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The Effects of Various Protein and Energy Supplements on Broiler Chickens Growth Performance with or Without Feed Additives

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Abstract: *Poultry development plays a crucial role in increasing egg and chicken meat production. Poultry rearing provides income and employment to large number of people. The objective of this investigation is to determine the performance of broiler chicken when fed with diets containing different combinations of energy and protein. Total of 200 (day-old chicken) broiler chickens of a commercial strain randomly selected for three different experiments and feeding with experimental rations. The birds rearing period was 6 weeks, the live body weight performance and health condition were measured by weekly. For each experiment Eighty (80) 1-day-old male broiler chickens of a commercial strain were selected in four groups with control including supplements diet treatments. Each treatment group of 20 birds was allocated. In the first and second weeks of feeding the body weight of broiler chicken was significantly increased by corn (starch rich supplements), however the body weight in week 4 and 5 was significantly increased by protein supplements particularly alfalfa. Also feed additives had significantly effect on growth performance where mortality rate was zero.*

Keywords*: Broiler, protein, energy, growth.*

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I. Introduction

Poultry development plays a crucial role in increasing egg and chicken meat production. Poultry rearing provides income and employment to large number of people. Currently in Khost province the broiler farms have the ability to raise day old chicks in their farms. According to agriculture directorate survey there are 120 total registered broiler farms in Khost province and their annually production is 1,673,640 chickens.

This study carried out to determine the effect of feeding with various protein and energy supplement on the performance and carcass values of broiler chicken. The relationship between protein and energy requirements has been discussed by many researchers around the world. It is clear that protein requirements have little meaning unless energy requirements have been considered [11]. Several workers have chosen to express these nutrient requirements in terms of protein and energy ratios. The physiological and practical implications of the interaction between energy intake and protein metabolism and between protein intake and energy metabolism must then be considered when the dietary requirements for either nutrient are assessed [3, 8]. But there is little information about the effects of a varying dietary energy and protein level on broiler chicken in Afghanistan. The objective of this investigation is to determine the performance of broiler chicken when fed with diets containing different combinations of energy, protein and feed additives.

Broilers require fewer nutrients as they grow older due to changes in growth and maintenance requirements [14]. In addition, poultry consume more feed as they grow heavier. Thus to balance and meet their nutrient requirements, the composition of diet has to change accordingly [2]. As such, it is common practice in the poultry industry to reduce dietary protein (amino acid) content and increase energy whilst keeping other nutrients constant throughout the feeding programme as the broiler gets older [1].

The feeding of industrial broiler chickens is often criticized because of the extensive use of feed sources which are neither socially nor ecologically sustainable [1–4]. The diet of intensively-raised broilers consists mainly of maize, soy and wheat [5–7], ingredients that could also be used directly in the human diet [8,9,10]. Proposed alternative ingredients, less sought after in the human diet that could be used in the chickens' diet. Solving the problems for both the industrial and the rural chickens is especially interesting since chickens are a widespread food source around the globe. The United Nation's Food and Agriculture Organization (FAO) estimated that there were nearly 22 billion living chickens in 2012 [15]. This is the equivalent of more than three chickens per person. Moreover, in developing countries, chickens are often the main source of animal protein through their meat and eggs and most of these chickens stem from indigenous, slow growing, breeds [16,17].Current theory holds that setting energy levels in feed formulation is not necessary because birds eat to maintain a constant energy intake [5]. A large

