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Evaluation of different levels of dietary protein on the growth performance of red Cornish birds

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Abstract
An experiment was conducted to evaluate the effect of different levels of protein on the growth performance of Red Cornish birds up to eight weeks of age. In this study 448 day old chicks were randomly distributed to four dietary treatments consisting of 19, 20, 21 and 22% crude protein with constant energy level of 2800 Kcal ME/kg during starter phase and 17, 18, 19 and 20% crude protein with constant energy level of 2900 Kcal ME/kg during finisher phase, with four replicates of 28 birds each. The birds were provided feed and water *ad libitum*. The experiment was conducted as per the Animal Ethical Committee recommendations (KVAFSU, Bidar, and Karnataka). Data on growth performance, Different growth parameters studied are Body weight gain (weekly), Feed consumption (weekly), Feed conversion ratio (weekly), Survivability, were recorded and presented. The dietary protein levels employed in this experiment had significant ($p \leq 0.05$) effect on body weight gain and feed consumption of Red Cornish birds fed with varying levels of protein. The feed conversion ratio was poor in 19% protein fed group while 22% CP diet resulted better feed efficiency when compared to other groups for starter phase. Similarly in finisher phase feed conversion ratio was poor in birds fed with 17% CP and was better in 20% CP. The optimum protein requirement for Red Cornish bird is 22% in starter phase and 20% in finisher phase.

Keywords: Dietary protein, growth performance, red Cornish birds, body weight gain, feed consumption, feed conversion ratio

Introduction
Indian poultry sector has been growing at around 8-10% annually over the last decade with broiler meat volumes growing at more than 10%. Poultry meat over last five years compared to other meat products as per Poultry WPI (whole sale price index) has grown at 12% y-o-y over 2008-2013 as against 21% for overall meat products basket – providing an affordable alternative for meeting protein requirements in Indian diet.
Domestic poultry meat production (broiler-carcass weight) is estimated to have increased from less than 1.0 million tons in 2000 to 3.4 million tons in 2012 with per capita consumption increasing from 0.8 kg to 2.8 kg p.a during same period. Protein has a major effect on growth performance of the bird and it is the most expensive nutrient in broiler diets (Kamran *et al*., 2004) [6]. Its account for 15% of feed cost. One of the most important decisions for the broiler nutritionist is the inclusion level of protein in diet. Because of the expense of providing sufficient protein to growing broilers, numerous studies have been carried out to investigate possibility of reducing dietary crude protein (CP) level. present study was under taken to evaluate the protein requirement of the Red Cornish birds reared up to eight weeks of age under intensive deep litter system to evaluate the effect of different levels of dietary protein on various growth performance parameters like Body weight gain (weekly), Feed consumption (weekly), Feed conversion ratio (weekly), Survivability.

Materials and Methods
448 day old straight run Red Cornish chicks from a single hatch were wing banded for identification, weighed and randomly distributed to four treatment groups in Randomized Complete Block Design. Each treatment had four replicates with 28 birds in each replicate. All the experimental chicks were healthy and received normal routine health care during eight weeks of the trial.

Experimental design and management
The birds were reared under deep litter with standard managemental practices for lighting programme, feeding pattern, watering methods and other routine bio-security aspects.

Brooding of chicks was carried out using infrared bulbs for three weeks. The room was provided with incandescent bulb throughout the experimental period. The birds were provided feed and water *ad libitum*. All methods fallowed for bird care in this experiment were approved by the institution of animal ethical committee of the university.

Experimental diet

Basal diet (control) was formulated using yellow maize, soybean meal extract, deoiled rice bran, feed additives and inorganic mineral mixture to meet the nutrients requirement as per BIS (1992) standards. Treatment group diets were formulated using basal diet with different levels of protein, keeping metabolizable energy (ME) requirement as constant as depicted in the table1. The composition of feed ingredients (Table 2) and calculated chemical composition of experimental diet are given in (Table 3).

