Asian Journal of Poultry Science

ISSN 1819-3609

Academic Journals Inc.

www.academicjournals.com

Asian Journal of Poultry Science 4 (2): 53-59, 2010
ISSN 1819-3609

Effect of Increasing Protein Percentage Feed on the Performance and Carcass Characteristics of the Broiler Chicks

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Abstract: The growth of broiler chickens on diets containing various levels of protein percentage diet was evaluated. Groups of broiler chicks were fed on diets containing 15, 23 and 35% protein diet for 4 weeks where, 15% is control group. As the level of protein percentage increased, weight gain and FCR (Feed Conversion Rate) did not increased. However, when diets were changed to the standard diet, compensatory growth was observed. In this study, diets were formulated with an isocaloric metabolizable energy. Chickens were fed on protein containing diets for 4 weeks. In each group was comprised of 5 animals. Birds feed on 23 and 35% protein diets the birds show increased in weight gain compared with chickens of control group. Experimental 23% protein diet was found to be optimum for birds showing significantly higher FCR in comparison to those birds with control and 35% protein dietary uptake. It was hypothesized that the optimum growth in minimum time incorporating protein percentage would provide a more sensitive assessment of nutritional status.

Key words: Diet, increasing protein percentage, FCR, 4 weeks, carcass, broiler chicks

INTRODUCTION

Several useful techniques have been developed for assessing the overall nutritional status or health of broiler chicks, including measures of body mass, selected organ and glandular development (Kirkpatrick, 1980; Koerth and Guthery, 1987). The most frequent approach is by measuring total weight to understand the overall health. Although, these techniques are successful indices of chronic nutritional status, particularly with respect to energy intake, they do not easily detect short-term alterations in diet quality or animal condition. Techniques for assessing acute changes in protein nutritional status of broiler chicks are limited. Altered nutritional states in birds often yield rapid adjustments in physiological homeostasis (Borghi *et al*., 2002; Jenni *et al*., 2000). The poorly defined sensitivity of most measures of physiological responses to alterations in diet quality limits their value in nutritional assessment, especially with regard to protein nutrition, in broiler chicks (Boren *et al*., 1996). The effect of feeding of different levels of thyme (*Thymus valgaris* L.) on performance, blood constituents, gastrointestinal tract and carcass characteristics was studied in broiler chickens (El-Ghouseinand Al-Beitawi, 2009). Gain ratio of broilers by restricting nutrient intake at an early age, so that the growth curve of the bird was more

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concave in nature rather than linear (Yagoub and Salih Ahmed, 2008). In some studies, have described the effects of dietary Crude Protein (CP) and/or amino acids level on body weight gain and body composition (Bedford and Summers, 1985; Moran *et al*., 1992; Summers *et al*., 1992).

Due to the lack of proper knowledge, the poultry farmers using higher percentage of protein diets for a better FCR output. But, what will be the appropriate dietary protein percentage and their composition? So, we have been examining alternatives to the traditional protein percentages to assess optimum growth with good quality of meet in broiler chicks in a short period of time. This study examines the sensitivity of body mass gain, feed intake, Feed Conversion Rate (FCR) and their relative of broiler chicks to three levels of protein in the diet under controlled experimental conditions. The effects of dietary protein on traditional gravimetric indices of condition are also presented.

MATERIALS AND METHODS

Experimental Diets and Experimental Design

Broiler chicks (1 day old) were obtained from a local breeder in Allahabad Hatcheries Pvt. Ltd. Fifteen broiler chicks (1 day old) were weighed, banded and randomly assigned to one of three experimental diets group varying in protein content (15, 23 or 35% crude protein) for a 4 weeks trial where 15% was control diet. Thus, there were three study groups: (1) a 15% protein containing diet group (control group), (2) a group of 23% protein containing diet and (3) a 35% protein containing diet group. Each experimental diet group was housed together in adjacent pens under identical environmental conditions. Temperature in the housing facility was maintained relatively constant (27.3 to 35.3°C) by using heat lamps and regulating ventilation. Water and experimental diets were provided for ad lib consumption throughout the trial (Bochno *et al*., 2006). Experimental protein diets were made isocaloric by varying the concentration of starch, ground corn, soyabean meal, vegetable oil, dicalcium phosphate vitamin mix, Methionine (99%), salt (NaCl), limestone, trace mineral mix and not significantly differ among each group (<0.05) (Table 1). Daily feed consumption of broiler chicks was measured by offering a known quantity of feed and weighing uneaten portions in the next day. Birds were then individually weighed and the feed consumption for each pen was recorded. The whole experimental design was approved by CSJM University, Kanpur, India. The project duration was 28 days (08/03/07-04/04/07), the animal rearing part of the experiment was occurred in the reproductive biology laboratory of Dayanand Girls College, CSJM University, Kanpur and the analytical part was done in Bioinorganic chemistry laboratory, IIT Kanpur, India.

