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Effect of fasting or post-hatch diet's type on performance of broiler chicks

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Abstract. An experiment was carried out to evaluate the effects of fasting and early diet composition on broiler chicken's development. A totally of 540 one-day old male broiler chicken were used in this study. The treatments included control (C), fasted for 24 h (24F), fasted for 48 h (48F), feeding a diet containing 15% egg powder for 24 h (24E) or 48 h (48E), feeding a diet containing 20% glucose syrup for 24 h (24G) or 48 h (48G), and feeding a diet containing 15% egg powder and 20% glucose syrup for 24 h (24EG) or 48 h (48EG). At 7 to 21 days of age, the chicks who were fed with 48EG diet, had higher ($P<0.05$) weight gain than both the control and the other experimental groups. In entire experimental period (1-42days), feeding E48 or EG48 resulted in higher weight gain than control group. Feed intake was not different for the experimental groups at 7 to 21 days of age. At 21 to 42 days of age, feeding E24 did result to higher feed intake than control. Over the entire experimental period, the chicks fed both egg powder and glucose syrup had significantly higher ($P<0.05$) feed intake than control. No significant differences in feed conversion ratios occurred among the treatment diet groups. The percentage of dressing weight was significantly ($P<0.01$) increased by feeding GE diet for 48 h or E diet for 24h at day 21 and by feeding E diet for 48h at day 42. Chicks not having access to feed for 24h and 48h had significantly lower blood sugar and for 24h a higher percentage of heterophil, HDL concentration increased markedly for 48h and LDL concentration increased for 24 h and 48h. In conclusion, the present study showed that the diet composition affects chick development post-hatch and feeding a semi-moist diet with high protein and suitable energy levels containing egg powder and glucose syrup for 48 hours post-hatch is beneficial for post-hatch growth and considerable performance benefits than control.

Keywords: Fasting, early diet, broiler, performance, glucose syrup, feed

1. Introduction

In commercial operation, chicks hatch over a 48 hours period and are removed from the incubator only when the maximum number of the birds have completely cleared the shell [1], and in some cases the chicks have to be sexed, vaccinated and etc. which may extend the off-feed time. Indeed, in some cases it normally take 24-48 hours to deliver the chicks to grow out facility and offer the first feed and water to newly hatched chicks. Body weight of poultry decreased linearly after hatch in the hatching trays between 0.14 and 0.17 g/h [16], and delaying placement increases this body weight reduction [13]. Early access to feed and/or protein results in more rapid gastro-intestinal and muscular development in the immediate post hatch period [10], investment in the chick's immune system [2] and faster utilization of yolk suck [12]. Therefore, it is extremely important for the chicks to consume nutrients as close to hatch as possible. Diet composition may

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interact with yolk suck utilization and different sources of energy and protein have variable impact on poultry, showing a need for more digestible nutrients [4]. The post-hatch chicks have different physiological conditions in comparison with older chicks and this may affect nutrient sources and nutritional requirements in first days of age. Suitable feed composition and optimal feed formulations for specifically the first days post-hatch of broiler chickens are less known Thus, this study was carried out to evaluate the effect of feed type and fasting over the first 48 hours immediately following hatch on performance and carcass characteristic of broiler chickens.

2. Material and methods

A total of 540 as hatched Ross 308 male broiler chicks were taken immediately after hatch from a commercial hatchery, and were transported to the facility within 30 min. Chicks were divided into experimental groups, so that each groups had approximately similar initial weight and weight distribution. Experimental treatments included feeding a corn- soybean meal based diet as control (C), fasted for 24 h (F24), fasted for 48 h (F48), feeding a diet containing 15% egg powder for 24 h (24E) or 48 h (48E), feeding diet containing 20% glucose syrup for 24 h (24G) or 48 h (48G), and feeding diet containing 15% egg powder and 20% glucose syrup for 24 h (24EG) or 48 h (48EG). All experimental diets (Table 1) were prepared as semi-moist and its moisture content was 30%. After 24 or 48 hours, all chicks were fed a commercial starter (up to 21 d), grower (22-35 d) and finisher (36-42 d) diets. Diets were formulated to meet nutrients concentration recommended for Ross 308 strain.

