneous	28.38	28.38	28.38	23.38
Cost of production	1422.92	1449.26	1462.37	1504.33
Average Weight of Vanaraja (Kg)	2.903	2.916	2.934	2.948
Average weight gain (Kg)	1.538	1.550	1.568	1.584
Cost of production per Kg weight (`)	490.15	497.00	498.42	510.28
Sale of Vanaraja @ ` .250 per Kg live weight (`)	725.75	729.00	733.50	737.00
Sale of eggs @ ` 8 per egg	1198.88	1256.48	1357.84	1251.44
Sale of gunny bags @ ` .20/bag	15.25	15.23	15.21	15.20
Total receipt (`)/bird	1939.88	2000.71	2.106.55	2003.64
Profit per bird (`)	516.96	551.45	644.18	499.31
Net profit per Kg gain (`)	336.12	355.77	410.82	315.22

However, there were no significant variations in the effects of turmeric supplementation on hen day, hen house egg production, or clutch size. In contrast, Widjastuti *et al.* (2017) reported an increase in both hen day and hen house egg production resulting from the incorporation of turmeric powder into the diet.

Economics

Table 3 presented the average production cost per bird for T_1, T_2, T_3 and T_4 to be 1422.92, 1449.26, 1462.37 and 1504.33 rupees, respectively. Profit yielded per bird for T_1, T_2, T_3 and T_4 was 516.96, 551.45, 644.18 and 499.31 rupees, respectively. The related values for net profit per kilogram of weight gain are presented in Table 3.

Economically, higher net profit per bird and net profit per kg weight gain was observed in group T_3 and the least in T_4 while all of the groups supplemented with turmeric had higher overall production costs than the control. The present finding was in agreement with Kafi *et al.* (2017) who had reported that net return was more economical when 0.75 per cent of turmeric was supplemented in feed as compared to control groups. The higher production costs were primarily due to the cost of turmeric.

CONCLUSION

Overall, turmeric powder supplementation at 0.75 and 1.5% resulted in higher performance in terms of body weight, egg production and net returns than the control group. As a result of the data presented above, the use of turmeric powder as a feed additive at 0.75 and 1.5 per cent can be suggested in chicken diets for improved production and reproductive performance.

Conflict of interest

All authors declare that they have no conflicts of interest.

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