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Effect of supplementation of Arjuna bark powder (*Terminalia arjuna*) as herbal feed additive on dry matter metabolizability, retention of nitrogen and comparative economics of broiler chicks in arid region of Rajasthan

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Abstract

The goal of this study was to investigate the use of Arjuna Bark Powder (*Terminalia arjuna*) in broiler rations as a feed additive on dry-matter (DM) metabolizability, retention of nitrogen and comparative economics of broilers in arid region of Rajasthan. Total 150, day old broiler chicks (broiler strain Cobb-430) were used in experiment. Total five dietary treatment groups (T₁-T₅) were created and each treatment group had 3 replicates. The T₁ group was fed on basal diet without feed additive and kept as control. Whereas treatment groups (T₂-T₅) were supplemented with graded levels (@ 0.50%, 0.75%, 1% and 1.25%) of Arjuna Bark Powder (*Terminalia arjuna*) in the broiler ration, respectively. In the end for duration of 5 days using 6 broiler chicks from each group, a metabolic trial also conducted. The findings revealed that the supplementation of Arjuna Bark Powder at graded levels did not bring any significant outcome on dry-matter metabolizability of feed and nitrogen retention but numerically higher DM metabolizability and nitrogen retention was observed in herb supplemented groups than control. However, it did bring substantial ($p < 0.05$) drop in the total cost of feed/kg body weight gain as compare to control and highest drop in total cost of feed/kg body weight gain was found in T₄ i.e., 9.26% reduction.

Keywords: Broiler, economics, nitrogen retention, dry matter (DM) metabolizability

Introduction

In India poultry is one of the speedily-rising section of the livestock business division. Currently it is coming out as a dawn section. CAGR (Compound Annual Growth Rate) of egg production is 6.77% (Anonymous, 2023) [2] and broiler meat production's CAGR is 7.52% (Anonymous, 2019) [1]. Indian poultry section has been attributed to augment the income expanding in bourgeoisie society and expeditious urbanization. Poultry meat remains the foremost component of the growth in overall Indian meat production. At present broiler meat is becoming meat of choice for not only to producers but for the consumers too, because of its lower production costs, high FCR, and cheaper than other meat. Broiler meat is famous in health-conscious consumers for its high protein and lower fat content. Main axis of economics of broiler meat industry is based on cost of feed. Feed plays pivotal role in poultry industry's economics and it accounts for 70-75% of total production costs in the broiler industry, so the efficiency with which poultry convert feed to meat is critical to the industry's economics Prajapat *et al.* (2020) [8]. Feed costs are regularly lowering down in broiler meat industry by various exertions to cut down production costs. The term feed additives are applied to all products other than those commonly called feedstuffs which could be added to the ration to obtain some special effects Feltwell and Fox (1979) [4]. The use of chemicals or synthetic feed additives (Antibiotics, enzymes, vitamins and etc.) has been seriously criticized by consumers due to their harmful effects. Hence, use of herbs like Arjuna Bark Powder has advantage because they are safe, economical, effective, and easily available. However, the information on the role of Arjuna on broiler performance in arid region is limited.

So, this experiment was taken up to evaluate the efficacy of different levels of Arjuna Bark Powder in improving DM metabolizability, nitrogen retention and economics in broiler chicks.

Materials and Methods

A total of 150 experimental day old, unsexed, apparently healthy broiler chicks (Cobb-430) were selected for the study. All chicks were weighed individually and after that all chicks were randomly divided into five treatment groups of 30 chicks each, and every treatment group had 3 replicates of 10 chicks in each replicate. Arjuna bark Powder (*Terminalia arjuna*) was supplemented at a graded level. T₁ group (control) were fed only on basal diet without any supplementation and other treatment groups were supplemented with 0.5%, 0.75%, 1%, and 1.25% of Arjuna Bark Powder in the experimental broiler starter and finisher ration, respectively. At the end of experiment a metabolic trial (Duration 5 days) were conducted for evaluation of dry-matter metabolizability and nitrogen balance. Total six chicks from each treatment group were selected for this metabolic trial, and these chicks reared in metabolic cages. Every treatment group were offered a fixed amount of basal ration at morning 8:00 AM every day. Mixed droppings of each treatment group were collected every day (24 hours interval period) from dropping trays of metabolic cages. Daily feed intake was evaluated after deducting the left over from the feed offered. Separate samples were drawn from collected droppings of each treatment group after proper mixing for the dry-matter and nitrogen estimation. Dropping samples which were going to be subjected for nitrogen estimation kept into wide-mouth glass stoppered bottles in refrigerator and preserved in 5% H₂SO₄. Dry-matter determination of droppings was done in duplicate for each

group by keeping the weighed droppings in a hot air oven at 85 °C till constant weight was obtained.

