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Effect of Supplementation of Black Pepper, Jaggery, along with Feed Restriction on Meat Composition in Thigh and Breast Muscles of Broilers

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ABSTRACT

The present investigation was carried out to study the effect of feed restriction and fat supplementation in broilers. The study was conducted at the poultry farm and poultry nutrition laboratory of the Department of Animal Nutrition, GADVASU, Ludhiana, Punjab. In this growth study, 480 chicks were weighed individually at 1 day of age and distributed randomly into 8 groups having total 60 birds per treatment with 4 replicates having 15 chicks in each replicate representing different treatments. Results of the study showed that Moisture was not affected by feed restriction. Numerically lower CP (crude protein) and fat values for thigh muscle composition were observed but, these were statistically non significant. For breast muscle CP was not affected by feed restriction conditions and decreased fat content were also observed for breast composition. Non significant effect of BP (black pepper) supplementation on moisture, crude protein and fat thigh muscle and breast muscle composition was observed. However, numerically value of fat in groups with BP supplemented groups decrease but statistically it was non-significant. Groups with jaggery supplementation on moisture, crude protein and fat thigh muscle and breast muscle composition differed non-significantly. No significant difference in moisture and crude protein was reported in thigh muscle and breast muscle due to feed restriction, black pepper and jaggery supplementation. But, fat value of breast muscle in T_4 (black pepper supplementation with feed restriction) and T_8 (black pepper + jaggery supplementation with feed restriction) was observed significantly lower as compared to control. So we can conclude that there was non- significant effect on all other parameters except fat value in T_4 (black pepper supplementation with feed restriction) and T_8 (black pepper + jaggery supplementation with feed restriction) which was significantly lower as compared to control.

Key words: *Black pepper, Jiggery, Feed restriction, Moisture*

INTRODUCTION

Plant-derived additives used in animal nutrition to improve performance have been called "phytogenic feed additives"[16]. This form of feed additives has recently become of particular interest for use in poultry production and there have been an increasing number of scientific publications since the ban of in-feed antibiotics growth promoters by European Union in 2006[6].

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In commercial broiler production mainly powder forms or essential oils of oregano (*Origanum vulgare*), rosemary (*Rosmarinus officinalis*), sage (*Salvia officinalis*), thyme (*Thymus vulgaris*), garlic (*Allium sativum*), black pepper (*Piper nigrum*) and chilli (*Capsicum annum*) are used singly or in combination as feed additives. Black pepper (*Piper nigrum*) is a flowering vine extracted from the core of a pepper plant, and belongs to the family Piperaceae, genus Piper and species Piper nigrum. Black pepper has been shown to be rich in glutathione peroxidase and glucose-6-phosphate dehydrogenase[8]. Black pepper was found to improve feed digestibility[15].

Feed restriction in poultry farming is a method of feeding in which time or amount of nutritive feed is limited and based on the fact whether the bird is capable of achieving same final body weight as those fed *ad libitum* or unrestricted[3,14,17]. Generally this restriction can be done both quantitatively (reducing daily feed offered) or qualitatively (nutrient dilution). The benefits of early feed restriction are the savings obtained by improved feed efficiency and reduced incidents of sudden death syndrome[4] ascites[2] lameness in broiler chicken[9] and reduce skeletal diseases[1]. Feed restriction increases enzyme secretions such as amylase, sucrose and lipase and may therefore influence growth rate[12]. The improvement in feed efficiency in restricted chickens has been attributed to reduce overall maintenance requirements caused by transient decrease in basal metabolic rate[13]. Additional benefits of this programme are reducing electricity cost along with decreased incidence of lameness, mortality with simultaneous improvement in feed efficiency without reduction in weight at market age.

MATERIAL AND METHODS

The present investigation was carried out to study the effect of feed restriction and fat supplementation in broilers. The study was conducted at the poultry farm and poultry nutrition laboratory of the Department of Animal Nutrition, GADVASU, Ludhiana, Punjab. The detailed information regarding procurement, distribution, maintenance of chicks, feed formulation and observation recorded in the present study are mentioned as:

GROWTH STUDIES

One feeding and one metabolic trial were conducted separately in meat type birds to determine the effects of feed restriction and graded fat supplementation on broiler performance. The growth studies in the feeding trial were divided into 3 phases i.e. starter (1-14 days), grower (15-21 days) and finisher (22-35 days) phase as per the recommendation of ICAR[7].

