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Effects of Glucose Injection and Feeding Oasis on Broiler Chick's Subsequent Performance

[1]M. Shivazad, M. Bejaei, R. Taherkhani, M. Zaghari and [2]M.M. Kiaei
[1]Department of Animal Science, Faculty of Agriculture, University of Tehran, Karaj, Iran
[2]Faculty of Veterinary Science, University of Tehran, Tehran, Iran

Abstract: An experiment was conducted to investigate the effects of glucose injection and feeding Oasis immediately posthatch on the subsequent performance of broilers. Experiment was carried out using a completely randomized design with factorial arrangement (2×2×2×2). Factors were included egg weight (small eggs weighting between 50 to 60 g and medium eggs weighting between 61 to 70 g), glucose injection (Control with no injection and 0.3 mL glucose injection), feeding in transportation boxes during shipping period (chicks fed Oasis and those hold with no access to feed and water) and house arrival feeding (chicks that receive feed immediately at arrival and those hold for an additional 12 h without feed). Treatments were replicated three times with 25 chicks per each. Live weight and feed intake were measured for each experimental unit at 7, 21 and 42 days of age and then weight gain and feed: gain was calculated. On days 3, 21 and 42, two chicks from each replicate were killed for carcass analysis including yolk sac residue weight (third day), duodenum, jejunum and ileum weight and length and also liver and gizzard weight. Results show an improved Weight Gain (WG) and feed efficiency ($p<0.05$) in chicks from medium eggs compared to those from small eggs. A significant interaction ($p<0.05$) between glucose injection and egg weight was observed, so that chicks of small eggs with glucose injection show a significant ($p<0.05$) depression in WG. Chicks with immediate access to Oasis had greater ($p<0.05$) duodenum and jejunum relative weight on day 3 and duodenum on day 42. Oasis fed chicks also had better WG and breast meat yield ($p<0.05$) while feeding Oasis did not influence feed efficiency. Feeding Oasis also increased yolk utilization. Chicks with delayed access to feed in the house compensate their initial decreased WG during the later stages. Glucose injection had no beneficial effect, but immediate access to feed in posthatch chicks improved their performance.

Key words: Glucose injection, oasis, posthatch feeding, egg size

INTRODUCTION

Poultry breeders and geneticists employed the high heritability (~0.4) for body weight and heterosis gained by crossing different parent stocks to improve poultry growth. Improved growth rate of today's broiler will result in early marketing age of approximately 1 day per year. The trend continues and emphasizes the importance of growth during the posthatch period. In normal commercial production practices, chickens often do not have access to feed and water for 48 to 72 h. It is often thought that the residual yolk found in the poult or chick is sufficient to maintain the bird until feed is offered. However, it has been suggested that the initiation of growth may be more dependent on feed consumption than the nutrients found in the yolk post-hatch (Nir and Levanon, 1993) and when feed consumption occurs early post-hatch the nutrients provided by the feed are complementary to the yolk nutrients (Murakami *et al.*, 1992). Therefore, it is extremely important for the poult and chicks to consume nutrients as close to hatch as possible in order to improve muscle development. Results shown that chicks with immediate access to feed utilize their yolk faster than those hold. This response may be due to stimulatory effects of exogenous feed on antiperistaltic movement. Providing poults and chicks with feed, aids in the development of the gastrointestinal tract and can up-regulate brush border enzymes (Uni, 1998). Organ systems also have high levels of growth during the first week post-hatch in poults relative to body weight, indicating a need for nutrients (Lilburn, 1998). Different sources of protein and energy have varying levels of impact on poultry (Lilburn, 1998), showing a need for more digestible nutrients. Noy and Sklan (1999a) found that offering nutrients to poults in solid, semi-solid, or liquid form immediately post-hatch improved body weight and breast meat percentage of body weight at market age. A novel idea about early nutrition is its effect on satellite cells

Corresponding Author: M. Shivazad, Department of Animal Science, Faculty of Agriculture, University of Tehran, Karaj, Iran

mitotic activity, which determines the extent of muscle fibers hypertrophy (increase in size which is the only way for muscle fiber's growth). Chicks and poults with immediate access to feed have higher satellite cells mitotic activity and consequently higher weight gain and breast meat production in comparison to those chick held without feed (Halevy *et al*., 2003, Moore *et al*., 2005). Objectives of this study were to investigate the effects of glucose injection, immediate access to feed (Oasis) and egg size on the subsequent performance of broiler chicks.