Table 1: Ingredient composition percentage of isocaloric15, 23 and 35% protein diets fed to broiler chicks

Ingredients	15	23	35
	(%)		
Starch	45.60	37.60	30.00
Ground corn	21.35	21.59	20.94
Soya bean meal	16.16	24.46	32.66
Vegetable fat	11.89	11.42	11.63
Dicalcium phosphate	2.96	2.82	2.61
Vitamin mix*	0.44	0.44	0.44
Methionine (99%)	0.44	0.44	0.44
Salt (NaCl)	0.44	0.44	0.44
Limestone	0.57	0.64	0.68
Trace mineral mix*	0.15	0.15	0.15

*Vitamin mixer- vitamin A (palmitate) 3, 968, 280 IU; cholecalciferol 1, 102, 300 IU; vitamin E (dl-tocopherol), 13, 228 IU; vitamin B12, 7.9 mg; riboflavin, 2,646 mg; niacin, 17,637 mg; d-biotin, 44 mg. *Trace mineral mixer-Ca 15.00%, Zn 10.00%, Mn 12.00%, Fe 7.50%, Cu 1.00%, I 0.25%

Body Condition Analysis

Post-mortem examination included determination of the masses of the whole body, liver, gizzard, spleen and adrenal gland organs.

Statistical Analysis

Differences in body condition indices, weekly absolute growth and feed intake and their relation concentrations among dietary protein treatments were determined by analysis of variance using the Originpro 7.5 of Microcol Software Inc. Procedure. Means ($p<0.05$) comparison using bonferroni test.

RESULTS AND DISCUSSION

Body Condition Indices

Initial body masses averaged 60 g and did not differ ($p<0.05$) among treatment groups. Average daily feed consumption for the 35, 23 and 15% protein treatment groups were 67.97, 62.25 and 35.08 g bird^{-1} during the trial, respectively. Body masses differed significantly ($p<0.001$) among all three treatment groups at 4 weeks (Fig. 1). The absolute liver weight of 15% chicks were significantly ($p<0.05$) lower than 23 and 35% while relative liver weight of 23% chicks were significantly differ ($p<0.05$) from 15 and 35% dietary protein fed chicks. The absolute adrenaline and gizzard weight were significantly higher ($p<0.05$) in 23% chicks than 15 and 35% dietary protein fed chicks. In case of relative adrenaline and gizzard weight were significantly higher ($p<0.05$) in 23 and 15% dietary protein fed chicks respectively than other. The absolute and relative spleen weight were significantly lower ($p<0.05$) among 15% dietary protein fed chicks than other groups. The relative and absolute liver, adrenal gland, gizzard and spleen mass relationship given in Fig. 2a-d. There was no mortality rate found during the experimental period among the dietary groups.

Feed Conversion and Carcass Characteristics

At 28 days the absolute carcass weight of all 3 dietary groups significantly differed from each other. But, the relative carcass weight of chicks fed with dietary 23% protein were better

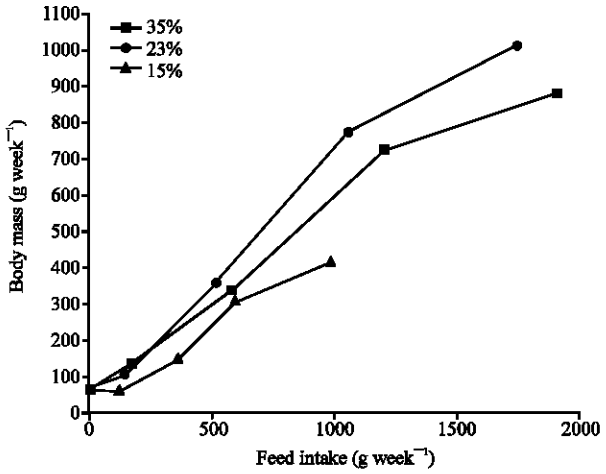

Fig. 1: Change in body mass (g week^{-1}) of chicks fed 35, 23 and 15% crude protein content

