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Effect of Feed Form and Duration Time in Growing Period on Broilers Performance

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Abstract: In a completely randomized design, (with 6 treatments and 3 replications) the effect of feeding mash, pellet and crumble diets and duration time on performance of broilers was studied. 936 Ross broilers randomly allocated to one of following treatments: T1) mash diet in total growing period (TGP) (control diet), T2) pellet diet in TGP, T3) pellet diet in starter and mash diet in other growing period (OGP), T4) mash diet in starter and pellet diet in OGP, T5) crumble diet in first ten days and mash diet in OGP, T6) mash diet in first ten days and pellet diet in OGP. All of chickens were fed with iso energetic and iso nitrogenous diets, for six weeks. In total period (1 to 42 days) feed intake was minimize for T2. Treatments had not different significant effects on weight gain and feed conversion ratio (FCR), but Duncan test were showed a significant difference between T3 and T6 (1859g vs. 2090g and 1.99 vs. 1.73 respectively). The lowest FCR and the highest weight gain were belonged to T6. Carcass, abdominal fat and heart weight percentages to live weight did not significantly differ.

Key words: Pellet, mash, broilers performance, feed

INTRODUCTION

It is well recognized that feed represents the most significant cost of broiler production. Most production costs estimates range from 60-70% as being feed cost. Certainly, the major portion of feed costs is for the ingredients used. However, the cost of feed processing represents a significant portion of feed costs and likely gives the greatest opportunity for influencing broiler performance beyond nutritional adequacy. "Feed processing" and the costs associated with processing include a wide range of unit operations including receiving, grinding, proportioning, mixing, pelleting, load out and delivery. The physical form of feed (mash, pellet and crumble) is a crucial factor in meat yield of broiler. Mash is a form of a complete feed that is finely ground and mixed so that birds cannot easily separate out ingredients; each mouthful provides a well balanced diet. Mash diet gives greater unification of growth, less death loss and more economical. However, ground feed is not so palatable and does not retain their nutritive value so well as ungrounded feed (Jahan *et al*., 2006). Pellet system of feeding is really a modification of the mash system. It consists of mechanically pressing the mash in to hard dry pellets or "artificial grains". It is generally accepted that, compared to mash, the feeding of pellets improves broiler growth rate with an increased feed intake (Calet, 1965; Choi *et al*., 1986; Nir *et al*., 1994a; Nir *et al*., 1994b). Reasons for the enhanced performance may be due to increased digestibility, decreased ingredient segregation, reduction of energy during prehension and increased palatability (Behnke, 1998). Pelleting of feed also provides the benefits of: Increasing the bulk density of feed, improving feed flow ability and providing opportunities to reduce feed formula costs through the use of alter native feed ingredients (Fairfield, 2003). But feeding pelleted rations is not enough to ensure enhanced performance of poultry. The quality of pellets must be taken into account also (Briggs *et al*., 1999). Pellet quality is dependent upon several factors, such as: feed formulation; feed particle size; mash moisture content; condition in; die specifications; and cooling (Fairfield, 2003). Pellet quality refers to durability, the physical integrity of the finished feed pellet in handling and transport with minimum generation of fines and broken pellets. It is generally recognized that good pellet quality improves the feeding efficiency, growth and uniformity of broilers (Keith and Behnke, 2001).

Although improved broiler performance is an advantage for pellet feeding, some disadvantages seem to be connected to this feeding method. With respect to animal health, a correlation between pellet feeding and the occurrence of certain metabolic diseases has been observed. The increased growth rate resulting from pellet feeding may increase mortality due to ascites and tibial dyschondroplasia especially in male birds (Havenstein *et al*., 1994; Nir *et al*., 1995). Crumble also is a type of feed prepared at the mill by pelleting of the mixed ingredients and then crushing the pellet to a consistency coarser than mash. Recently this form of feed is becoming popular in broiler production due to its convenience of feeding. Choi *et al*. (1986) reported that chicks fed the crumbled starter diet consumed more feed.