MATERIALS AND METHODS

A total of 1200 as hatched Ross 308 broiler chicks were obtained from a commercial hatchery within 1 h of clearing the shell. Chicks were weighted individually and allocated to treatments so that experimental units (n = 48) had equal initial weight and weight distribution. Three replicate of 25 chicks were fed each treatment. Experiment was carried out using a completely randomized design with factorial arrangement (2^4). Factors were included egg weight (small eggs weighting between 50 to 60 g and Medium eggs weighting 61 to 70 g), glucose injection (Control group with no injection and injection of 0.3 mL of 50% glucose in glucose), feeding in transportation boxes during shipping period to the house (chicks fed Oasis and those hold with no access to feed and water) and house arrival feeding (chicks that receive feed immediately at arrival and those held an additional 12 h without feed). Chicks with glucose injection were injected immediately after allocation to experimental groups. Each chick receives 0.3 mL glucose subcutaneously on the back neck. Chicks with access to Oasis (The Oasis hatching supplement is a semi-solid hydrated nutritional supplement that contain 70% water, 10% protein, 20% carbohydrate and less than 1% fat) during the shipping period to house received 2.5 g Oasis per chick. At the arrival time to the house, the remaining Oasis was added to the starter diet in order to ensure that the entire Oasis be consumed by the chickens. A starter diet (Table 1) were available for the chicks with immediate access to feed in the house and chicks with no access to feed in the house hold for a further 12 h. Live weight and feed intake were measured for each experimental unit at 7, 21 and 42 days of age and then weight gain and feed: gain were calculated. On days 3, 21 and 42 two chicks from each replicate were slaughtered for carcass analyses including yolk sac residue weight (third day), duodenum, jejunum and ileum weight and length, liver and gizzard weight. The small intestine of chicks were removed and segments of duodenum (from the pylorus to the distal point of entry of the bile ducts), jejunum (Meckel`s diverticulum marked the end point of the jejunum) and ileum (the ileocecal junction marked the end of the ileum)were taken and then were gently flushed twice with phosphate-buffered saline to remove the intestinal content. Weight and length of each segment was measured. Data are presented as mean±SE. Data were

Table 1: Composition and nutrient content of the diet

Ingredients	Starter (0-10 day of age) (%)	Grower (10-24 day of age) (%)	Finisher (24-42 day of age) (%)
Corn	59.36	63.21	71.38
Soybean meal	34.92	31.89	23.50
Dicalciumphosphate	2.08	1.75	1.61
Oystershell	1.28	1.12	1.15
Sunflower oil	1.00	1.02	1.18
DL-Methionine	0.27	0.15	0.16
L-Lys.HCl	0.27	-	0.07
Vitamin Premix[1]	0.25	0.25	0.25
Mineral Premix[2]	0.25	0.25	0.25
Common salt	0.34	0.36	0.15
$NaHCO_3$	0.03	-	0.31
Nutrients (Calculated)			
AMEn (Kcal kg^{-1})	2850.00	2900.00	3000.00
Crude protein (%)	20.70	19.33	17.45
Ca (%)	1.00	0.87	0.82
Pavailable (%)	0.49	0.43	0.39
Na (%)	0.16	0.16	0.16
Lysine (%)	1.36	1.36	0.87
Methionine	0.54	0.45	0.44
Met+Cys (%)	0.88	0.78	0.72
DCAB (meq kg^{-1})	205.00	208.00	205.00

[1]Supplied per kilogram of diet: Vitamin A, 9,000 IU; Cholecalciferol, 3,000 IU; vitamin E; 18 IU, vitamin K3, 2 mg; vitamin B12, 0.015 mg; thiamin, 1.8 mg; riboflavin, 6.6 mg; folicacid, 1 mg; biotin, 0.10; niacin, 35 mg; pyridoxine, 4 mg; choline chloride, 250 mg; ethoxyquine, 0.125; [2]Supplied per kilogram of diet: manganese sulfate, 100 mg; copper sulfate, 10 mg; selenium (sodium selenate), 0.2 mg; iodine (EEI), 1 mg; zinc sulfate, 100 mg; Fe,50 mg

examined by analysis of variance by the general linear models procedures of SAS software (1996), involving a factorial arrangement of main factor (egg weight, glucose injection, feeding during shipping period to the house and house arrival feeding) in a completely randomized design (Data about interaction does not included in tables). Significant differences between means were separated by the GLM procedure of SAS software (1996).Statistical significance was considered p<0.05.