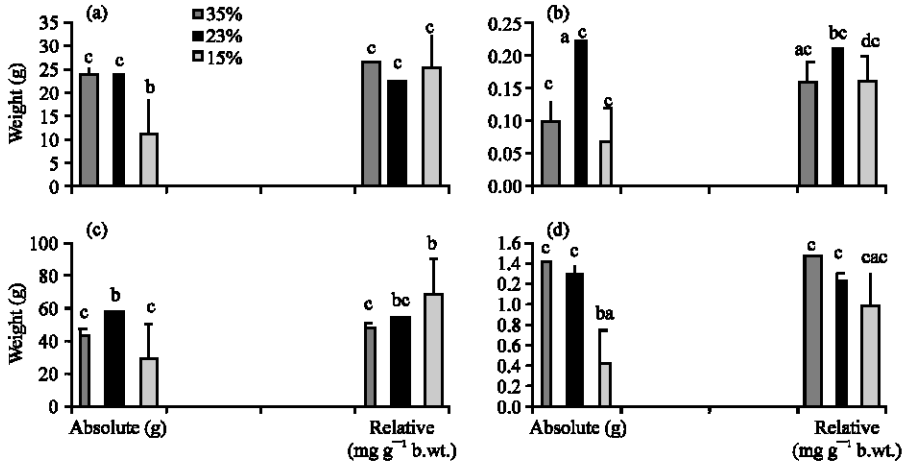

Fig. 2: Absolute and relative mass of the (a) liver, (b) gizzard, (c) adrenalin gland and (d) spleen

Table 2: Growth performance of 28 days broiler chick groups and slaughter traits

	Chick groups			
	35	23	15	
Parameters	(%)			SEM
Feed intake (FI) (g bird^{-1})	1903.2	1743.04	982.21	381.99
Live wt (LW) (g bird^{-1})	938.2	1067.25	470.00	223.52
Feed conversion ratio (LW/FI)	49.0	61.00	48.00	4.70
Carcass weight (CW) (g bird^{-1})	744.5	947.25	357.00	194.67
Dressing out (CW/LW) (%)	79.0	89.00	76.00	2.80

SEM: Standard Error Mean

($p<0.05$) than those of the others (Table 2). During the experimental period, the feed intake of 35% dietary group was highest ($p<0.05$) (Table 2). The live weight of 15% dietary group was significantly lower ($p<0.05$) than those found in 23 and 35% dietary groups (Table 2). Feed conversion rate or FCR (live weight/feed intake) was highest among 23% dietary groups while 35 and 15% dietary groups showing lower FCR. Dressing out percentage (carcass weight/live weight) was nearly same among 35 and 15% dietary groups. While, 23% dietary groups showing highest dressing out percentage.

At the end of 4th week (28 days), the absolute feed intake and body mass gain of 35 and 23% dietary protein groups were significantly varied ($p<0.05$) from control diet group 15%. Here, 23% body mass gain is highest where, 35% and control group was near about same ($p<0.05$) (Fig. 3a-d). Protein required to obtain 1 g body mass among 23% dietary group is minimum which is denoted by relative FI/BMG (feed intake/body mass weight gain/bird/g/g) (Fig. 4a-d). By eating 1 g of protein diet the maximum body weight gain was found among 23% dietary groups where 35% group was slightly fluctuated with control group ($p<0.05$) and 23% group showing best result.

The inability of young broiler chicks to acquire proper levels (protein % and composition) of dietary protein results in depressed growth and development as indicated by reduced body masses and FCR of Broiler chicks fed either 15 or 35% protein diets in this study. Metabolically active organs such as the liver will often change in size with altered nutritional states, reflecting physiological adaptation to changes in circulating nutrient levels. Liver mass responds to different physiological states in ring-necked pheasants