Performance and carcass traits

Live weight and feed intake were measured for each experimental unit at 7, 21, and 42 d of age and then weight gain and gain: feed were calculated. On days, 21 and 42 of experiment one chick from each replicate was slaughtered for carcass analysis including carcass, liver, bursa, spleen, heart and abdominal fat weights.

Statistical analysis

Data were subjected to analysis of variance procedure using the general linear model procedure of SAS (2001) [15] statically different means were separated using Duncan's Multiple Range Test ($P<0.05$).

Table 1. Composition and calculated nutrient content of experimental diets that fed for 24 or 48 hours post-hatch.

Feed ingredients	Control	Egg powder	Glucose syrup	E. powder + G. syrup
Corn	550.5	526.0	438.0	230.0
Soybean meal	349.5	296.5	267.5	378.0
Fish meal	66.0	0.0	60.0	0.0
Egg powder	0.0	150.0	0.0	150.0
Glucose Syrup	0.0	0.0	200.0	200.0
Mono-calcium phosphate	10.0	11.5	9.0	11.5
CaCo3	9.0	10.5	8.0	10.5
Soybean oil	10.0	0.0	0.0	0.0
NaCl	0.0	0.0	2.5	3.0
Mineral premix[1]	2.5	2.5	2.5	2.5
Vitamin premix[2]	2.5	2.5	2.5	2.5
Calculated nutrients				
Metabolizable energy	2900	2700	3050	2700
Crude protein (g/kg)	230	240	183	250
Met (g/kg)	7.7		6.1	
Lys (g/kg)	14.4		11.5	
Ca (g/kg)	9.4	7.5	8.5	8.0

AP (g/kg)	5.2	3.5	4.5	3.5

1- Mineral premix per kg of diet: Fe ($FeSO_4.7H_2O$, 20.09% Fe), 50 mg; Mn ($MnSO_4.H_2O$, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu ($CuSO_4.5H_2O$), 10 mg; I (KI, 58% I), 1mg; Se ($NaSeO_3$, 45.56% Se) , 0.2 mg.
2- Vitamin premix per kg of diet: vitamin A (retinol), 2.7 mg; vitamin D3 (Cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate), 18 mg; vitamin k3, 2 mg; thiamine 1.8 mg; riboflavin, 6.6 mg; panthothenic acid, 10 mg; pyridoxine, 3 mg; cyanocobalamin, 0.015 mg; niacin, 30 mg; biotin, 0.1 mg; folic acid, 1 mg; choline chloride, 250 mg; Antioxidant 100 mg.

3. Results and discussion

Performance: Delayed access to feed for 24 or 48 hours resulted to lower weight gain in first 7 days of age. However, feeding diets containing egg powder for 24 or 48 hours (24E and 48E), glucose syrup for 24 and 48 hours (24G and 48G) and both egg powder and glucose syrup for 24 hours (24EG) resulted to higher ($P<0.05$) weight gain than control birds in first 7 days of age (Table 2). At 7 to 21 days of age, feeding a diet contains both egg powder and glucose syrup for 48 hours (48EG) resulted to higher ($P<0.05$) weight gain than control and other experimental groups (Table 2). There was no significant difference in weight gain between experimental groups. However, in entire experimental period, feeding diets contains egg powder (E48) or both egg powder and glucose syrup (EG48) for 48 hours resulted in higher weight gain than control group (Table 2).

Lower weight gain in fasted chicks in first week is in agreement with those of [1]. Lower weight gain in fasted groups could be attributed to lower feed intake and poor development of digestive tract. Feed intake is most important in the youngest birds. Most of the energy and nutrients consumed by birds younger than four weeks goes toward growth [18]. This means that if nutrients are restricted early in the bird's life, it reduce the bird performance. When feed consumption starts soon after hatch, the nutrients provided by the feed are complementary to the yolk nutrients [8]. Initiation of feed consumption as close to hatch as possible is necessary to support early muscle development, which may ultimately affect meat yield. Muscle development is seriously compromised when feed is withheld during the first few days after hatch and feeding the semisolid diet containing the egg powder and glucose syrup for 48 hours resulted to higher weight gain in birds. This could be related to higher feed intake in this group (Table 2). This treatment also was higher in protein and lower in energy than control and other treatments (Table 1). [5] Also, found that high protein levels in combination with low energy levels in the diet showed a positive effect on post-hatch growth. Other studies showed as well that body weight gain during the first weeks increased with increasing protein levels [19]. They stated that chicks might have a high protein requirement for the development of specific tissues post hatch. Especially the small intestines grow rapidly in the post-hatch period [17]. In this study, increasing the energy of early diet by feeding glucose syrup in a semi-solid diet did not result to higher post hatch performance which may be due to immaturity of digestive enzyme secretion. This may occur because glucose is absorbed with no additional enzymatic activity, which yields no stimulation of intestinal processes.