Table 1: Descriptions of experimental treatments for starter phase diet and for finisher diet**.** Control diet (as per BIS, 1992)

Treatment	Crude Protein percent	Metabolizable Energy (Kcal/kg) for starter phase diet	Metabolizable Energy(Kcal/Kg) for finisher diet
TI	19	2800	2900
T2	20	2800	2900
T3	21	2800	2900
T4	22	2800	2900

Table 2: Ingredient composition of starter phase and in finisher diet

Feed Ingredients	Treatment Starter Phase Diets				Treatments In Finisher Diet			
	T1	T2	T3	T4	T1	T2	T3	T4
Yellow maize(kg)	58	51.2	57.7	55.6	63	58	55	54.2
Soyabean meal extract (kg)	28.7	31	35	38	23.4	25.7	29	31.7
Dorb(kg)	9	13.5	3	2	8.3	11	10.7	8.8
*Mineral mixture (kg)	2	2	2	2	2	2	2	2
Dcp (kg)	1	1	1	1	1	1	1	1
Salt (kg)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Dl methionine(kg)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
**Vit ab2d3k(kg)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
***Vit b complex(kg)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Hepatocare(kg)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Albac(antibiotic) (kg)	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Coccidiostat (kg)	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Biobantox (kg)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100	100	100	100

*Mineral Mixture contained: Calcium: 32%, Phosphorus: 6%, Copper: 100 ppm, Cobalt: 60 ppm, Manganese: 2700 ppm, Iodine: 100 ppm, Zinc: 60 ppm, Iron: 120 ppm.

** Vit. A B_2 D_3 K: Per gram contains Vit. A: 82, 500 IU, D_3:12,000 IU, B_2:50 mg and K: 10 mg

*** B-complex: Per gram contains Vit B_1:4 mg, B_6:8 mg, B_{12}:40 µg, E: 20 mg, Niacin: 60 mg and calcium pantothenate: 12.5 kg

Table 3: Calculated nutrient composition of basal diet during starter phase & during finisher phase

Nutrient	Nutrient composition of basal diet during starter phase				Nutrient composition of basal diet during finisher phase			
	T1	T2	T3	T4	T1	T2	T3	T4
Metabolizable energy Kcal/ Kg	2829	2761	2845	2832	2933	2886	2862	2862
Crude protein (%)	19.02	20.00	20.98	21.99	17.04	17.95	19.10	19.97
Crude fiber (%)	4.14	4.77	3.67	3.67	3.83	4.24	4.34	4.22
Lysine (%)	1.10	1.19	1.25	1.34	0.93	1.02	1.12	1.19
Methionine (%)	0.52	0.53	0.54	0.56	0.48	0.50	0.52	0.53
Calcium (%)	1.10	1.10	1.10	1.10	1.09	1.09	1.10	1.10
Phosphorus (%)	0.66	0.74	0.57	0.56	0.64	0.69	0.69	0.66

Vaccination regime

Chicks were vaccinated against MD with HVT strain on day one, subcutaneously against ND with B1 strain on 7th day by ocular route and 21st day through drinking water and IBD with intermediate vaccine on 14th day by ocular route and 28th day through drinking water.

Growth parameters studied are

Body weight gain

Individual body weights were recorded at the beginning of the experiment and further at the end of each week to monitor the pattern of body weight changes. Group wise average weights under different treatments were arrived. The weighing of the birds was done in the early hours of the day before feeding.

Feed consumption

The daily amount of the respective treatment diet was weighed and offered to each replicate group. The feed consumption in each replicate was recorded weekly by subtracting the weight of residual feed from the total quantity of feed offered during that week.

Feed conversion ratio

The feed conversion ratio (FCR) expressed as the relationship between amount of feed consumed (kg) to the body weight gain (kg) during particular week under each group of birds

was determined. The FCR is calculated by using following formula.

$$\text{Feed conversion ratio} = \frac{\text{Average feed consumption per bird during the week (Kg)}}{\text{Average weight gain per bird during the week (Kg)}}$$

Survivability

Mortality in respective group was recorded as and when the birds died. Mortality percentage in each treatment during the course of the experiment was recorded. The dead birds were subjected to detailed postmortem examination to ascertain the cause of death.

Statistical analysis

Data pertaining to various parameters obtained during the experiment were analyzed statistically according to the methods described by Snedecor and Cochran (1989) [14]. The data was analyzed statistically by one way analysis of variance (ANOVA) using SPSS statistical software. The significant mean differences between the treatments were determined at $p \leq 0.05$ using Duncans Post hock Test.

Results and Discussion

Body weight gain

The effect of feeding different levels of protein on the mean body weight gain of Red Cornish birds from day old to eighth week of age is presented in Tables. 4 & 5. Graphically depicted in Graph.1. Statistical analysis of data revealed that varying protein levels in the rations exhibited significant ($p \leq 0.05$) effect on body weight gain.

During the first week of the experimental period, maximum body weight gain of 70.34 g was observed in T4 (22%) followed by 69.22 g in T3 (21%) and 67.13 g in T1(19%) ,whereas the lowest body weight gain of 66.71g was observed in T2 containing 20% protein. There was significant difference ($p \leq 0.05$) between 20% (T2) and 22% (T4) protein levels. The remaining rations with different protein levels did not show any significance in body weight gain.