body of data suggests that although birds fed high energy diets eat less than those fed low energy diets, they also grow better. Current linear programming models do not consider differences in response from different energy or protein levels [4]. Iterative linear programming techniques can be used to choose among alternative diets with various protein and energy levels. A quadratic programming model can choose the levels of protein and energy that maximize profits [13]. Diets for poultry generally consist of a cereal grain (most commonly corn, but also wheat, barley, sorghum, and others) and a protein source (most commonly soybean meal, but there are also several animal and plant protein sources) [15]. Animals that receive only these rudimentary ingredients will not thrive. Feeds include trace vitamin and mineral supplements and, sometimes, macro minerals, such as calcium, that improve their nutritionsness [16]. The nutritional quality of a feed also depends on as a variety of other factors, including feed presentation, microbial contamination, and content of ant nutritional factors, digestibility, palatability, and intestinal healthfulness [12]. A variety of feed additives are available to deal with these issues [6]. Feed additives are gaining importance due to various functions such as growth promotion, controlling infectious diseases and enhancement of feed digestibility in poultry [8]. In our experiments the mixture of additive (Antibiotics, Vitamins, Antioxidants, feed enzymes, probiotics and Acidifiers) were used respectively. The objective of this investigation is to determine the optimum protein and energy levels for broiler chickens growth performance in Khost province, and to improve the quality and balance of imported broiler feed by supplementing local available feed in the market.

II. Materials & Methods

2.1 Animal Husbandry and experimental design

A total of two hundred (n=200) Day-old male broiler chicken of commercial strain randomly selected for three different experiments and feeding with experimental rations. The deep litter housing system was offered to the chicks, where one square feet space was provided to each chick. The poultry house was entirely cleaned, washed with fresh water and disinfectant. Before housing the chick's entire shed was coated with limestone and left to dry over 24 hours. The recommended temperature and humidity was maintained throughout the experimental period and recorded. The chicks were weighed on receipt, and then equally assigned to four dietary treatments, each diet replicated 6 times with 20 birds per replication in a completely randomized block design (CRD). Birds were vaccinated for prevention of infection diseases (table 4). The brooding temperature was kept at 33-35°C during first week and then gradually decreased by 2°C each week. Twenty-four hours light was provided by electric tube lights in the rearing house throughout the experimental period. Each pen was equipped with three separate feeders and drinkers. Feed was provided ad libitum to the broiler, given twice daily and refusal of feed was collected from feeders of each group and weighed and finally consumed feed was noted daily. The birds rearing period was 6 weeks, the live body weight performance and health condition were measured by weekly.

2.2 Protein, energy and feed additives supplements

Experiment 1: This experiment was conducted to determine the effect of three different protein supplements individually; control (T1) including three different protein supplements alfalfa, soybean meal, oil cake (T2) (table 1). Eighty (80) of day-old male broiler chickens of a commercial strain were selected in four groups. Experiment 2: this experiment was conducted to determine the effect of three different energy supplements individually; control (T1) including three different protein supplements alfalfa, soybean meal, oil cake (T3) (table 1). Eighty (80) of day-old male broiler chickens of a commercial strain were selected in four groups. In the third experiment was determine the effect of feed additives on broiler chicken growth; control (T1) including feed additives (T4) (table 1). Fourty (40) of day-old male broiler chickens of a commercial strain was selected in two groups.

3.2Statistical analyses

All collected data were statistically analyzed using JMP software (ver.5.1.2 SAS institute, Tokyo, Japan). The data were analyzed using one-way ANOVA with diet as factor. The significance of differences between means was determined by student t-test, significant difference<.05.

Table.1. Ingredients composition of experimental diets

Ingredient composition %	Treatments			
	T1	T2	T3	T4
Alfalfa	0.0	30.0	0.0	0.0
Soya Bean Meal	0.0	30.0	0.0	0.0
Oil cake	0.0	30.0	0.0	0.0
Corn	0.0	0.0	30.0	0.0
Barley	0.0	0.0	30.0	0.0
Wheat	0.0	0.0	30.0	0.0
Feed Additives	0.0	0.0	0.0	5.0
Corn	55.0	45.0	45.0	50.0
Soya Bean Meal	15.0	5.0	5.0	15.0
Canola Meal	10.0	5.0	5.0	10.0

Rice Polish	10.0	5.0	5.0	10.0
Corn Gluten Meal	3.0	3.0	3.0	3.0
Vegetable Oil	1.0	1.0	1.0	1.0
Lime Stone	1.0	1.0	1.0	1.0
Di calcium Phosphate	0.6	0.6	0.6	0.6
Salt	0.2	0.2	0.2	0.2
Sodium Bicarbonate	0.2	0.2	0.2	0.2
Premixes	4.0	4.0	4.0	4.0