Table 1: Ingredient composition and nutrient content of experiment diet (as fed basis)

Ingredients (g/kg)	Starter	Grower	Finisher
Yellow corn	505.0	430.0	480.0
Soybean meal	369.0	235.3	255.3
Wheat	0	160	160
Dicalcium phosphate	14.0	13.3	12.0
Oyster	10	10.5	8.0
DL- methionine	1.8	1.5	1.2
Lysine	0.7	0.7	0.5
Oil	5	10	20
Vitamin Premix [1]	3	3	3
Mineral Premix [2]	3	3	3
Lucerne meal	15	10	10
Choline chloride	1	1	1
Salt	1	1	0
Bicarbonat sodium	1	0	0
Anzymit	20	20	20
$Cuso_4$	0.5	0.7	1.0
Canola meal	0	50	0
Fish meal	50	50	25
Total	1000	1000	1000
Calculated composition			
Crude Protein (%)	22.5	19.5	18
ME (kcal/kg)	2850	2910	3020
Calcium (%)	1	1	0.87
Av. Phosphorus (%)	0.47	0.44	0.40
L-Lysine (%)	1.49	1.30	1.12
Methionine (%)	0.60	0.53	0.44

[1]Supplied per kilogram of diet: vitamin A - 8000 IU; vitamin D_3 - 1200 IU; vitamin E - 10 IU; vitamin K_3 - 2 mg; thiamine - 2 mg; riboflavin - 5 mg; 0.2 mg; vitamin B_{12} - 0.03 mg; pantothenic acid - 10 mg; niacin - 50 mg; biotin - 0.1 mg; folic acid - 0.5 mg. [2]Supplied per kilogram of diet: Iron - 80 mg; zinc - 40 mg; manganese - 60 mg; iodine - 0.8 mg; copper - 8 mg; selenium - 0.2 mg; cobalt - 0.4 mg

Generally, costs of pellet and crumble are slightly more than the same ration in mash form, that it should be observed in better broiler performance. Therefore, this experiment was conducted to study the effect of different feed form (mash, pellet and crumble) and duration time in growing period upon the broilers performance. In order to using the best form of diet and duration time in nutrition of broiler was determined.

MATERIALS AND METHODS

A total of 936 commercial broilers (Ross 308) were used in a completely randomized design with 6 treatments and 3 replications. One-day-old broilers (average initial BW of 45 g) were allocated to dietary treatments. There were 52 birds per pen and 3 pens per treatment. Initial room temperature was 32°C and was then gradually decreased according to usual brooding practices. All diets were corn-soybean based. Feed and water were given ad libitum. Treatments were T1) mash diet in total growing period (TGP) (control diet), T2) pellet diet in TGP, T3) pellet diet in starter and mash diet in other growing period (OGP), T4) mash diet in starter and pellet diet in OGP, T5) crumble diet in first ten days and mash diet in OGP, T6) mash diet in first ten days and pellet diet in OGP. The birds were fed a commercial diet formulated according to the NRC (1994) recommendations to meet the nutrient requirements of broilers during days 1 to 21 (starter, 22.5% CP and 2850 kcal ME/kg), days 22 to 35 (grower, 19.5% CP and 2910 kcal ME/kg) and days 36 to 42 (finisher, 18% CP and 3020 kcal ME/kg) of the experimental period (Table 1).

The birds were pen-weighed at 0, 7, 14, 21, 28, 35 and 42 days and feed consumption was determined for each of these periods. Six birds per treatment, two birds per pen, were selected at 41 days, weighed, fasted overnight, and then killed and processed at 42 days of age to determine carcass yield and weight of internal organs. Eviscerated carcass, abdominal fat pad, pancreas, breast muscle, thigh, total heart and right ventricle of each bird were weighed. All birds that died during the trial were weighed. Feed conversion ratio was corrected for mortality by including the weight of the dead birds in the body weight gain. The data were analyzed using the GLM procedures by SAS soft ware (1997). Separations of individual treatment mean differences were determined by Duncan's multiple-range test.