In second week of the experiment, highest body weight gain of 120.49 g was observed in T4 group (22%) followed by 119.68 g, 118.61 g and 118.35 g in birds fed with diet 21%, 20%, and 19%, respectively. No significant difference ($p \geq 0.05$) in body weight gain was observed among varying levels of protein fed treatments.

In third week, the mean value of body weight gain was highest 195.64 gain T3 (21%) followed by 195.53 g in T2 (20%), 194.88 g in T4 group (22%) and lowest of 193.24 g was observed in T1 (19%). No significant difference ($p \geq 0.05$) was observed among varying levels of protein fed treatments.

In fourth week, the highest body weight gain was recorded in T3 (212.48 g) followed by 211.72 g in T4 (22%), 211.27 g in T1 (19%) and 210.34 g was the lowest gain seen in T2 (20%). No significant difference ($p \geq 0.05$) was observed among varying levels of protein fed treatments.

In fifth week, the mean values of body weight gain were highest (229.41 g) in T1 (17%) followed by 228.22 g in T4 (20%), 226.12 g in T2 (18%) and lowest of 222.66 g in T3 group (19%). No significant difference ($p \geq 0.05$) was observed in body weight gain among the varying levels of protein fed treatments.

In sixth week, the highest body weight gain of 242.89 g was observed in T2 (18%) group followed by 240.58, 237.34 and 236.82 g in birds fed with diet containing 20, 19 and 17% respectively. No significant difference ($p \geq 0.05$) was observed in body weight gain among varying levels of protein fed treatments.

In seventh week, the highest body weight gain 280.37 g was recorded in T3 (19%) followed by 280.34 g in T4(20%) group, 278.99 g in T1(17%) and lowest of 274.78 g in T2(18%).No significant difference ($p \geq 0.05$) in body weight was observed among varying levels of protein fed treatments.

The respective means of body weight gain at eighth week of age for 17%, 18%, 19% and 20% of protein level were 327.57 g, 336.34 g, 321.09 g and 320.88 ssg, respectively. The highest body weight gain was recorded in T2 group (336.34 g) as against the lowest observed in T4 group (320.88 g).

At the end of eighth week of the experiment, the mean value of cumulative body weight gain of the birds under different treatments was statistically non-significant ($p \geq 0.05$) ranging from 1650.24 g in T1 to 1672.50 g in T4.

Table 4: Effect of different levels of protein on body weight gain (g) in Red Cornish birds during Starter phase (Mean ± SE)

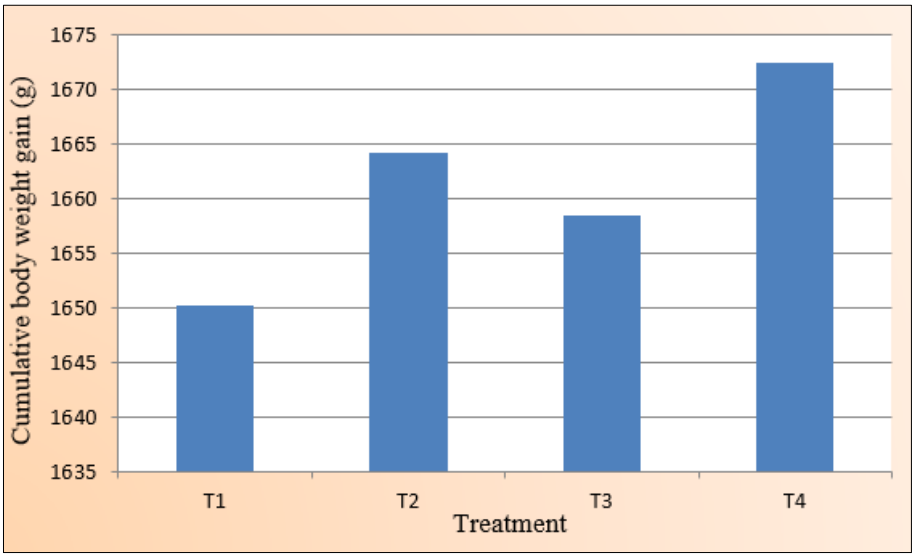
Treatment	Protein level (%)	Week			
		I*	II^{NS}	III^{NS}	IV^{NS}
T 1	19	67.13±1.22^{ab}	118.35±2.97	193.24±4.41	211.27±3.86
T2	20	66.71±1.27^{a}	118.61±2.08	195.53±3.55	210.34±5.20
T3	21	69.22±0.92^{ab}	119.68±1.76	195.64±3.14	212.48±4.26
T4	22	70.34±1.05^{b}	120.49±1.97	194.88±4.06	211.72±4.27

NS=Non-significant. Means bearing at least one common superscript column wise does not differ significantly ($p<0.05$)
*Significant ($p \leq 0.05$)

Table 5: Effect of different levels of protein on body weight gain (g) in Red Cornish birds during Finisher phase (Mean ± SE).

