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Effect of ghee residue on growth performance and economics of production of native chicken

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ABSTRACT

The biological experiment was designed to study the effect of feeding ghee residue in native chicken (Aseel) for a period of 12 weeks on various parameters, viz. bi-weekly body weight, gain in body weight, feed consumption, feed conversion ratio, livability and the cost effectiveness of feeding ghee residue. A total of 300 day-old, unsexed, Aseel native chicken belonging to single hatch were utilized for this study. The treatment groups were fed with diets containing ghee residue at different inclusion levels, i.e. 0% (T_1-control), 5% (T_2), 10% (T_3) and 15% (T_4). Biological experiment revealed that there was significant difference in body weight and body weight gain and feed conversion ratio and no significant difference was observed in feed consumption and livability. The cost effectiveness of the native chicken fed with various levels of ghee residue showed increased net profit per kg live weight in the group fed 5% ghee residue.

Key words: Aseel, Economics, Ghee residue, Growth performance, Native chicken

Indigenous chicken are an important source of animal protein and could be very helpful in combating the nutritional deficiencies and generating income for the rural masses, especially in the developing countries. Moreover, the better adaptability of native chicken breeds to the local climatic conditions and greater robustness over commercial chicken make them a preferred choice to raise them with lesser amount of capital and under inclement weather conditions.

Generally, feed alone accounts for 60–70% cost of production in any type of livestock and poultry rearing. There are many unconventional feed sources such as tamarind seed, azolla, acacia seed etc that have been included in the ration to minimize the cost of feed.

Ghee residue is one such alternate feed ingredient which is a brownish solid mass obtained as a by-product of ghee industry. Ghee residue proved to be a good source of protein, energy and minerals, especially calcium and phosphorus. Though the ghee residue has been used in food industry for making sweets, bakery products and as a flavour enhancer etc, most of the times, it is considered as a waste at the industry level as well as at the domestic level. As ghee residue contains 32–70% of fat, it is used as a potential substrate for enzyme production of lipase (Sahasrabudhe *et al.* 2012), used to improve the keeping quality of pet food in addition to lowering its cost (Rani *et al.* 2014) and also used as an alternative feed ingredient to formulate low cost fish feed (Singh *et al.* 2015). Ghee residue utilisation in native chicken's diets would contribute to reduce feed cost and improve meat quality. Thus, the objective of this study was to evaluate the effect of ghee residue on growth performance and cost effectiveness in native chicken diet.

MATERIALS AND METHODS

A total of 300 day-old, unsexed, Aseel native chicken belonging to single hatch were wing banded, weighed and randomly allotted into four treatment groups. All the treatment had three replicates and each consisted of 25 chicks. The treatment groups were fed with diets containing ghee residue at different inclusion levels, i.e. 0% (T_1-control), 5% (T_2), 10% (T_3) and 15% (T_4). The chicken was reared for a period of 12 weeks. Up to 4 weeks of age, the birds were housed at Poultry Research Station, Chennai in cage system of flat deck cages in a gable roofed, open sided house. All the chicken were reared under standard management conditions. The experimental birds were reared at Instructional Livestock Farm Complex, Chennai from the age of 5 weeks to the end of biological experiment under mud floor system to simulate the field conditions by providing standard management conditions.

The ghee residue was included in the diet at graded levels to prepare experimental diets on *iso-caloric* and *iso-nitrogenous* basis. The native chickens (Aseel) were fed

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ad lib. with brooder and grower diets prepared at Central Feed Technology Unit, Kattuppakkam from 1 to 8 and 9 to 12 weeks of age, respectively.

The ingredient and nutrient composition of the brooder and grower diets are presented in Table 1. Feed consumption and livability were recorded daily and the body weight was recorded once in every two weeks. Feed conversion ratio and livability were calculated. The economics of feeding with graded levels of ghee residue were calculated by taking in to account prevailing cost of different feed ingredients including ghee residue, total feed consumed, total weight gain and market price of native chicken that prevailed during the period of study.