T1; diet refer to control or basal diet, T2; three kind of protein supplements each of them used one time 30 % treatment, T3; three kind of energy supplements each of them used one time 30 %, T4; feed additives

Table.2. Composition of Mixed Feed Additive

Items	Action	Quantity %
Oxy tetracycline & penicillin	Antimicrobials	10
Vitamins	Co enzymes	10
Electrolytes	Growth promoter	25
Trace elements	Growth promoter	25
Organic acids	Acidifiers	25
Feed enzymes	Biological catalysts	5

Table. 3. Time table of Vaccination

No	Vaccine	Age	Doss
1	IB+ND	6	
2	IBD-A	12	
3	IBD-B	18	
4	ND+IB	26	
5	ND Lasota	30-32	According to label

III. Results and discussion

Experiment 1: In the proteins supplemented group; the feed consumption of broiler rapidly increased with development of their age and different between weeks for feed consumption were significant (table 4). In the first two weeks consumption of control feed was higher than the protein supplement, however in weeks 4 an5 alfalfa groups increased their feed consumption significantly. Soybean and oil cake supplemented feed consumption were lower in the all periods of feeding (table 4). After measuring live body **weight**; in first week there was no significant different between control and protein treatments, but in the second week protein supplements had negative effect on live body weight of broiler chicken, where control was significantly higher. Although in week four the body weight was significantly increased with control and alfalfa, however in week five alfalfa alone significantly increased live body weight of broiler chickens (figure 1). Soybean meal and oil cake had negative effect, where the body weight was decreased from week 1-5 incessantly (figure 1).

Growth performance in broiler chickens has been regarded as the primary criterion for determining the feed nutrient requirements because the broiler chick is an ideal research tool with a limited nutrient store, high nutrient demand and rapid growth rate (Ammerman, 1995). In this study, overall growth responses of the broilers were influenced adversely by feeding supplemented (T2, T3, T4) diet. The reduced performance of broilers on supplemented diet could be due to poor feed intake of the birds as observed in our study. The poor feed intake of broilers on (Soybean and oil cake) supplemented diet could also be caused by poor weight gain of the birds and the consequent lower nutritional requirement (Hossain et al., 2016). Though palatability test of the diet was not done, but it can be assumed that the less palatability and poor nutrient (AAs) digestibility of the diet could be reasons which might influence the feed intake and growth performance of the birds (Jackson et al., 1982; Mahmoudnia et al., 2011). It is reported that the AAs imbalances in diets decreased the biological value and feed intake of the diets (Jackson et al., 1982). Besides, other factors such as organoleptic traits (e.gcolour, smell, odour, flavor, taste and texture) of diet might also affect the feed ingestion and feed regulation of broiler chickens (Cruze et al., 2005). In the last three weeks alfalfa consumption was increased and simultaneously the broiler body weight were increased, this result suggest that in the early stage of growth the chickens difficulty to ingestion in alfalfa feed, however with increasing of age can easy ingest alfalfa. It is obvious from the current study that broilers fed protein supplemented diet (Soybean and Oil cake) grew poorly, most probably as a result of reduced feed consumption.

Table. 4. Feed consumption (g/b) of broiler as influenced by various protein supplements

Weeks	Control	Alfalfa	Soybean	Oil Cake
1	160 ± 7 a	152 ± 5 b	151 ± 3 b	152 ± 8 b
2	305 ± 11 a	298 ± 9 ab	288 ± 7 b	280 ± 5 b
4	942 ± 11 ab	965 ± 9 a	886 ± 16 b	846 ± 12 b
5	1345 ± 27 b	1435 ± 23 a	1274 ± 34 c	1266 ± 22 c
Total	2752 b	2850 a	2599 c	2544 c