Treatment	Protein Level (%)	Week				Cumulative ^{NS}
		V^{NS}	VI^{NS}	VII^{NS}	VIII^{NS}	
T 1	17	229.41±6.06	236.82±8.61	278.99±7.84	327.57±13.88	1650.24±26.66
T 2	18	226.12±6.15	242.89±11.22	274.78±11.80	336.34±12.97	1664.28±28.96
T 3	19	222.66±5.90	237.34±8.69	280.37±11.16	321.09±13.69	1658.48±28.19
T 4	20	228.22±5.69	240.58±6.36	280.34±8.11	320.88±11.84	1672.50±19.75

NS=Non-significant. Means bearing at least one common superscript column wise does not differ significantly ($p<0.05$)



Graph 1: Cumulative body weight gain (g) of Red Cornish birds

The results of the present study indicated that different levels of protein used in the starter phase (1 to 4 weeks) and the finisher phase (5 to 8 week) had significant ($p \leq 0.05$) influence on body weight gain of Red Cornish birds. The present observations are in agreement with the findings of Shyam sunder *et al.* (1988) who conducted an experiment to know the influence of varying dietary protein and energy levels on the performance of pure bred broiler chicks. The four dietary protein levels (23, 21, 19 and 17%) in combination with three energy levels (3200, 3000 and 2800 Kcal ME/Kg) were studied utilizing 360 day old purebred Plymouth Rock chicks. They found that dietary protein at 23 or 21% level produced significantly better growth compared to 19 or 17% protein up to 5 weeks of age. The present study also confirmed the findings of Devegowda *et al.* (1976) [2] who conducted an experiment and found that, with the increase in the protein levels from 15 to 24% protein, there was significant increase in body weight gain.

On the contrary, O'Neil *et al*. (1961) [9] carried out a study to determine growth response of broiler and replacement chicks by feeding diet containing different levels of protein (16, 20, 24 and 28%) and productive energy (750, 850 and 950 calories per pound of feed). Based on their experiment, they concluded that an excess of productive energy in relation to the amount of protein in the diet decreases the rate of growth. Oyedeji *et al*. (2005) [10] and Folorunso *et al*. (2012) [3] also found no significant difference in body weight gain, when fed with varying levels of protein.

During eight weeks of age, better weight gain was achieved in Red Cornish birds fed with 22% protein containing 2800 Kcal ME/kg energy during starter period and 20% protein containing 2900 Kcal ME/kg energy during finisher period. The study indicated that the optimum protein level for Red Cornish birds may be set at 22% for starter period and 20% for finisher period.

Feed consumption

The data on feed consumption as influenced by different levels of protein in Red Cornish birds from week one to eight weeks of age is presented in Tables 6 &7 and Cumulative feed consumption (g) of Red Cornish birds graphically depicted in Graph. 2. The statistical analysis revealed significant differences ($p \leq 0.05$) among various treatment groups during all weeks of the experiment. At the end of first week, the feed consumption was highest (83.68g) in T1 group (19%) followed by T2 (20%), T3 (21%) and T4 group (22%) consuming 79.73g, 72.77g and 69.02g feed, respectively and found significant differences ($p \leq 0.05$) among treatment groups. At the end of second week, the mean values of feed consumption was maximum (152.84 g) in T1 (19%) followed by 145.92, 142.75 and 141.34 g in T2 (20%), T3 (21%), and T4 (22%), respectively. There was a significant difference ($p \leq 0.05$) between control group (T4), T2 and T1group. However, there was no significant difference in feed consumption between T2 and T3 groups and between T3 and T4. The feed consumption trend was continued during third week, as observed during first 2 week of experimental period. The feed consumption was highest (267.25 g) in T1 (19%) followed by T2 (20%), T3 (21%) and T4 (22%) consuming 257.41, 245.48 and 242.23g feed, respectively and found significant difference ($p \leq 0.05$) among treatment groups. The pattern of feed consumption is similar during fourth week as observed during earlier week. At the end of fourth week, feed consumption ranged from 352.86g in T4 (22%) to 377.59g in T1 (19%). Statistical analysis revealed that there was a significant difference ($p \leq 0.05$) among treatment groups.