PROCUREMENT OF CHICKS

Day old unsexed meat type chicks (Vencobb) were procured from local market in Ludhiana. Chicks were reared at GADVASU Poultry Farm under normal conditions. Recommended feed was offered with *ad libitum* clean drinking water.

DISRIBUTION AND HOUSING OF CHICKS

In this growth study, 480 chicks were weighed individually at 1 day of age and distributed randomly into 8 groups having total 60 birds per treatment with 4 replicates having 15 chicks in each replicate representing different treatments which are as follows:

Control group fed *ad libitum* as per ICAR specification i.e.

- Starter diet (0-14 DOA) i.e. 22% CP and 3000 Kcal/Kg ME,
- Grower diet (15-21 DOA) i.e. 21.5% CP and 3050 Kcal/Kg ME.
- Finisher diet (22-35 DOA) i.e. 19.5% CP and 3100 Kcal/Kg ME.

Treatments

Table 1: Different treatments along with their feeding methods

T_1	Control feeding
T_2	Control Feeding along with 7-17 day Feed Restriction
T_3	Control Feeding + 0.5 % Black Pepper
T_4	Control Feeding + 0.5 % Black Pepper along with 7-17 day Feed Restriction
T_5	Control Feeding + 1% Jaggery
T_6	Control Feeding + 1% Jaggery with 7-17 day Feed Restriction
T_7	Control Feeding + 0.5% Black Pepper + 1% Jaggery
T_8	Control Feeding + 0.5% Black Pepper + 1% Jaggery along with 7-17 day Feed Restriction

EXPERIMENTAL DIETS

Eight broilers diets were formulated for the study for all the three phases i.e. starter (1^{st} – 14^{th} day), grower (15^{th} – 21^{st} day) and finisher (22^{nd} – 35^{th} day) phase. The percent ingredient composition of diets for all the phases were kept as per ICAR[7] specifications given in Table-1, Table-2, Table-3, respectively.

These experimental diets were balanced for meeting the nutrient requirement of energy, protein, vitamins and minerals etc. Each diet was fed to quadruplicate group of chicks having 15 birds in each replicate during all the phases of growth. Prescribed feeding with *ad libitum* watering was done throughout the experimental period and feed was offered twice daily in the morning and evening. The record of daily feed offered to each replicate was maintained and feed residue was recorded weekly. The feeders were removed from 8-10 hours during 8 p.m. to 6 a.m. (next day) to apply feed restriction.

Table 2: Percent ingredient composition of experimental diets (1^{st} - 14^{th} day)

Ingredients (kg/100 kg)	Treatments							
	T1	T2	T3	T4	T5	T6	T7	T8
Maize	54.2	54.2	54.8	54.8	55.3	55.3	54.8	54.8
Soybean Meal	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Groundnut Extraction	6.0	6.0	6.5	6.5	7.0	7.0	7.0	7.0
De-oiled Rice Bran	3.0	3.0	1.4	1.4	-	-	-	-
Black Pepper	-	-	0.5	0.5	-	-	0.5	0.5
Jaggery	-	-	-	-	1	1	1	1
Oil	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.9
Di-calcium Phosphate	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Limestone Powder	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Methionine (g)	130	130	120	120	130	130	140	140
Salt (g)	300	300	300	300	300	300	300	300
Additives *(g)	200	200	200	200	200	200	200	200
Total (Kg)	100	100	100	100	100	100	100	100

*. Additives include Vit A 8,25,000 IU, Vit D_3 1,20,000 IU/, Vit K 100 mg, Riboflavin 500 mg, Thiamine 80 mg, Pyridoxine 160 mg, Vit E 800 mg, Cyanocobalamine 100 mcg, Niacin 1200 mg, Calcium pantothenate 80 mg, Manganese sulphate 25 g, Ferrous sulphate 10 g, Copper sulphate 500mg, Zinc oxide 8g Potassium Iodide 100 mg, Coccidiostat 60g.