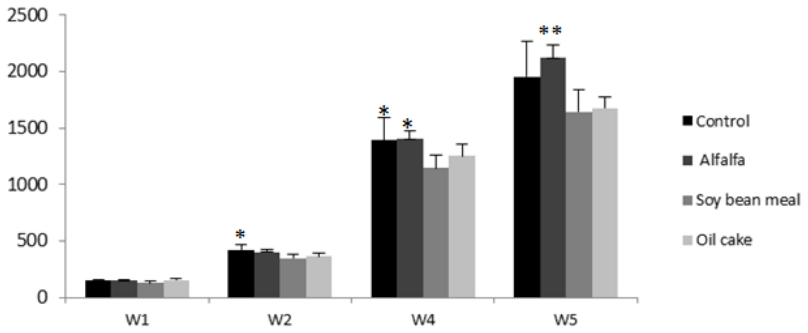
Table 5 Feed consumption (g/b) of broiler as influenced by various energy and feed additives supplements

Weeks	Control	Corn	Barley	Wheat	Feed additives
1	161 ± 6 b	182± 4 a	172 ± 3 ab	168 ± 5 b	162 ± 5 b
2	337 ± 11 b	352 ± 7 a	305 ± 5 bc	314 ± 11 bc	338 ± 7 b
4	957 ± 17 a	913 ± 13 b	948 ± 12 a	904 ± 23 b	949 ± 8 a
5	1337 ± 23 b	1245 ± 23 c	1435 ± 16 a	1236 ± 21 c	1355 ± 11 b
Total	2792 a	2692 ab	2860 a	2622 ab	2803 a

a,b,c: Showed that was significantly differ between diets

Experiment 2: In the energy supplemented group; the feed consumption of broiler rapidly increased with development of their age and different between weeks for feed consumption was significant (table 5). In the first two weeks consumption of corn supplemented feed was higher than control and other supplements, however in weeks 4 and 5 barley supplementation increased their feed consumption significantly. Wheat supplemented feed consumption were lower in the all periods of feeding (table 5). In first week of feeding the energy supplements (corn, barley and wheat) had effect on broilers growth, where the live body weight was increased significantly. In week 2 only corn had significantly effect on growth performance of broiler chicken, where barley and wheat had negative effect on growth. In week 4; the body weight was higher with control, in contrast the energy supplements had no effect on growth performance. However in week 5; barley had significant effect of broiler chicken growth performances (figure 2).

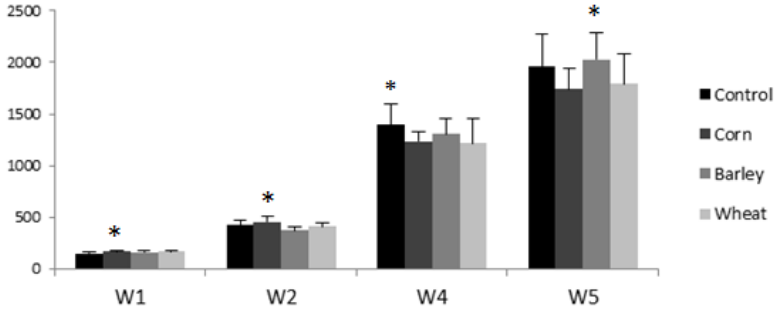
Fig.1. Effects of protein supplements (live body weight-gr/week)



* P< 0.05, **P<001 subscribe different significantly between diets in each week (w).

Supplementation of corn improved feed intake and body weight of broilers in the first two weeks. The response to the corn in starter is in agreement with the results of Cafe et al. (2002), who found a significant improvement in body weight of male broilers at different ages with a nutritionally adequate broiler diet based on maize, and Shakouri et al. (2008) reported a similar positive effect of supplemental corn on the performance of broiler chickens fed on a wheat-based diet. Also result shows that wheat and barley supplementation didn't effect positively on growth performance. Several studies proved that the wheat its water soluble and viscous NSP (non-starch polysaccharides) which caused poor performance compared with non-viscous cereals as corn.