The highest feed consumption (438.38 g) at fifth week of age among various treatment groups was recorded in T1 (17%), as against the lowest (393.30g) being observed in T4 (20%). There was significant difference ($p \leq 0.05$) observed among treatment groups. The mean feed consumption at the end of sixth week of age ranged from 461.61g in T4 (20%) to 510.14g in T1 (17%). Statistical analysis revealed that there was significant difference ($p \leq 0.05$) between all the treatment groups.

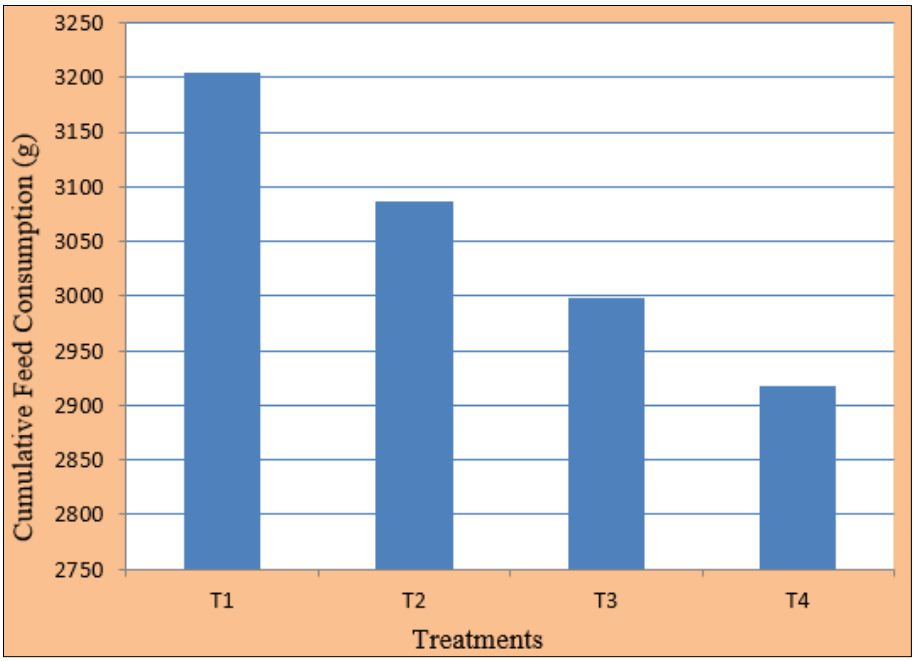
The respective means of feed consumption at seventh week of age for 17, 18, 19 and 20% of protein were 609.95, 592.30, 573.02 and 564.73 g, respectively. There was significant difference ($p \leq 0.05$) observed among treatment groups.

Table 6: Effect of different levels of protein on feed consumption (g) during starter phase (Mean ± SE).*Significant ($p \leq 0.05$)

Treatment	Protein level (%)	Week			
		I*	II*	III*	IV*
T1	19	83.68±0.15^{d}	152.84±0.32^{c}	267.25±0.18^{d}	377.59±0.27^{d}
T2	20	79.73±0.16^{c}	145.92±0.27^{b}	257.41±0.24^{c}	367.30±0.36^{c}
T3	21	72.77±0.21^{b}	142.75±0.34^{ab}	245.48±0.28^{b}	359.82±0.43^{b}
T4	22	69.02±0.10^{a}	141.34±0.19^{a}	242.23±0.11^{a}	352.86±0.22^{a}

Table 7: Effect of different levels of protein on feed consumption (g) during Finisher phase (Mean ± SE).*Significant ($p \leq 0.05$)

Treatment	Protein level (%)	Week				Cumulative*
		V*	VI*	VII*	VIII*	
T1	17	438.38±0.28^{d}	510.14±0.19^{d}	609.95±0.31^{d}	764.29±0.36^{d}	3204.11±1.56^{a}
T2	18	427.83±0.32^{c}	495.73±0.33^{c}	592.30±0.36^{c}	720.98±0.38^{c}	3087.23±2.10^{c}
T3	19	409.95±0.31^{b}	481.02±0.25^{b}	573.02±0.27^{b}	713.39±0.43^{b}	2998.20±2.10^{b}
T4	20	393.30±0.38^{a}	461.61±0.43^{a}	564.73±0.38^{a}	692.86±0.32^{a}	2917.95±1.25^{a}



Graph 2: Cumulative feed consumption (g) of Red Cornish birds.

At eighth week of age, the feed consumption (764.29 g) was highest in T1 (17%) as against lowest of 692.86 g in T4 (20%). Statistical analysis showed significant difference ($p \leq 0.05$) among all the treatment groups. At the end of eighth week of experiment, the mean cumulative feed consumption showed significant difference ($p \leq 0.05$) in birds fed with different levels of protein.