Table 3: Percent ingredient composition of experimental grower diets (15^{th} - 21^{st} day)

Ingredients (kg/100 kg)	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Maize	58.5	58.5	56.9	56.9	57	57	56.5	56.5
Soybean Meal	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Groundnut Extraction	5.0	5.0	5.5	5.5	5.5	5.5	5.5	5.5
Black Pepper	-	-	0.5	0.5	-	-	0.5	0.5
Jaggery	-	-	-	-	1	1	1	1
Oil	3.0	3.0	3.5	3.5	3.2	3.2	3.2	3.2
Di-calcium Phosphate	1.3	1.3	1.4	1.4	1.7	1.7	1.7	1.7
Limestone Powder	1.6	1.6	1.6	1.6	1.0	1.0	1.0	1.0
Methionine (g)	140	140	160	160	120	120	120	120
Salt (g)	300	300	300	300	300	300	300	300
Additives *(g)	200	200	200	200	200	200	200	200
Total (Kg)	100	100	100	100	100	100	100	100

*. Additives include Vit A 8,25,000 IU, Vit D_3 1,20,000 IU/, Vit K 100 mg, Riboflavin 500 mg, Thiamine 80 mg, Pyridoxine 160 mg, Vit E 800 mg, Cyanocobalamine 100 mcg, Niacin 1200 mg, Calcium pantothenate 80 mg, Manganese sulphate 25 g, Ferrous sulphate 10 g, Copper sulphate 500mg, Zinc oxide 8g Potassium Iodide 100 mg, Coccidiostat 60g.

Table 4: Percent ingredient composition of experimental finisher diets (22nd - 35th day)

Ingredients (kg/100 kg)	Treatments							
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Maize	62.3	62.3	61.8	61.8	61.3	61.3	60.8	60.8
Soybean Meal	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
Groundnut Extraction	4.0	4.0	4.0	4.0	4.5	4.5	4.5	4.5
De-oiled Rice Bran	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0
Black Pepper	-	-	0.5	0.5	-	-	0.5	0.5
Jaggery	-	-	-	-	1.0	1.0	1.0	1.0
Oil	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Di-calcium Phosphate	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Limestone Powder	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Methionine (g)	230	230	230	230	230	230	230	230
Salt (g)	300	300	300	300	300	300	300	300
Additives *(g)	200	200	200	200	200	200	200	200
Total (Kg)	100	100	100	100	100	100	100	100

*. Additives include Vit A 8,25,000 IU, Vit D_3 1,20,000 IU/, Vit K 100 mg, Riboflavin 500 mg, Thiamine 80 mg, Pyridoxine 160 mg, Vit E 800 mg, Cyanocobalamine 100 mcg, Niacin 1200 mg, Calcium pantothenate 80 mg, Manganese sulphate 25 g, Ferrous sulphate 10 g, Copper sulphate 500mg, Zinc oxide 8g Potassium Iodide 100 mg, Coccidiostat 60g.

Carcass Parameters

At the end of feeding trial, 4 birds of comparable body weight from each treatment were selected. The birds were off-fed for overnight to empty the intestinal content and sacrificed to assess the effect of various dietary treatments on the dressing %, abdominal fat and development of various vital organs i.e. the heart, gizzard, liver and breast and thigh muscle composition. The sample of thigh and breast muscle were taken to assess the chemical composition of these muscles. Percentage of moisture, fat and protein were estimated in thigh and breast muscle.

RESULTS AND DISCUSSION

Meat Quality Of Broilers

Meat samples from sacrificed birds were sent to Department of Livestock products and Technology, GADVASU where they were analysed for chemical composition and sensory evaluation was conducted by expert panel of 5 analysts on 8-point Hedonic scale**.**

Chemical composition of meat

The data pertaining to various parameters of chemical composition of meat, thigh and breast muscle in terms of moisture, crude protein and meat fat have been given in Table 5-7

Effect of feed restriction on chemical composition of meat of broilers

The effect of feed restriction on thigh muscle composition and breast muscle composition were observed as represent in Table 5 and Table 6. Moisture was not affected by feed restriction. Numerically lower CP and fat values for thigh muscle composition were observed but these were statistically non significant ($P \geq 0.05$) (Table 5). Malpotra[10] reported significantly higher crude protein in second week feed restriction as compared to control and other restriction groups. The carcass fat significantly ($P \leq 0.05$) lower in second week restriction group than other groups including control as reported by Malpotra[10].