RESULTS

Chicks from medium size egg had an improved weight gain (Table 2), feed efficiency (Table 3) and breast meat yield (Table 6) compared to chicks hatched from small eggs (p<0.05). They also had significantly (p<0.05) higher duodenum weight on day 3 (Table 4), higher duodenum, jejunum and ileum weight on day 21 (Table 5) and higher duodenum weight on day 42 (Table 6), in comparison to chicks from small eggs. A significant interaction was observed (data not shown) between egg weight and glucose injection so that chicks from small eggs with glucose injection had significantly (p<0.05) lower weight gain, feed intake and feed efficiency than those from same weight category with no injection. Immediate access to feed improved WG (Table 2), breast meat yield and small intestine development (p<0.05). As shown in Table 3, yolk weight was significantly (p<0.05) lower in chicks with

Table 2: Mean daily weight gain in different period

Parameters	1-7 day of age (g/day/bird)	7-21 day of age (g/day/bird)	21-42 day of age (g/day/bird)	1-42 day of age (g/day/bird)
Small egg	5.87±0.97[b]	21.87±2.89[b]	63.60±6.18[b]	37.86±3.18[b]
Medium egg	8.54±0.92[a]	25.58±2.01[a]	76.91±5.40[a]	42.64±1.71[a]
No injection	7.31±1.49	24.06±3.02	65.31±5.65	40.80±2.93
0.3 mL glucose injection	7.10±1.81	23.39±3.68	65.14±5.40	39.70±3.97
Without Oasis	6.82±1.65[b]	23.51±3.18[b]	64.46±5.16	39.79±3.35[b]
2.5 g Oasis/bird	7.59±1.57[a]	24.94±3.61[a]	66.01±5.79	41.70±3.65[a]
Immediate access to feed	7.54±1.75[a]	23.57±3.32	65.45±5.13	40.55±3.38
Hold for 12 h+	6.96±1.52[b]	23.87±3.50	65.05±5.87	39.95±3.69

[a-b]Any two means for a factor with no common superscripts are significantly different (p<0.05)

Table 3: Mean feed: gain in different period

Parameters	1-7 day of age ($kg\ kg^{-1}$)	7-21 day of age ($kg\ kg^{-1}$)	21-42 day of age ($kg\ kg^{-1}$)	1-42 day of age ($kg\ kg^{-1}$)
Small egg	1.42±0.07[a]	1.71±0.05[a]	1.96±0.10	1.90±0.07[a]
Medium egg	1.32±0.08[b]	1.58±0.08[b]	1.90±0.06	1.84±0.05[b]
No injection	1.37±0.08	1.62±0.10	1.92±0.09	1.86±0.06
0.3 mL glucose injection	1.36±0.10	1.67±0.06	1.94±0.05	1.88±0.07
Without Oasis	1.36±0.10	1.63±0.06	1.91±0.09	1.86±0.04
2.5 g Oasis/bird	1.38±0.07	1.67±0.09	1.95±0.14	1.89±0.07
Immediate access to feed	1.39±0.10	1.66±0.10	1.93±0.10	1.87±0.06
Hold for 12 h	1.35±0.08	1.64±0.08	1.93±0.13	1.87±0.07

[a-b]Any two means for a factor with no common superscripts are significantly different (p<0.05)