Table 2: Effect of fasting or type of post-hatch diet on body weight gain, feed intake and feed conversion ratio of broiler chickens.

	Body weight gain (g/d)				Feed intake (g/d)				Feed conversion ratio (g/g)			
Treatments	1-7d	7-21d	21-42d	1-42d	1-7d	7-21d	21-42d	1-42d	1-7d	7-21d	21-42d	1-42d
Control	10.7^{d}	23.7^{bc}	65.1	40.5^{c}	13.1^{b}	29.4	117.1^{b}	70.5^{b}	1.04^{abc}	1.63^{b}	1.91	1.74
F24*	9.9^{e}	26.7^{b}	67.1	42.5^{abc}	8.9^{c}	33.1	119.0^{b}	72.0^{ab}	0.77^{d}	1.55^{b}	1.85	1.69
EG24	11.4^{c}	25.9^{b}	70.5	43.9^{ab}	14^{b}	33.6	124.7^{ab}	75.9^{ab}	1.04^{abc}	1.71^{ab}	1.88	1.73
E24	11.5^{c}	25.6^{b}	68.7	42.9^{abc}	13.5^{b}	30.8	128.5^{a}	76.8^{ab}	1.00^{bc}	1.57^{b}	1.97	1.79
G24	11.4^{c}	25.8^{b}	69.0	43.1^{abc}	13.9^{b}	29.0	120.1^{ab}	72.3^{ab}	1.04^{abc}	1.45^{b}	1.81	1.68
F48	8.1^{f}	21.7^{c}	68.0	41.2^{bc}	5.6^{d}	37.8	122.0^{ab}	74.5^{ab}	0.60^{e}	2.18^{a}	1.88	1.80
EG48	12.8^{a}	31.7^{a}	68.1	44.6^{a}	17.4^{a}	38.8	123.^{ab}	77.4^{a}	1.18^{a}	1.58^{b}	1.94	1.74
E48	12.0^{b}	26.2^{b}	70.6	44.0^{ab}	13.1^{b}	36.2	121.8^{ab}	75.1^{ab}	0.93^{c}	1.82^{ab}	1.81	1.71
G48	10.6^{d}	23.7^{bc}	67.9	41.9^{abc}	14^{b}	33.1	118.8^{b}	72.8^{ab}	1.13^{ab}	1.76^{ab}	1.84	1.74
SEM	0.22	0.53	0.55	0.34	0.56	1.09	0.94	0.67	0.032	0.061	0.019	0.016

*F24: fasted for 24 h ; EG24; diet containing 15% egg powder and 20% glucose syrup that fed for 24 h ; E24: diet containing 15% egg powder that fed for 24 h; G24: diet containing 20% glucose syrup that for 24 h; F48: fasted for 48 h ; EG48: diet containing 15% egg powder and 20% glucose syrup that fed for 48 h; E48: diet containing 15% egg powder that fed for 48 h; and G48: diet containing 20% glucose syrup that fed for 48 h.
SEM: Standard error of means.

At first week of age, no access to feed for 24 (F24) or 48 (F48) hours resulted in lower (P,0.05) feed intake and feeding a diet containing both egg powder and glucose syrup for 48 hours (EG48) resulted in higher ($P<0.05$) feed intake than control (Table 2). Feed intake had no changed between experimental groups in 7 to 21 days of age. At 21 to 42 days of age, feeding diet contains egg powder for 24 hours (E24) resulted to higher feed intake than control (Table 2). In entire experimental period, feeding both egg powder and glucose syrup resulted to higher ($P<0.05$) feed intake than control (Table 2). Higher feed intake in chicks fed with EG diet could be attributed to lower energy content and better amino acid balance in this diet. Other researchers also found that feed intake was influenced by energy density in the feed [11]. Feed intake in post-hatch chicks might be regulated by environmental temperature as well and chicks do not have a fully developed thermoregulatory system in the post-hatch period [9]. However, in this experiment, birds were kept in a similar brooding system.