RESULTS AND DISCUSSION

Different growth performance parameters include weight gain, feed intake, FCR and mortality rate of broiler chicks fed on mash, pellet and crumble were presented in Table 2. There were significant difference between treatments on weight gain ($P<0.05$) from 1 to 21 days. T6 had the highest weight gain (541g) and the best FCR (1.54). Feed intake and FCR, from 22 to 35 days between treatments showed significant difference ($P<0.01$). T2 had the best FCR (1.47) in this period.

Feed intake ($P<0.01$) and FCR ($P<0.05$) differ between treatments from 36 to 42 days of age. T2 and T6 had the best FCR (2.05 and 2.1 respectively) and the lowest feed intake (1232g). Although weight gain and FCR between treatments had not statistical significant difference in total growth period (1 to 42 days), but T6 showed the best FCR (1.73) and the highest weight gain (2090 g) by Duncan test. T2 had differed ($P<0.01$) lower feed intake (3361g) than the other treatments.

In accordance with other results authors (Calet, 1965; Choi *et al*., 1986; Nir *et al*., 1994 a,b, 1995) the feeding of pellets, compared to mash improved broiler growth rate, which was associated with an increased feed intake and improved feed conversion efficiency. Van Biljon (2005) reported that chickens on the crumble-pellet dietary regimen were significantly heavier at 42 d when compared with birds fed either all-mash, or fed the ground crumble - pellet regimen. Jahan *et al*. (2006) reported that the highest body weight gain was observed in the crumble group throughout the experiment period but these data were statistically similar with pellet group from 5th to 8th weeks of age. Allerd *et al*. (1996)

Table 2: Growth performances and feed intake of broiler chicks fed on mash, pellet and crumble in different duration time in growing period[1]

		Treatments[2]						
Periods	Items	T1	T2	T3	T4	T5	T6	Significance[3]
Days 1 to 21	Weight gain, g	485^{ab}	374^{c}	459^{b}	480^{ab}	474^{ab}	541^{a}	**
(Starter)	Feed intake, g	800	761	743	838	785	838	NS
	FCR	1.62^{b}	2.06^{a}	1.78^{ab}	1.77^{ab}	1.68^{b}	1.54^{b}	*
Days 22 to 35	Weight gain, g	902	933	922	1014	934	919	NS
(grower)	Feed intake, g	1851^{a}	1369^{d}	1658^{bc}	1776^{ab}	1765^{abc}	1645^{c}	**
	FCR	2.08^{a}	1.47^{b}	1.83^{a}	1.78^{a}	1.91^{a}	1.82^{a}	**
Days 36 to 42	Weight gain, g	613	608	479	531	525	630	NS
(Finisher)	Feed intake, g	1389^{ab}	1232^{c}	1382^{ab}	1355^{ab}	1429^{a}	1315^{bc}	**
	FCR	2.32^{ab}	2.05^{b}	2.92^{a}	2.55^{ab}	2.80^{a}	2.10^{b}	*
Days 1 to 42	Weight gain, g	1999^{ab}	1916^{ab}	1859^{b}	2026^{ab}	1933^{ab}	2090^{a}	NS
	Feed intake, g	4040^{a}	3361^{d}	3782^{c}	3969^{ab}	3980^{ab}	3799^{bc}	**
	FCR	1.89^{ab}	1.86^{ab}	1.99^{a}	1.91^{ab}	1.94^{ab}	1.73^{b}	NS
	Mortality, %	3.18^{b}	9.90^{ab}	12.52^{a}	7.00^{ab}	6.27^{ab}	7.92^{ab}	NS

[1]A total of 936 chicks (52 chicks per pen and 3 pens per treatment) with initial BW of 45 g. [2]T1 mash diet in total growing period (TGP) (control diet), T2) pellet diet in TGP, T3) pellet diet in starter and mash diet in other growing period (OGP), T4) mash diet in starter and pellet diet in OGP, T5) crumble diet in first ten days and mash diet in OGP, T6) mash diet in first ten days and pellet diet in OGP. [3]NS= not significant; * P<0.05; ** P<0.01. [a-d]Means within rows with different superscripts differ at P<0.05.