The study revealed significant ($p \leq 0.05$) influence of dietary protein levels on weekly and cumulative feed intake of Red Cornish birds. The results of this study are in agreement with the findings of Rahimi *et al*. (2007) [11] who observed the effects of different protein and energy contents of the diet on growth performance and hormonal parameters in two commercial broiler strains and concluded that the effect of energy and protein on feed intake was significant, while no interaction was found between energy and protein was. Similar results were found by Kamran *et al*. (2008) [6] who worked on the effect of low-protein diets having constant energy-to-protein ratio on performance and carcass characteristics of broiler chickens from one to thirty-five days of age and found an increase trend in the feed intake. M bajiorgu *et al*. (2011) [7] and Nguyen *et al*. (2005) [8] also found significant difference in feed consumption of Red Cornish birds fed with varying levels of protein.

On the contrary, Oyedeji *et al*. (2005) [10] who conducted a research on response of broiler chickens to different dietary crude protein and feeding regimens from 0 to 8 weeks of age at 18, 20 and 23% of dietary protein levels and found no significant variations in feed consumption. Golian *et al*. (2010) [4] and Folorunso *et al*. (2012) [3] also found no significant influence of different levels of protein on feed consumption.

During eight weeks of age cumulative feed intake per bird progressively and significantly decreased as the level of protein was increased from 19 to 22% during starter period and 17 to 20% during finisher period. These results indicate that protein content of the diet influences the feed intake depending upon the protein requirement of the birds.

Feed conversion ratio

The mean value of weekly feed conversion ratio as influenced by varying levels of protein in Red Cornish birds from week one to eighth week of age are presented in Tables 8 & 9 and Cumulative feed consumption ratio of Red Cornish birds graphically summarized in Graph.3. Analysis of variance revealed significant difference ($p \leq 0.05$) in mean FCR values among various treatment groups when compared with control group during the experiment.

The feed efficiency value at first week of age was better 0.97 in T4 (22%) compared to other treatment groups. Whereas poor feed efficiency 1.24 was observed in T1 (19%). Statistical analysis revealed significant difference ($p \leq 0.05$) in feed conversion ratio between T4 (22%) and T1, T2 groups. However, there was no significant difference between T1 and T2 groups.

At second week of age, the mean values of FCR ranged from 1.19 in T3 (21%) to 1.29 in T1 (19%). T1 group differed significantly ($p \leq 0.05$) from T3 group and control (T4) showed non-significant difference with other treatment groups. At third week of age, best feed conversion efficiency was observed (1.23) in T4 (22%) and poor (1.37) in T1 (19%). T1 group differed significantly from T3 and T4 group. Statistical analysis showed significant difference among control (T4) and T1 and T2 groups. At fourth week of age, the mean values of FCR ranged from 1.66 in T4 (22%) to 1.78 in T1 (19%). Statistical analysis revealed no significant difference among T2 and T3group but, T1 group showed significant difference ($p \leq 0.05$) when compared with T4 (control) group. The feed conversion ratio at fifth week of age was found to be 1.69 in T4 (20%) whereas it was 1.92 in T1 (17%). Statistical analysis revealed no significant difference ($p \geq 0.05$) between the treatment groups.

At sixth week of age, the mean values of FCR ranged from 1.92 in T4 (20%) to 2.21 in T1 (17%). Statistical analysis revealed no significant difference ($p \geq 0.05$) between the treatment groups.

The feed conversion ratio at seventh week of age was found to be the best 2.01 in T4 (20%) and 2.23 in T1 (17%). Statistical analysis revealed that there was no significant difference ($p \geq 0.05$) between the treatment groups.