Table 5: Effect of feed restriction, black pepper & jaggery on meat composition in thigh muscle

Variable	Effect of Feed Restriction		Effect of Black Pepper		Effect of Jaggery	
	No	Yes	No	Yes	No	Yes
Moisture	71.13±0.31	70.32±0.29	70.85±0.31	70.6±0.36	70.58±0.24	70.87±0.4
Crude Protein	18.04±0.09	17.88±0.11	17.95±0.09	17.97±0.13	17.97±0.12	17.95±0.09
Fat	7.95±0.08	7.81±0.06	7.91±0.08	7.85±0.07	7.95±0.06	7.82±0.08

a, b = Means bearing different superscripts in a row differ significantly (P<0.05)

Table 6: Effect of feed restriction, black pepper & jaggery on meat composition of breast muscle

Variable	Effect of Feed Restriction		Effect of Black Pepper		Effect of Jaggery	
	No	Yes	No	Yes	No	Yes
Moisture	70.96±0.26	70.8±0.23	70.88±0.24	70.87±0.25	70.83±0.27	70.92±0.22
Crude Protein	17.93±0.11	17.85±0.04	17.86±0.1	17.92±0.06	17.88±0.09	17.9±0.08
Fat	8.01±0.06^{a}	7.82±0.03^{b}	7.97±0.06	7.86±0.05	7.92±0.06	7.91±0.05

a, b = Means bearing different superscripts in a row differ significantly (P<0.05)

Table 7: Combined effect of feed Restriction, black pepper & jaggery supplementation on meat composition of thigh muscle

Variable	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Moisture	70.68±0.56	70.25±1.01	70.83±0.38	70.58±0.04	71.73±0.42	70.75±0.1	71.31±1.21	69.7±0.8
Crude Protein	17.83±0.08	17.97±0.13	18.38±0.03	17.71±0.4	18.16±0.06	17.85±0.35	17.82±0.14	17.99±0.12
Fat	8.08±0.14	7.92±0.05	8±0.1	7.81±0.17	7.9±0.25	7.76±0.22	7.84±0.26	7.77±0.08

a, b = Means bearing different superscripts in a row differ significantly (P<0.05)

Table 8: Combined effect of feed Restriction, black pepper & jaggery supplementation on meat composition of breast muscle

Variable	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Moisture	70.21±0.64	71.21±0.34	70.86±0.65	71.07±0.75	71.45±0.25	70.67±0.31	71.32±0.22	70.25±0.4
Crude Protein	17.83±0.38	17.75±0.11	18.05±0.07	17.88±0.03	18.04±0.2	17.82±0.13	17.81±0.27	17.94±0.04
Fat	8.14±0.18^{a}	7.9±0.01^{ab}	7.89±0.09^{ab}	7.76±0.05^{b}	7.98±0.12^{ab}	7.88±0.07^{ab}	8.05±0.07^{ab}	7.74±0.03^{b}

a, b = Means bearing different superscripts in a row differ significantly (P<0.05)

For breast muscle CP was not affected by feed restriction conditions and decreased fat content were also observed for breast composition (Table 6). Malpotra[10] observed that in breast muscle, CP gave non-significant results while fat was significantly decreased. These results are in line with the findings of Omosebi *et al.*[11] who also found highest CP content and lowest crude fat content with 40% feed restriction for 6 weeks duration. Similar results were also observed by Butzen *et al.*[5] with time restriction and Zhan *et al* [18].

Effect of black pepper on chemical composition of meat of broilers

Effect of black pepper on thigh muscle composition and breast muscle composition

were observed as represent in Table 5 and Table 6, respectively. Non significant (P≥0.05) effect of BP supplementation on moisture, crude protein and fat thigh muscle and breast muscle composition was observed. However, numerically value of fat in groups with BP supplemented groups decrease but statistically it was non-significant.

Effect of jaggery on chemical composition of meat of broilers

As represented in Table 5 and Table 6, effect of jaggery on thigh muscle composition and breast muscle composition were observed, respectively. However, values of groups with jaggery supplementation on moisture, crude protein and fat thigh muscle and breast muscle composition were differ non significantly (P≥0.05).

Combined effect of feed Restriction, black pepper & jaggery supplementation on meat composition of thigh muscle and breast muscle

As represented in Table 7, 8. No significant (P≥0.05) difference in moisture and crude protein was reported in thigh muscle and breast muscle due to feed restriction, black pepper and jaggery supplementation. Malpotra[10] also concluded similar non significant results due to feed restriction. But, fat value of breast muscle in T_4 (black pepper supplementation with feed restriction) and T_8 (black pepper + jaggery supplementation with feed restriction) was observed significantly (P≤0.05) lower as compared to control. Abou Elkhair *et al.*[1] reported that dietary supplements with black pepper enhanced the performance and health status of broilers. But no significant (P≥0.05) difference in fat values of thigh muscle was reported due to feed restriction, black pepper and jaggery supplementation.