The feed cost per kg live weight gain was calculated as follows:

$$\text{Feed cost/kg live weight gain} = \frac{\text{Cost/kg} \times \text{Total feed consumed}}{\text{Total body gain}}$$

Table 1. Native chicken brooder and grower feed formula

Feed ingredient (%)	Control (T_1)	GR 5% (T_2)	GR 10% (T_3)	GR 15% (T_4)
Brooder mash				
Maize	61.06	52.48	41.05	30.00
Ghee residue	0.00	5.00	10.00	15.00
De-oiled rice bran	0.00	5.09	15.31	24.43
Soya	34.88	33.03	29.53	26.16
Calcite/LSP	1.00	0.87	0.80	0.64
DCP	0.50	1.00	0.75	1.22
Mineral mixture poultry	2.00	2.00	2.00	2.00
Methionine	0.01	0.01	0.01	0.01
Lysine	0.05	0.02	0.05	0.04
Salt	0.50	0.50	0.50	0.50
Grower mash				
Maize	51.50	40.00	31.50	23.00
Ghee residue	0.00	5.00	10.00	15.00
De-oiled rice bran	22.80	33.00	39.00	45.80
Soya	21.60	18.20	15.60	12.50
Calcite/LSP	1.10	0.80	0.80	0.70
DCP	0.60	0.80	1.00	0.80
Mineral mixture poultry	2.00	2.00	2.00	2.00
Methionine	0.05	0.04	0.03	0.10
Lysine	0.00	0.00	0.00	0.00
Soda bicarbonate	0.05	0.05	0.05	0.05
Salt	0.25	0.15	0.15	0.15
Supplements (*g*)				
Vitamin AB_2D_3K[1]	10.00	10.00	10.00	10.00
B-complex vitamins[2]	25.00	25.00	25.00	25.00
Trace minerals[3]	50.00	50.00	50.00	50.00

[1]One gram of Vitamin AB_2D_3K supplement contained 82,500 IU of Vitamin A, 50 mg of Vitamin B_2, 12,000 IU of Vitamin D_3 and 10 mg of Vitamin K. [2]One gram of B-Complex supplement contained 8 mg of Vitamin B_1, 16 mg of Vitamin B_6, 80 mg of Vitamin B_{12}, 80 mg of Vitamin E, 120 mg of Niacin, 8 mg of Folic acid, 80 mg of Calcium pantothenate, 120 mg of Calcium and 300 mg of Phosphate. [3]One gram of trace minerals contained 54 mg of manganese, 52 mg of zinc, 20 mg of iron, 2 mg of iodine and 1 mg of cobalt.

The recorded data were used to calculate the gain in body weight, feed efficiency and per cent livability. The data was subjected to statistical analysis as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Data pertaining to body weight, weight gain, feed conversion ratio and economics are presented in Table 2 and 3 respectively. There was highly significant ($P \leq 0.01$) difference between treatment groups in body weight due to dietary inclusion of ghee residue throughout the study period except during the 2nd week. At the end of experimental period, i.e. at 12 weeks of age, dietary inclusion of 5% ghee residue (T_2) had significantly ($P \leq 0.01$) higher body weight than other treatment groups. The dietary inclusion of 15% ghee residue (T_4) had lower body weight among all treatment groups. Based on statistical analysis, highly significant difference ($P \leq 0.01$) in body weight gain of native chicken was observed in the birds receiving 5% ghee residue during the entire experimental period than other treatment groups except at the end of 2 weeks. At the age of 12 weeks, dietary inclusion of 5% ghee residue (T_2) recorded higher body weight gain followed by 10% (T_3), control (T_1) and 15% (T_4). The findings were in accordance with Arumugam *et al.* (1989), who stated that ghee residue can be included in poultry ration with or without amino acids. It also corroborates the finding of Loganathan (2012) who affirmed that ghee residue can be included in broiler diet up to 10% for attaining significantly higher body weight and body weight gain. The result clearly indicates that ghee residue can be included in native chicken ration up to 15% so as to produce either higher or comparable body weight and body weight gain than control.

The non-significant reduction in body weight and body weight gain in group fed with ghee residue at 15% might due to higher crude fibre content of the feed.