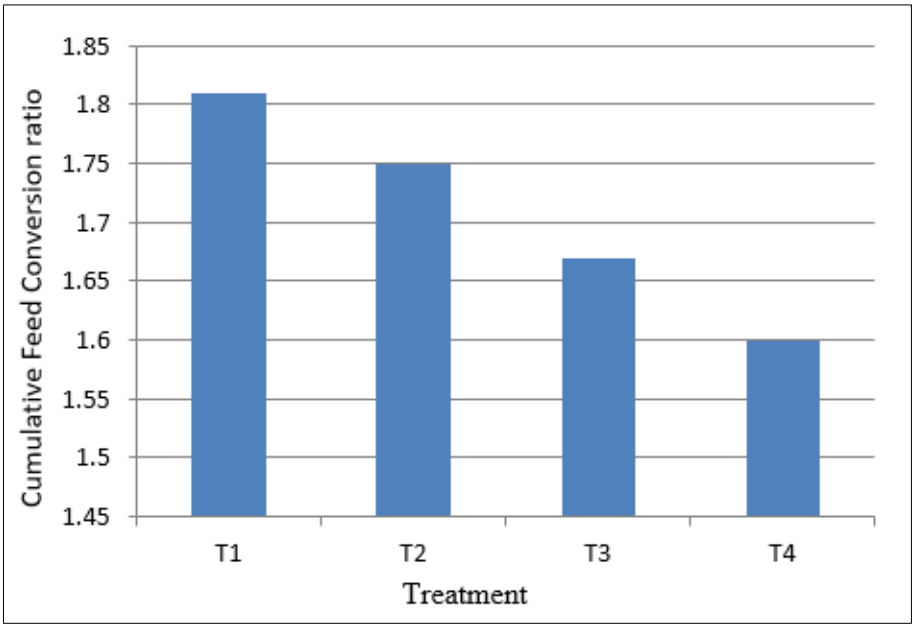
Table 8: Effect of different levels of protein on weekly feed conversion ratio during starter phase (mean± SE) *Significant ($p \leq 0.05$)

Treatment	Protein level (%)	Week			
		I*	II*	III*	IV*
T1	19	1.24±0.037^{b}	1.29±0.037^{b}	1.37±0.035^{c}	1.78±0.051^{b}
T2	20	1.18±0.019^{b}	1.22±0.012^{ab}	1.31±0.013^{bc}	1.73±0.011^{ab}
T3	21	1.04±0.017^{a}	1.19±0.030^{a}	1.25±0.004^{ab}	1.69±0.022^{ab}
T4	22	0.97±0.025^{a}	1.21±0.023^{ab}	1.23±0.017^{a}	1.66±0.023^{a}

Table 9: Effect of different levels of protein on weekly feed conversion ratio during finisher phase (mean± SE).

Treatment	Protein level (%)	Week				Cumulative*
		V^{NS}	VI^{NS}	VII^{NS}	VIII^{NS}	
T1	17	1.92±0.086	2.21±0.219	2.23±0.183	2.48±0.292	1.81±0.028^{c}
T2	18	1.89±0.112	2.17±0.265	2.18±0.199	2.31±0.231	1.75±0.047^{bc}
T3	19	1.78±0.068	2.03±0.133	2.14±0.279	2.27±0.211	1.67±0.030^{ab}
T4	20	1.69±0.027	1.92±0.031	2.01±0.029	2.15±0.048	1.60±0.016^{a}

NS=Non-significant. Means bearing at least one common superscript column wise does not differ significantly ($p<0.05$) *Significant ($p \leq 0.05$)



Graph 3: Cumulative feed consumption ratio of Red Cornish birds

At eighth week of age, the mean values of FCR ranged from (2.15) in T4 (20%) to (2.48) in T1 (17%).Statistical analysis revealed no significant difference ($p \geq 0.05$) between the treatment groups. At end of eighth week of age, the mean value of cumulative feed conversion ratio under different treatments ranged from 1.60 in T4 (20%) to 1.81 in T1 (17%). The control group (T4) was significantly different ($p \leq 0.05$) from T1 and T2 groups.

Significant ($p \leq 0.05$) variations have been observed in efficiency of feed utilization when birds fed with different levels of protein. The results of this study are in agreement with Kamran *et al.* (2008) [6] who worked on broiler chickens from one to thirty-five days of age, Dehury *et al.* (2007) [1] in broiler finisher, Rajpura *et al.* (2010) [12] in color cross bred

broilers, Nguyen *et al*. (2005) [8] in Betong chicks, Tabeidian *et al*. (2005) [15] in commercial broilers.

On the contrary Floronuso *et al*. (2012) [3] examined the effect of diets of different protein levels fed on dry or wet forms on the performance and carcass characteristics of broiler chicken and indicated that feeding of diets of varying dietary protein levels (17.72% to 21.52%) had no significant effect on the final live weight, feed intake, weight gain and feed conversion ratio. Jafarnejad *et al.* (2011) [5] and Oyedeji *et al*. (2005) [10] found no significant variation in feed conversion ratio.

Survivability

The overall survivability percentage of birds under different treatment groups during 56 days of experimental period is presented in Tables 10.

The% livability of birds under different treatments was statistically non-significant ($p \geq 0.05$) ranging from 98.13% in T4 (22%) to 98.54% in T1 (19%) during starter phase and there was no mortality observed during finisher phase of the experiment. The above results indicated that different levels of protein in the diet did not have any significant ($p \geq 0.05$) effect on survivability% of Red Cornish birds.