Fig.2. Effects of energy supplements (live body weight-gr/week)

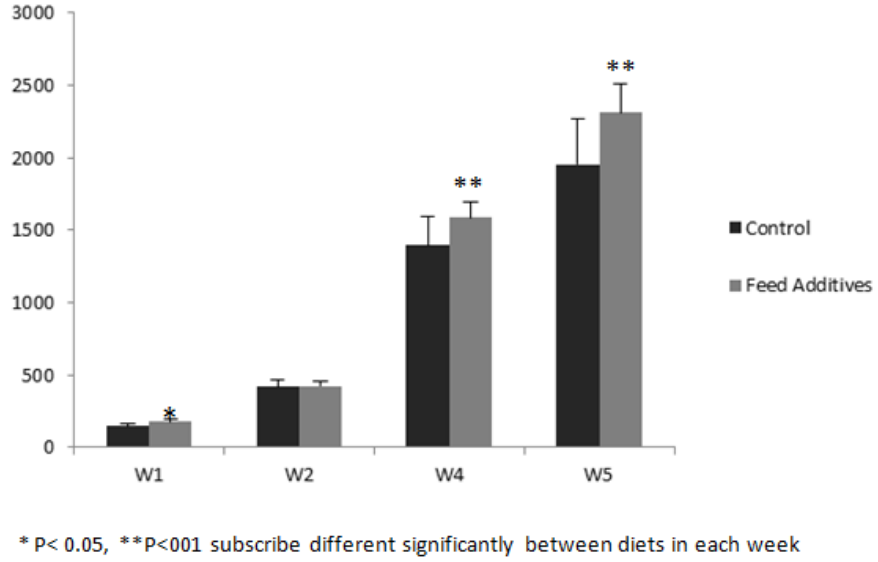


* P< 0.05, subscribe different significantly between diets in each week (w).

Experiment 3: Consumption of feed additive supplemented feed was similar to control diet (table5). According to feed additives feeding, the live body weight of broiler chicken was significantly increased during weeks 1, 4 and 5. Only in week, 2 there was no significantly effect of feed additive supplementation (figure 3). As evident maximum weight gain was obtained in response to treatment of feed additives. Similar observations were made by Grafin (1982) who observed maximum weight gain in response to the addition of penicillin, Zinc Bacitracin, oxy tetracycline, vitamins and Electrolytes. In their study the body weight gain was more than the control when feed additives were used in the ration but the superiority of individual feed additive varied with feeding period.

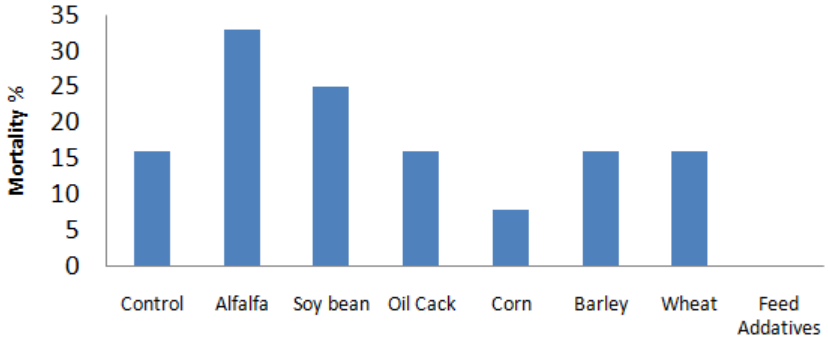
The mortality rate was higher with alfalfa feeding following by soybean meal; the mortality rate was 15 % with control feed, barley and wheat, however the mortality rate was lower by corn feeding and become zero with feed additives supplementation (figure 4). The mortality rate was higher in the first two weeks with alfalfa, because chicken had difficulty with swallowing of the dried particles of alfalfa, also probably should have fungi contamination as well.

Fig.3. Effects of Feed additives (live body weight-gr/week)



* P< 0.05, **P<001 subscribe different significantly between diets in each week

Fig.4. Mortality Rate (each flock)



IV. Conclusion

In the first and second weeks the body weight of broiler chicken was significantly increased by starch rich supplements corn, however the body weight in week 4 and 5 was significantly increased by protein supplements particularly alfalfa. Also feed additives had significantly effect on growth performance where mortality rate was zero. From this conclusion we suggest to the farm owners to use corn as a supplement in the first two weeks and alfalfa in the following weeks along with feed additives. By supplementing these materials we will improve live body weight and decrease the mortality rate of broiler chickens in Khost province.

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