As the incorporation level of ghee residue is getting increased, it is inevitable to increase the level of inclusion of rice bran in experimental ration to balance the preparation of *iso-caloric and iso-nitrogenous ration* and for proper mixing of ghee residue with the feed ingredients. This was supported by the finding of Loganathan (2012) who reported that there was reduction in body weight of broilers when fed with 30% ghee residue because, the experimental feed become rich in fibre due to the necessity of increasing the rate of inclusion of de-oiled rice bran according to the rate of incorporation of ghee residue. Gallinger *et al.* (2004) also reported that there will be reduction in body weight of chicken when the diet with more than 20% of rice bran is fed to chicken.

Statistical analysis revealed that no significant difference was observed in feed consumption between treatment groups throughout the study period. This was in agreement with earlier report of Loganathan (2012) who had stated that there was no significant difference in feed consumption between treatment groups during the entire experimental period.

Data on feed conversion ratio revealed highly significant

Table 2. Effect of feeding ghee residue on cumulative bi-weekly body weight (g/bird), cumulative body weight gain (g/bird) and cumulative feed conversion ratio (Mean±SE) of native chicken

Treatment	2nd week^{NS}	4th week**	6th week**	8th week**	10th week**	12th week**
			Body weight			
T_1 (Control)	85.45±1.55	229.81^{b}±2.44	441.27^{ab}±3.86	623.32^{ab}±5.04	777.15^{b}±5.78	1003.10^{b}±6.15
T_2 (GR 5%)	87.35±1.61	236.24^{a}±2.42	445.93^{a}±3.31	632.17^{a}±3.98	793.48^{a}±4.21	1103.91^{a}±11.31
T_3 (GR 10%)	84.47±1.64	225.35^{bc}±2.13	433.34^{b}±4.15	621.52^{ab}±4.80	772.99^{bc}±5.29	1012.36^{b}±6.05
T_4 (GR 15%)	83.12±1.20	221.93^{c}±1.42	423.63^{c}±2.20	612.07^{b}±2.66	763.09^{c}±3.79	999.39^{b}±4.86
			Cumulative body weight gain			
	2nd week^{NS}	4th week**	6th week**	8th week**	10th week**	12th week**
T_1 (Control)	55.33±1.48	199.69^{b}±2.37	411.15^{ab}±3.76	593.20^{ab}±4.96	747.03^{b}±5.71	972.99^{b}±6.22
T_2 (GR 5%)	56.66±1.58	205.54^{a}±2.40	415.23^{a}±3.27	601.47^{a}±3.90	762.78^{a}±4.16	1073.20^{a}±11.25
T_3 (GR 10%)	54.13±1.59	205.01^{bc}±2.09	403.01^{b}±4.12	591.18^{ab}±4.77	742.65^{bc}±5.24	982.02^{b}±5.84
T_4 (GR 15%)	52.40±1.11	191.21^{c}±1.34	392.91^{c}±2.10	581.35^{b}±2.56	732.37^{c}±3.70	968.67^{b}±4.73
			Cumulative feed conversion ratio			
	2nd week^{NS}	4th week^{NS}	6th week**	8th week**	10th week*	12th week**
T_1 (Control)	2.88±0.12	2.40±0.03	2.33^{a}±0.01	2.81^{b}±0.003	3.53^{b}±0.003	4.09^{b}±0.02
T_2 (GR 5%)	2.85±0.10	2.33±0.03	2.30^{a}±0.01	2.75^{a}±0.01	3.44^{a}±0.03	3.69^{a}±0.02
T_3 (GR 10%)	2.94±0.04	2.35±0.10	2.37^{b}±0.01	2.82^{b}±0.01	3.55^{b}±0.01	4.06^{b}±0.01
T_4 (GR 15%)	3.11±0.07	2.53±0.02	2.45^{c}±0.01	2.87^{c}±0.01	3.55^{b}±0.04	4.11^{b}±0.01

GR, Ghee residue; NS, non-significant; *Significant at 5% level (P≤0.05); **Significant at 1% level (P≤0.01).