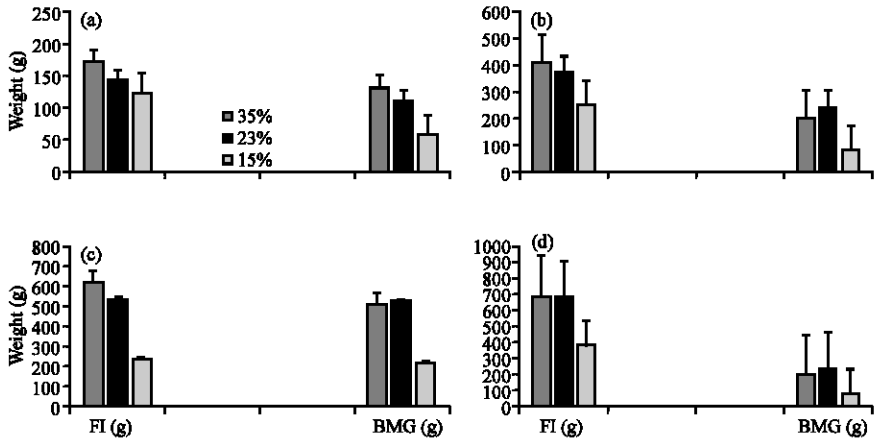

Fig. 3: Absolute feed intake and body mass gain (a) 7th day (b) 14th day (c) 21st day (d) 28th day

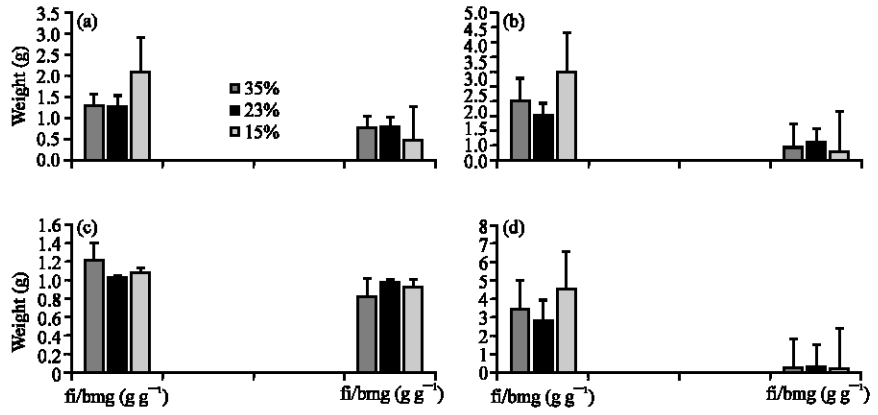

Fig. 4: Relative feed intake and body mass gain (a) 7th day (b) 14h day (c) 21st day (d) 28th day

(Zhao *et al*., 2006) and spruce grouse (Działa and Wesołowska, 2008) and may be a useful measure of condition in broiler chicks. Broiler chicks showed increased relative liver masses among 35% dietary protein groups. However, absolute liver masses were decreased with the decreasing protein percentage. Chicks fed low-protein diets may consume an excess of energy relative to their needs as they attempt to meet protein requirements. Masses of the gizzard and spleen were also useful morphometric discriminators for evaluating body condition in broiler chicks. The gizzard may serve as a protein reserve source in birds subjected to a dietary protein deficiency through catabolism of protein (Gloutney *et al*., 2001; DuBowy, 1985). Atrophy of major lymphoid organs such as the spleen has been demonstrated in mammals subjected to protein malnutrition during early development (Swanson and Weinacht, 1997). Dietary protein level of broilers could be reduced from 23 to 20%, with beneficial effects on growth performance and carcass characteristics and increased economic returns in hot environmental conditions, provided that levels of essential amino

acids are closely looked after. But, in our results, it is concluded that rearing chickens by 23% protein and their diet composition is more beneficial and effective as it provides better FCR, quantity and quality meat production in comparison to other protein percentages within a restricted period of time (4 weeks). Where as, 35% protein diet provides less quantity of meat by wasting large amount of feed in comparison to 23% dietary protein group. So, increasing or decreasing crude protein percentage in broiler chick's diet are not an important factor but an optimum protein percentage is required for better FCR and better carcass weight within minimum period of time, in our case it is 23% crude protein diet and the period is 4 weeks.

ACKNOWLEDGMENTS

N.P. and T.K.M. are grateful to Prof. R. Gurunath, Prof. B. Prakash IIT Kanpur for providing necessary laboratory facilities and also thankful to Dr. E. Pandey, Department of Zoology, D.G.P.G. College, Kanpur University, Kanpur for her support and suggestions executing this study.

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