REFERENCES

1. Abou-Elkhair, R., Ahmed, H. A., and Selim S., Effects of black pepper (*Piper nigrum*), turmeric powder (*Curcuma longa*) and coriander seeds (*Coriander sativum*) and their combination as feed additives on growth performance, carcass traits, some blood parameters and humoral immune response of broiler chickens. *Asian Australasian Journal of Aniaml Science* **27(6):** 847-54. (2014).
2. Arce, J., Berger, M. and Coello, C. L., Control of ascites syndrome by feed restriction techniques. *Journal Appl. Poultry Research* **1:** 1-5. (1992)
3. Ballay, M., Dunnington, E. A., Gross, B. W. and Siegel, P. B., Restricted feeding and broiler performance: age at initiation and length of restriction. *Poultry Science.* **71:** 440-47. (1992)
4. Bhat, G. A. and Banday, M. T. Effect of feed restriction on the performance of broiler chickens during the winter season. *Indian Journal Poultry Science* **35:** 112-14. (2000).
5. Butzen, F. M., Vieira, M. M. , Kessler, A. M., Aristimunha, P. C., Marx, F. R., Bockor, L. and Ribeiro, A. M. L., Early feed restriction in broilers. II: Body composition and nutrient gain. *Journal of Applied Poultry Research* **24:** 198-205. (2015).
6. Castanon, J., History of the use of antibiotic as growth promoters in European poultry feeds. *Poult Sci*. **86(11):** 2466-71. (2007).
7. ICAR. *Nutrient Requirements of Animals - Poultry* (ICAR-NIANP) 3rd edition. Krishi Bhawan. New Delhi. (2013).
8. Karthikeyan, J. and Rani, P., Enzymatic and non-enzymatic antioxidants in selected Piper species. *Indian Journal of Experimental Biology* **41(2):** 135-40. (2003).
9. Kuhlers, D. L. and G. R. McDaniel., Estimates of heritabilities and genetic correlations between tibial dyschondroplasia expression and body weight at two ages in broilers. *Poultry Science*, **75:** 959-961. (1996).
10. Malpotra, K., 'Effects of phased feed restriction and additional fat supplementation on broiler performance'. M.V.Sc. Thesis. GADVASU, Ludhiana, India. (2017).

11. Omosebi, D. J., Adeyemi, O. A., Sogunle, O. M., Idowu, O. M. O. and Njoku, C. P., Effects of duration and level of feed restriction on performance and meat quality of broiler chickens. *Archivos de zootecnia* **63(244):** 611-21. (2014).
12. Pinheiro, D. F., Cruz, V. C., Sartori, J. R and Vicetini, Paulino, M. L., Effect of early feed restriction and enzyme supplementation on digestive enzyme activities in broilers. *Poultry Science* **83:** 1544-50. (2004).
13. Rincon, M. U. and Leeson, S., Quantitative and qualitative feed restriction on growth characteristics of male broiler chickens. *Poultry Science* **81:** 679-88. (2002).
14. Robinson, F., Clessen, H. L., Hpnson, J. A. and Onderkp, D. K., Growth performance, feed efficieny and the incidence of skeletal and metabolic disease in fa-fed and feed restricted broiler and roaster chickens. *Journal of Applied Poultry Research* **1:** 33-41. (1992).
15. Singh, J., 'Herbal feed additives as alternatives to antibiotic growth promoters in broilers.' Ph.D. Dissertation, GADVASU, Ludhiana, India. (2014).
16. Windisch, W., Schedle, K., Plitzner, C., and Kroismay, A., Use of phytogenic products as feed additives for swine and poultry. *Journal of Animal Science* **86:** 140-48. (2008).
17. Yu, M. E and Robinson, F. E., The application of short-term feed restriction to broiler chicken production: A review. *Journal of Applied Poultry Research* **1:** 147-53. (1992).
18. Zhan, X. A., Wang, M., Ren, H., Zhao, R. Q., Li, J. X. and Tan, Z. L., Effect of early feed restriction on metabolic programming and compensatory growth in broiler chickens. *Poultry Science* **86:** 654-60 (2007).