Table 3. Effect of feeding ghee residue on cost effectiveness (economics) of native chicken

Treatment group	Body weight (kg)	Chick cost (₹)	Total feed consumed (kg)	Cost of feed (₹)	Total feed cost per bird (₹)	Total cost of production per bird (₹)	Total cost of production per kg live weight (₹)	Total income per bird (₹)	Net profit per bird (₹)	Net profit per kg (₹)
	a	b	c	d	e	f = (b + e + A)	g = f/a	h = a × B	i = h–f	j = B–g
T_1 (Control)	1.00	35	3.978	26.33	104.74	145.74	145.74	200	54.26	54.26
T_2 (GR 5%)	1.10	35	3.958	26.00	102.92	143.92	130.83	220	76.08	69.17
T_3 (GR 10%)	1.01	35	3.984	25.16	100.23	141.23	139.83	202	60.77	60.17
T_4 (GR 15%)	0.99	35	3.978	24.50	97.46	138.46	139.85	199.8	61.34	60.15

A (Miscellaneous cost), ₹ 6/bird; B (Price of one kg live weight of native chicken), ₹ 200; Cost of ghee residue, ₹ 10/kg.

(P≤0.01) difference between treatment groups throughout the experimental period except at the end of 2 weeks and 4 weeks. At the end of experimental period, the treatment group fed on experimental diet incorporated with 5% ghee residue (T_2) recorded better feed conversion ratio than other treatment groups. Though feed consumption remains same in all treatment groups, the alteration in feed conversion ratio by the group fed with 5% ghee residue is due to the significant difference in body weight than other treatment groups. This was in agreement with earlier report of Arumugam *et al.* (1989) and Loganathan (2012) who had stated that there was a significant difference between treatment groups on feed conversion ratio while studying the effect of feeding ghee residue in chicken ration.

There was no mortality among the birds belonging to various treatment groups during the entire experimental period and this substantiates the earlier reports of Arumugam *et al.* (1989) and Loganathan (2012) who have also observed non-significance in livability of chicken while feeding ghee residue at graded level.

The total feed cost per bird was highest in group T_1, i.e. control (₹ 104.74) followed by T_2 (₹ 102.92), T_3 (₹ 100.23) and lowest in T_4 (₹ 97.46). The net profit per bird ranged from ₹ 54.26 to ₹ 76.08. The net profit per bird was highest in T_2 (₹ 76.08) and the lowest in T_1 (₹ 54.26) due to the low cost of ghee residue with higher rate of inclusion. In this study, the cost effectiveness of the native chicken fed with various levels of ghee residue showed increased net profit per kg live weight in T_2 (₹ 69.17) followed by T_3 (₹ 60.17), T_4 (₹ 60.15) and T_1 (₹ 54.26). This may be due to increased body weight gain of the birds receiving 5% ghee residue and resultant decreased cost of feed per kg than control.

Though the inclusion level of ghee residue at 10% and 15% level produced lesser benefit in terms of body weight and feed efficiency, the reduction in feed cost at 10 and 15% inclusion resulted in increased net profit per bird and net profit per kg than control. The reduction in feed cost is due to the extent of replacement of maize and soya meal and inclusion of de-oiled rice bran, with respect to the every kilogram addition of ghee residue into the feed mixture. Inclusion of 1 kg of ghee residue has replaced about 2 kg

of maize and about 0.6 kg of soya meal but necessitated an inclusion of 1.4 kg of de-oiled rice bran. Hence, the reduction in feed cost is subject to the prevailing price of ghee residue (based on its demand and supply) and other feed ingredients involved in the preparation of feed at graded levels of inclusion of ghee residue.

The above factors and facts involved in the cost effectiveness of feeding ghee residue, leads to the conclusion that though feeding ghee residue at the rate of 10% and 15% levels is effective for obtaining profit margin above the cost of production per bird but feeding at the rate of 5% level produces significantly higher body weight gain with better feed conversion ratio and better return over feed cost.

From the results of the present study, inclusion of ghee residue in native chicken ration showed better body weight, body weight gain and feed conversion ratio between treatment groups. Inclusion of ghee residue at 5% level resulted in lowest feed cost per bird and with highest net profit.

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