At first week of age, feed conversion ratio reduced ($P<0.05$) in chicks that had no access to feed for 24 or 48 hours (Table 2). Feed conversion ratio did not affected by experimental treatments during 7 to 21, 21 to 42 and 1 to 42 days of age. This finding is in agreement with findings of [1] and [14].

The percentage of dressing weight was significantly ($P<0.01$) increased by feeding GE diet for 48 h or E diet for 24 h at day 21 and by feeding E diet for 48 h at day 42.The increase in ultimate meat yield observed after 48 hours feeding of GE and E diets could be associated with more satellite cell proliferation. [6] observed that muscle satellite activity begins as early as 25 days of incubation, peaking shortly after hatch, and decreases significantly by 7 days post-hatch. Poults and chicks that experience delayed access to feed immediately post-hatch exhibit lower satellite cell mitotic activity when compared to their fed counterparts [7].

No significant differences were observed between experimental treatments in bursa, spleen, and heart weights at days 21 and 42, and in abdominal fat weights in day 42. This finding is not in line with those of [3] who showed a reduction in gastro intestinal organs weight in fasted chicks. Feeding G diet for 24 h resulted in higher ($P<0.05$) liver weight than chicks received E diet for 24 h. (Table 3).

Table 3: Effect of fasting or type of post-hatch diet on carcass characteristic of broiler chicks at 21 and 42 days of age.

	At 21 d (% of body weight)				At 42 d (% of body weight)					
Treatments	Carcass	Bursa	Spleen	Heart	Carcass	Bursa	Spleen	Heart	Liver	Fat pad
Control	55.6^{b}	0.29	0.07	0.70^{b}	71.0^{ab}	0.09^{a}	0.11	0.55	2.39^{ab}	1.86
F24*	59.5^{ab}	0.27	0.09	0.90^{ab}	74.9^{ab}	0.08^{ab}	0.12	0.65	2.56^{ab}	1.94
EG24	63.6^{ab}	0.26	0.10	0.80^{ab}	69.5^{b}	0.07^{ab}	0.10	0.53	2.43^{ab}	1.92
E24	65.5^{a}	0.22	0.07	0.86^{ab}	70.5^{ab}	0.08^{ab}	0.11	0.54	2.19^{b}	2.40
G24	61.1^{ab}	0.27	0.11	0.88^{ab}	75.9^{ab}	0.08^{ab}	0.13	0.58	2.99^{a}	2.08
F48	60.3^{ab}	0.30	0.10	0.95^{a}	74.0^{ab}	0.06^{ab}	0.12	0.62	2.42^{ab}	2.25
EG48	67.8^{a}	0.30	0.09	0.82^{ab}	73.8^{ab}	0.06^{ab}	0.13	0.52	2.53^{ab}	2.27
E48	63.1^{ab}	0.26	0.08	0.89^{ab}	80.9^{a}	0.05^{b}	0.13	0.55	2.92^{ab}	2.36
G48	62.4^{ab}	0.35	0.10	0.82^{ab}	69.5^{b}	0.06^{ab}	0.10	0.58	2.39^{ab}	2.19
SEM	1.002	0.015	0.004	0.021	1.12	0.004	0.006	0.013	0.076	0.080

*F24: fasted for 24 h ; EG24; diet containing 15% egg powder and 20% glucose syrup that fed for 24 h ; E24: diet containing 15% egg powder that fed for 24 h; G24: diet containing 20% glucose syrup that for 24 h; F48: fasted for 48 h ;
EG48: diet containing 15% egg powder and 20% glucose syrup that fed for 48 h; E48: diet containing 15% egg powder that fed for 48 h; and G48: diet containing 20% glucose syrup that fed for 48 h.

SEM: Standard error of means.

4. Conclusion

This study indicates that the diet composition affects chick development post-hatch. The results of this study showed that feeding a semi-moist diet with high protein and suitable energy levels containing egg powder and glucose syrup for 48 hours post-hatch is beneficial for post-hatch growth and considerable performance benefits. Under practical conditions, this may be carried out by placing feed in the incubator trays or transportation boxes.

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