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Research Article

EFFECTS OF FEED RESTRICTION AND FAT SUPPLEMENTATION ON CARCASS TRAITS AND BLOOD PARAMETERS OF BROILERS

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ABSTRACT

A study was conducted to study the effects of feed restrictions and additional (1%) fat supplementation on growth performance of broilers. In this growth study, 480 chicks were distributed randomly into 8 treatments having 60 birds per treatment (4 replicates x 15 chicks in each replicate). No significant effect of feed restriction and fat supplementation individually was found on various carcass traits (dressing percentage, giblet weight, abdominal fat, shank weight and neck). But in combine effect of feed restriction and fat supplementation, giblet percentage was significantly better for second week feed restricted group as compared to third and fourth week feed restricted groups at 4% fat supplementation. For abdominal fat, at 3% fat supplementation, none of the feed restrictions had any significant differences but additional (1%) fat supplementation reduced abdominal fat percentage in second week feed restricted group. Haemoglobin, PCV, glucose and total protein were not affected significantly by feed restriction except cholesterol which was significantly low in second week feed restricted group.

Keywords: Broilers, blood, carcass traits, fat supplementation, feed restriction

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 (Yu and Robinson, 1992). Generally this restriction can be done both quantitatively (reducing daily feed offered) or qualitatively (nutrient dilution). Feed restriction increases enzyme secretions such as amylase, sucrose and lipase and may therefore influence growth rate. The improvement in feed efficiency in restricted chickens has been attributed to reduce overall maintenance requirements caused by transient decrease in basal metabolic rate (Rincon and Leeson, 2002).

Lipids constitute the source with highest calorific value. Besides having high caloric values, they are the major sources of essential fatty acids (Ω-3 and Ω-6), fat soluble vitamins i.e. vitamins A, D, E and K (Iqbal and Hussain, 2009) and lecithin. Moreover, supplementation of fats and oils to poultry rations increases the metabolizable energy of the ration. This "extra-caloric" effect of the fat comes from the increased utilization of other dietary components. Additionally, fats facilitate absorption of fat soluble vitamins and increases taste and palatability. Also, chicks fed diets devoid of supplemental fat had higher levels of lipogenesis and increased adipose fat deposition (Dvorin, *et al.* 1998).

So, feed restriction and fat supplementation in poultry diet play an important role in growth performance, nutrient utilization as well as body composition of birds. But scanty efforts are made to study the effect of feed restrictions with fat supplementation on broiler's carcass traits. So here efforts are made to study the effect of feed restrictions with additional fat supplementation on carcass traits and blood parameters of broilers.

MATERIALS AND METHODS

Four hundred eighty day old chicks (Vencobb) were procured from local market and reared at GADVASU Poultry Farm under normal conditions after they were vaccinated and wing banded at 0 day of age. Whole experiment was conducted in three phases i.e. starter (1st – 14th day), grower (15th – 21st day) and finisher (22nd – 35th day) phase. In this growth study, 480 chicks were weighed individually at 1 day of age and distributed randomly after removing heavy and light weight birds into 8 groups having 60 birds per treatment with 4 replicates having 15 chicks in each replicate representing different treatments T_0 control group as basal diet, T_1- T_0 with additional 1% fat supplementation, T_2- T_0 with feed restriction at 8-14 DOA (8-10 hrs), T_3- T_1 with feed restriction at 8-14 DOA (8-10 hrs), T_4- T_0 with feed restriction at 15-21 DOA (8-10 hrs), T_5- T_1 with feed restriction at 15-21 DOA (8-10 hrs), T_6- T_0 with feed restriction at 22-28 DOA (8-10 hrs) and T_7-T_1 with feed restriction at 22-28 DOA (8-10 hrs). The feed restriction of 8-10 hours at 8-14 days of age weeks of restriction (WOR2), 15-21days of age (WOR3) and 22-28 days of age (WOR4) were applied accordingly. Eight diets were formulated for the three phases as presented in Table 1. The percent ingredient composition of all three phases was kept as per ICAR (2013) specifications. Lysine and methionine levels were also maintained. Each dietary treatment was fed to quadruplicate group of chicks containing 15 birds in each replicate. Each bird was weighed and feed residue was recorded at weekly interval. The feeders were removed from 8-10 hours during 8 p.m. to 6 a.m. (next day) to apply feed restriction. Standard managemental practices were followed.