Table 10: Effect of different levels of protein on survivability percentage of Red Cornish birds during experimental period

Treatment	Protein level (%)	Survivability (%)^{NS}
T1	19	98.54 ± 0.25
T2	20	98.21 ± 0.28
T3	21	98.31 ± 0.28
T4	22	98.13 ± 0.40

NS=Non-significant. Means bearing at least one common superscript column wise does not differ significantly ($p<0.05$)

The study revealed no significant ($p \geq 0.05$) influence of dietary protein levels on survivability of Red Cornish birds.

The observations of the present experiment are in agreement with the findings of Oyedeji *et al*. (2005) [10] and Kamran *et al*. (2008) [6] found no significant difference in the survivability in different protein levels.

Conclusion

The outcome of the current study concluded that the dietary protein levels employed in this experiment had significant ($p \leq 0.05$) effect on body weight gain and feed consumption of Red Cornish birds fed with varying levels of protein. The feed conversion ratio was poor in 19% protein fed group while 22% CP diet resulted better feed efficiency when compared to other groups for starter phase. Similarly in finisher phase feed conversion ratio was poor in birds fed with 17% CP and was better in 20% CP for the diet of Red Cornish birds.

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References

1. Dehury PK, Panda N, Das N, Mishra SC, Mishra PK, Das SK. Evaluation of energy and protein requirement of broiler finisher in summer under hot humid condition. Indian J Poult. Sci. 2007;43(1):55-58.
2. Devegowda G, Rao PV, Sadagopan VR, Panda B. Studies on protein requirement of pure-bred broiler chicks. Indian J Anim. Sci.1976;46(3):143-146.
3. Folorunso OR, Onibi GE. Effect of different protein levels fed on dry or wet forms on the performance and carcass characteristics of broiler chicken finishers. Inter. J of Agri. Sci. 2012;2(6):538-545.
4. Golian A, Aami Azghadi M, Pilevar M. Influence of various levels of energy and protein on performance and humoral immune responses in broiler chicks. Global veterinaria. 2010;4(5):434-440.
5. Jafarnejad S, Sadegh M. The effects of different levels of dietary protein, energy and using fat on the performance of broiler chicks at the end of the third weeks. Asian J of Poult. Sci. 2011;5(1):35-40.
6. Kamran Z, Sarwar M, Nisa M, Nadeem MA, Mahmood S, Barbar ME, Ahmed S. Effect of low protein diets having constant energy to protein ration on performance and carcass characteristics of broiler chickens from one to thirty five days of age. Poult. Sci. 2008;87:468-474.
7. Mbajiorgu AB, Ambi JW, Norris D. Effect of varying dietary energy to protein ratio level on growth and productivity of Indigenous Venda chickens. Asian Journal of Animal and Veterinary Advances. 2011;6(4):344-352.
8. Nguyen TV, Bunchasak C. Effects of dietary protein and energy on growth performance and carcass characteristics of Betong chicken at early growth stage. Songklanakarin J Sci. Tech. 2005;27(6):1171-1178.
9. O'neil JPB, Biely J, Hodgson GC, Aitken JR, Robblee AR. Protein energy relationship in the diet of the chick. Poult. Sci. 1961;41:739-745.
10. Oyedeji JO, Umaigba JO, Okugbo OT, Ekunwe PA. Response of broiler chicken to different dietary crude protein and feeding regimens. Braz. J Poult. Sci. 2005;7(3): 165-16.
11. Rahimi G, Hassanzadeh M. Effects of different protein and energy contents of the diet on growth performance and hormonal parameters in two commercial broiler strains. Inter. J of Poult. Sci. 2007;6(3):195-200.
12. Rajpura RM, Savaliya FP, Khanna, K, Patel AB. Growth and feed efficiency in coloured crossbred broilers reared on different dietary energy and protein levels. Ind. J Poult. Sci. 2010;45(2):146-149.
13. Shyamsunder G, Sadagopan VR, Maitra DN. Influence of varying dietary protein and energy levels on the performance of purebred broiler chicks. Ind. J Poult. Sci. 1988;23(1): 72-78.
14. Snedecor GW, Cochran AW. Statistical methods, VI. Edn. Oxford and IBH Publ. CO., Calcutta; c1989.
15. Tabeidian A, Sadeghi GH, Pourreza J. Effect of dietary protein levels and soybean oil supplementation on broiler performance. Inter J Poult. Sci. 2005;4(10):799803.