Table 3: Effect of feed form and different duration time in growing period on carcass characteristic of broiler chicks at 42 days of age Carcass/organ weight (% of live bird weight)

Treatments	Eviscerated carcass[1]	Breast	Thigh	Abdominal fat	Heart	Pancreas	RV/TV
T1	66.1^{b}	22.8^{ab}	18.6	1.68	0.50	0.29^{a}	0.53
T2	64.3^{b}	20.8^{b}	19.5	1.87	0.54	0.26^{a}	0.54
T3	65.8^{ab}	22.5^{ab}	19.3	1.98	0.51	0.25^{a}	0.47
T4	65.8^{ab}	23.7^{a}	18.9	1.98	0.49	0.20^{b}	0.53
T5	64.2^{b}	21.3^{ab}	18.9	1.98	0.56	0.24^{ab}	0.50
T6	66.1^{a}	23.1^{ab}	19.4	1.95	0.55	0.19^{b}	0.46
Significance[2]	NS	NS	NS	NS	NS	**	NS

[1]Eviscerated carcass = carcass with feathers, head, neck, feet and viscera removed. [2]NS= not significant; * P<0.05; ** P<0.01.
[a, b]Means within columns with different superscripts differ at P<0.05.

also reported that chicks grew faster when fed pellets or crumbles than when the same diets fed as mash.

Bolukbasi *et al.* (2005) determined that feed type (pellet and mash) has no effect on body weight, weight gain, feed consumption and FCR, that is in agreement with result of present study. In this experiment, haven't significant difference on weight gain and FCR (from 1 to 42 days) between T1 (control) and other treatments can be related to unsuitable quality of consumed pellet.

Also Proud Foot and Seefton (1978) reported no difference between birds fed mash and the diet made up from 100% reground pellets and observed that all pellet treatments resulted in superior body weight and feed conversion compared to the mash control. Further, they reported that as the level of fines increased in the diets, performance decreased, however differences were not significant.

In the present study, significant difference between treatments on mortality rate was not observed, but Duncan test showed the lowest mortality rate (3.18%) for T1. This finding is consistent with previous research (Engberg *et al.*, 2002; Bolukbasi *et al.*, 2005; Bennett *et al.*, 2002), that demonstrated birds in the mash feed groups had a significantly lower mortality rate than birds in the pellet feed groups (P<0.05). Because mortality rate increases with faster growth rate following pellet feeding, which is often due to a higher frequency of ascites and leg disorders (Havenstein *et al.*, 1994; Nir *et al.*, 1995).

The results of carcass characteristic of broiler chicks at 42 d of age are given in Table 3. The ratio of right ventricle to the total ventricle (RV/TV), eviscerated carcass yield and the percentage weight of other organs were unaffected by feeding mash, pellet and crumble diet in the different duration time in growing period, except for pancreas (P<0.01).

In the experiment of Shafiee *et al.* (2006) and Bolukbasi *et al.* (2005), the RV/TV ratio was not affected by form of diet, that this results was agreement with present study. In this experiment, the percentage weight of pancreas was decreased by using pellet form compared to mash form diets (P<0.01), which is in agreement with Keith and Behnke, (2001) and Engberg *et al.* (2002), that reported pellet-fed birds had significantly lower relative pancreas weights and lower activities of pancreatic digestive enzymes (amylase, lipase, chymotrypsin),

which indicates the existence of a feedback mechanism, which may have been triggered by the intestinal concentration of enzymatically hydrolyzed products or of the respective digestive enzymes.

Conclusions: The results from this study demonstrate that although weight gain and FCR between treatments had not statistical significant difference in total growth period, but the usage of mash diet in first ten days and pellet diet in OGP (T6) could be haven the best FCR (1.73) and the highest weight gain (2090g).

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