At the end of feeding trial, 4 birds of comparable body weight (2 male and 2 female) 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 data were analyzed using ANOVA in SAS version 9.4

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Table 1
Percent ingredient composition of experimental diets

Ingredients (kg/100 kg) \ Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7
				Starter diet				
Maize	54.7	50.0	54.7	50.0	54.7	50.0	54.7	50.0
Soybean Meal	31.0	32.0	31.0	32.0	31.0	32.0	31.0	32.0
Groundnut Extraction	7.7	6.0	7.7	6.0	7.7	6.0	7.7	6.0
De-oiled Rice Bran	0	4.4	0	4.4	0	4.4	0	4.4
Vegetable Oil	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
Di-calcium Phosphate	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Limestone Powder	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
				Grower diet				
Maize	57.5	54.0	57.5	54.0	57.5	54.0	57.5	54.0
Soybean Meal	31.4	24.4	31.4	24.4	31.4	24.4	31.4	24.4
Groundnut Extract	5.0	12.5	5.0	12.5	5.0	12.5	5.0	12.5
De-oiled Rice Bran	0	2.0	0	2.0	0	2.0	0	2.0
Vegetable Oil	3	4	3	4	3	4	3	4
Di-calcium Phosphate	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Limestone Powder	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
				Finisher diet				
Maize	63.0	58.0	63.0	58.0	63.0	58.0	63.0	58.0
Soybean Meal	21.9	24.0	21.9	24.0	21.9	24.0	21.9	24.0
Groundnut Extract	9.0	6.0	9.0	6.0	9.0	6.0	9.0	6.0
De-oiled Rice Bran	0	4.9	0	4.9	0	4.9	0	4.9
Vegetable Oil	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
Di-calcium Phosphate	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Limestone Powder	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25

* Additives (600gm) 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, Cynacobalamine 100 mcg, Niacin 1200 mg, Calcium pantothenate 80 mg, Manganeese sulphate 25 g, Ferrous sulphate 10 g, Copper sulphate 500mg, Zinc oxide 8g Potassium Iodide 100 mg, Coccidiostat 60g, Methionine 100gm, Salt 300gm.

Table 2
Individual effect of feed restriction and fat supplementation on carcass traits

Variable	Effect of feed restriction				Effect of fat levels	
	Control	WOR2	WOR3	WOR4	3%	4%
Dressing %	56.42±0.46	56.78±0.82	56.71±0.44	56.78±0.63	57±0.41	56.35±0.4
Giblet %	5.1±0.19	5±0.18	4.91±0.19	4.8±0.24	5.08±0.15	4.82±0.12
Abdomimal Fat%	2.38±0.28	2.87±0.32	2.25±0.13	2.25±0.13	2.45±0.16	2.42±0.18
Shank %	5.29±0.23	5.3±0.22	5.44±0.19	5.25±0.22	5.27±0.14	5.37±0.16
Neck %	4.57±0.25	4.56±0.11	5.06±0.16	4.56±0.1	4.78±0.14	4.6±0.1

*Values with different superscripts differ significantly (p=0.05) within each row

Table 3
Combined effect (feed restriction x fat) on carcass traits

Variable	Fat	Control	WoR2	WoR3	WoR4
Dressing %	3%	55.65±0.61	57.75±0.64	57.23±0.73	57.37±1.13
Dressing %	4%	57.18±0.47	55.81±1.45	56.19±0.44	56.2±0.56
Giblet %	3%	5.21±0.35	4.73±0.16	5.2±0.3	5.19±0.4
Giblet %	4%	$4.99±0.19^{ab}$	$5.27±0.26^{a}$	$4.63±0.15^{b}$	$4.41±0.07^{b}$
Abdomimal Fat %	3%	2.6±0.45	$2.94±0.32^{A}$	2.03±0.1	2.23±0.21
Abdomimal Fat %	4%	$3.13±0.47^{a}$	$1.83±0.24^{bB}$	$2.47±0.21^{ab}$	$2.27±0.17^{ab}$
Shank %	3%	4.96±0.14	5.47±0.22	5.48±0.29	5.16±0.41
Shank %	4%	5.62±0.39	5.13±0.41	5.4±0.28	5.34±0.22
Neck %	3%	4.65±0.53	4.55±0.09	5.15±0.2	$4.77±0.1^{B}$
Neck %	4%	$4.49±0.06^{ab}$	$4.57±0.23^{ab}$	$4.98±0.27^{a}$	$4.35±0.07^{bA}$