In this experiment the comparative economics of broiler feed was calculated by the cost of feed to produce a kilogram of meat (Total feed cost/unit gain in broilers). The cost of feed of all treatment groups were evaluated by calculating feed cost of readymade starter feed (56 Rs./Kg.), finisher feed (59 Rs./Kg.), and Arjuna bark powder (125 Rs./Kg.). Percentage reduction in feed cost /Kg weight gain was calculated over control group (T₁).

Results and Discussion

The findings of DM metabolizability and nitrogen balance studies has been presented in Table 1 revealed that non-significant effect due to Arjuna Bark Powder supplementation on DM metabolizability but numerically higher DM metabolizability were observed in Arjuna supplemented groups than control and are in agreement with conclusions of Namdev (2007) [6], Rajput *et al.* (2013) [9] and Singh *et al.* (2017) [10].

Nitrogen available for various metabolic processes was found to be similar in all supplemented groups. Statistical scrutiny of data revealed non-significant effect due to Arjuna Bark Powder supplementation on overall nitrogen-intake (gram/day/chick), nitrogen-voided (gram/day/chick) and retention of nitrogen (gram/day/chick) in broilers among various treatment. Even though, there is numerical increase in nitrogen balance of phyto-genic feed additive supplemented group as compared to control which might support better performance in corresponding groups and are in accordance with conclusions of Weerasingha and Atapattu (2013) [12], Olukosi and Dono (2014) [7] Widodo *et al.* (2019) [13] and El-hadi *et al.* (2021) [3].

Table 1: DM Metabolizability (%) and N-Balance Study

Treatment groups	DM Metabolizability (%)	N-intake gram/day/chick	N-voided gram/day/chick	N-balance gram/day/chick
T ₁	74.39	2.79	0.91	1.88
T ₂	75.00	2.85	0.92	1.93
T ₃	76.30	2.89	0.93	1.96
T ₄	77.38	2.93	0.93	2.00
T ₅	76.15	2.91	0.94	1.98
SEM	0.6920	0.0768	0.0171	0.0649

Table 2: Overall cost/kg gain (Rs) and % reduction in feed cost/kg gain

Treatment groups	Overall cost/kg gain (Rs)	% Overall reduction in feed cost/kg gain
T ₁	107.45 ^b	0.00
T ₂	104.69 ^b	2.57
T ₃	101.49 ^{ab}	5.55
T ₄	97.50 ^a	9.26
T ₅	105.19 ^b	2.10
SEM	1.19960	-

Note- a, b means superscripted with different letters within a column differ significantly ($p < 0.05$) from each other.

Overall cost/kg gain (Rs) and % reduction in feed cost/kg gain has been presented in Table 2 and revealed that addition of Arjuna Bark Powder at different levels significantly ($p < 0.05$) reduce the overall cost of feed per kg gain as compared to control and highest reduction in overall cost of feed per kg gain was obtained in T₄ (Basal diet + 1% Arjuna Bark Powder) *i.e.*, 9.26% reduction and are in line with Gawande (2015) [5] and Singh *et al.* (2019) [11].

Conclusion

An endeavour has been made to determine the optimum level of supplementation of Arjuna Bark Powder in the diet of broilers and its effect on the dry-matter metabolizability of feed and nitrogen retention of broilers reared in arid zone of Rajasthan. Nitrogen available for various metabolic processes was found to be similar in all supplemented groups. Even though, there is numerical increase in nitrogen

balance of phytogetic feed additive supplemented group as compared to control which might support significant ($p < 0.05$) reduction in the overall cost of feed per kg gain as compared to control and highest reduction in overall cost of feed per kg gain was obtained in T₄ (Basal diet + 1% Arjuna Bark Powder) *i.e.*, 9.26% reduction in corresponding groups. So, it could be concluded that supplementation of Arjuna Bark Powder at 1.00% is quite effective and could be a viable proposition for lucrative broiler farming for meat production. Though the results are concrete and indicative but replication of feeding experiments with large number of broilers are recommended before reaching to final recommendation for incorporation of Arjuna Bark Powder in the broiler feed for wellbeing of broiler industry.

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