*Values with different superscripts a,b,c,d differ significantly ($p \leqslant 0.05$) within each row and values with superscript A,B differ significantly ($p \leqslant 0.05$) within the column.

(2000) to test the difference between various treatments.

RESULTS AND DISCUSSION

Carcass traits: The data pertaining to the percent yield of various carcass parameters in terms of dressing percentage, giblet weight, abdominal fat, shank weight and neck weight have been given in Table 2 and 3.

Effect of feed restriction on carcass traits

No significant effect of feed restriction was found

Table 4
Individual effect of feed restriction and fat supplementation on blood parameters

Variable	Effect of feed restriction				Effect of fat levels	
	Control	WoR2	WoR3	WoR4	3%	4%
Haemoglobin	8.83±0.21	9.1±0.33	9.18±0.44	8.83±0.28	9.02±0.25	8.95±0.2
PCV	28.64±0.3	28.93±0.38	28.85±0.42	28.77±0.63	28.38±0.29	29.21±0.28
Glucose	236.71±1.36	236.18±1.91	237.32±0.65	236.58±1.42	236.45±1	236.94±0.93
Cholesterol	154.32±0.94[a]	143.73±0.87[c]	149.75±0.67[b]	149.91±0.73[b]	149.57±1.19	149.28±1.04
Total Protein	3.98±0.06	3.86±0.03	3.86±0.08	3.93±0.06	3.85±0.03	3.96±0.05

*Values with different superscripts differ significantly (p=0.05) within each row

Table 5
Combined effect (feed restriction x fat) on blood parameters

Variable	Fat	Control	WoR2	WoR3	WoR4
Haemoglobin	3%	8.82±0.19	9.02±0.46	9.51±0.88	8.72±0.27
Haemoglobin	4%	8.84±0.41	9.18±0.53	8.85±0.22	8.94±0.54
PCV	3%	28.21±0.24	28.75±0.44	28.5±0.6	28.05±1.01
PCV	4%	29.07±0.47	29.11±0.68	29.2±0.6	29.48±0.72
Glucose	3%	235.94±1.98	237.09±3.33	236.85±0.65	235.94±2.03
Glucose	4%	237.48±2.08	235.26±2.33	237.79±1.18	237.23±2.24
Cholesterol	3%	156.04±1.28[a]	144.1±1.15[c]	149.7±0.87[b]	148.45±0.64[bB]
Cholesterol	4%	152.61±0.7[a]	143.36±1.45[b]	149.79±1.17[a]	151.37±0.82[aA]
Total Protein	3%	3.94±0.08	3.86±0.05	3.79±0.06	3.83±0.07
Total Protein	4%	4.01±0.1	3.85±0.06	3.93±0.14	4.04±0.08

*Values with different superscripts [a,b,c,d] differ significantly (p=0.05) within each row and values with superscript [A,B] differ significantly (p=0.05) within the column.

on various carcass traits (dressing percentage, giblet weight, abdominal fat, shank weight and neck). However, values for dressing percentage were numerically higher for restricted groups as compared to control, although non-significant as shown in Table 2. Non-significant results for various carcass parameter were given by David and Subalini (2015) who reported that these traits were unaffected by the feed restriction for 3, 5 and 7 hours. Higher values for dressing percentage with restrictions were also observed by De Silva and Kalubowila (2012) in contrast to Saleh *et al.* (2005) who showed decrease in dressing percentage after restrictions. Non-significant results for dressing percentage were reported by Ramlah *et al.* (1996). Non-significant results for gizzard and liver weight were reported by Jahanpour *et al.*(2015). The non-significant results for abdominal fat were also reported by Ramlah *et al.* (1996) and Saleh *et al.* (2005). However, abdominal fat decreased with increased levels of restriction (Mirshamsollahi, 2013; Omosebi *et al.*, 2014). Skip-a-day feeding also reduced abdominal fat as reported by Santoso *et al.* (1995). Restricted feeding increased the total giblet weight (liver+heart+gizzard) (P<0.01) as reported by De Silva and Kalubowila (2012).

Effect of fat supplementation on carcass traits

No effect of fat supplementation was seen in carcass traits as depicted from Table 2. Similar results were also given by Duraisamy *et al.* (2013) with various sources of fat. Significantly higher dressed weight was observed due to 5% fat supplementation as compared to 2.5% but it was not significant for other carcass cuts (Rai *et al.*, 2015). In contrast, gizzard weight decreased with fat supplementation as reported by Shahryar *et al.* (2011). The abdominal fat content was found on higher side with higher levels of fat side as per the findings of Shahryar *et al.* (2011). Results from study of Poorghasemi *et al.* (2013) suggested that the supplementation with a combination of vegetable and animal fat sources in broiler diet supported positively carcass traits.

Effect of feed restriction along with fat supplementation on carcass traits

Dressing percentage remained similar due to feed restrictions and fat supplementation in various treatments. Giblet percentage was significantly better for second week feed restricted group as compared to third and fourth week feed restricted groups at 4% fat supplementation. For abdominal fat, at 3% fat supplementation, none of the feed restrictions had any significant differences but additional (1%) fat supplementation reduced abdominal fat percentage in second week feed restricted group as compare to control. Moreover, lower value of abdominal fat percentage was observed in third week feed restricted group (2.41±0.21) and fourth week restricted group (2.27±0.17) as compared to control (3.13±0.47). This reduction in abdominal fat due to restriction is in agreement with the finding of previous worker (Omosebi *et al.*, 2014). The values for shank percentage ranges from 4.96 to 5.48 at 3% fat and 5.13 to5.62 at 4% fat but differences were non-significant. However, for neck percentage feed restriction at 3% fat did not gave significant results as shown by Jahanpour *et al.* (2015) but

at 4% third week restrictions gave best yield. Also, during fourth week restrictions, additional (1%) fat gave higher yield for neck percentage.

Blood parameters:

The data pertaining to various blood parameters in terms of hemoglobin, PCV, glucose, cholesterol and total protein have been given in Table 4 and 5.

Effect of feed restriction on blood parameters

Effect of feed restriction on blood parameters has been illustrated in Table 4. Hemoglobin, PCV, glucose and total protein were not affected significantly by feed restriction except cholesterol which was significantly low in second week feed restricted group. This result is in accordance with that of Afsharmanesh *et al.* (2016) who reported decreased levels of blood cholesterol in birds fed dry feed with restrictions compared to birds that were fed wet diets without any restrictions.

Effect of fat supplementation on blood parameters

Additional fat did not give any significant results with any of the parameters (hemoglobin, PCV, glucose, cholesterol and total protein) as depicted in Table 4. Rai *et al.* (2015) also observed non-significant results with cholesterol and other biochemical parameters with different grades of fat supplementation. However, Duraisamy *et al.* (2013) reported decreased levels of serum cholesterol with sunflower oil as compared to tallow.

Effect of feed restriction along with fat supplementation on blood parameters

Hemoglobin, PCV, glucose and total protein were not affected significantly by feed restriction as well as fat levels as given in Table 5. However, significantly lowest value for blood cholesterol was observed in second week of restriction with both 3% and 4% level of fat. Cholesterol values were also affected by fat levels during fourth week restrictions where 3% fat supplementation gave significantly lower value as compared to additional 1% fat group.

So from this study, it was concluded that no significant effect of feed restriction and fat supplementation was found on various carcass traits (dressing percentage, giblet weight, abdominal fat, shank weight and neck) but cholesterol level was low in second week feed restriction.

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