Table 4: Mean organ weight on third day posthatch analyses

Parameters	Residual yolk weight[1]	Duodenum weight[1]	Jejunum weight[1]	Ileum weight[1]	Liver weight[1]
Small egg	1.06±0.51	2.67±0.39	2.37±0.52	1.74±0.62	4.83±0.69
Medium egg	1.80±0.72	2.35±0.34	2.35±0.53	1.56±0.23	5.05±0.67
No injection	1.78±0.71	2.45±0.45	2.36±0.51	1.72±0.39	4.91±0.75
0.3 mL glucose injection	1.09±0.59	2.57±0.34	2.35±0.54	1.58±0.41	4.98±0.63
Without Oasis	1.78±0.73[a]	2.50±0.38	2.12±0.41	1.64±0.46	4.81±0.66
2.5 g Oasis/bird	1.08±0.55[b]	2.52±0.43	2.60±0.51	1.66±0.44	5.08±0.70
Immediate access to feed	0.88±0.49	2.51±0.37	2.51±0.37	1.66±0.21	4.65±0.49[a]
Hold for 12 h	1.98±0.66	2.51±0.43	2.51±0.43	1.64±0.34	5.24±0.73[b]

[1]As percentage of eviscerated carcass, [a-b]Any two means for a factor with no common superscripts are significantly different (p<0.05)

Table 5: Mean organ weight on 21 day posthatch analyses

Parameters	Pancreas weight[1]	Duodenum weight[1]	Jejunum weight[1]	Ileum weight[1]	Liver weight[1]
Small egg	0.524±0.08	1.29±0.23	2.43±0.44	1.98±0.39	0.84±0.09
Medium egg	0.456±0.07	1.05±0.15	2.10±0.34	1.72±0.23	0.72±0.08
No injection	0.492±0.07	1.16±0.22	2.31±0.41	1.82±0.32	0.77±0.10
0.3 mL glucose injection	0.487±0.10	1.19±0.24	2.21±0.44	1.88±0.36	0.78±0.11
Without Oasis	0.494±0.09	1.15±0.22	2.28±0.41	1.88±0.37	0.78±0.10
2.5 g Oasis/bird	0.486±0.08	1.19±0.24	2.24±0.44	1.82±0.32	0.78±0.10
Immediate access to feed	0.479±0.10	1.20±0.25	2.29±0.47	1.94±0.36	0.79±0.11
Hold for 12 h	0.483±0.07	1.14±0.20	2.23±0.38	1.76±0.31	0.76±0.09

[1]As percentage of eviscerated carcass, [a-b]Any two means for factor with no common superscripts are significantly different (p<0.05)

Table 6: Mean organ weight on 42 day posthatch analyses

Parameters	Breast meat[1]	Duodenum weight[1]	Jejunum weight[1]	Ileum weight[1]	Liver weight[1]
Small egg	0.20±0.01[b]	0.0058±0.0010	0.0125±0.0024	0.0098±0.0022	0.025±0.003[b]
Medium egg	0.24±0.02[a]	0.0063±0.0010	0.0145±0.0021	0.0108±0.0017	0.027±0.004[a]
No injection	0.24±0.01	0.0065±0.0009	0.01454±0.0023	0.0113±0.0020	0.027±0.003
0.3 mL glucose injection	0.24±0.02	0.0064±0.0012	0.01468±0.0023	0.0106±0.0018	0.028±0.004
Without Oasis	0.23±0.02[b]	0.0067±0.0011[a]	0.01468±0.0023	0.0111±0.0019	0.027±0.004
2.5 g Oasis/bird	0.25±0.01[a]	0.0063±0.0010[b]	0.01429±0.0022	0.0108±0.0020	0.028±0.004
Immediate access to feed	0.24±0.02	0.0065±0.0012	0.01477±0.0025	0.0112±0.0020	0.027±0.003
Hold for 12 h	0.24±0.01	0.0065±0.0009	0.01419±0.0020	0.0107±0.0019	0.028±0.004

[1]As percentage of eviscerated carcass, [a-b]Any two means for a factor with no common superscripts are significantly different ($p<0.05$)

immediate access to Oasis. Chicks received starter diet at arrival time had significantly higher ($p<0.05$) WG on 7 days of age (Table 2) compared to those hold for an additional 12 h, but it didn't remain during the later stages.

DISCUSSION

Digestive tract supplies nutrients for all the other organs of body and sooner it achieved to its functional state, sooner growth will initiate. Numerous studies indicated a relationship between small intestine weight and improved weight gain (WG) and feed efficiency (Dibbner, 1999; Geyra *et al*., 2001; Bigot *et al*., 2003; Skaln and Noy, 2000, 2003). In the current study, chicks from medium eggs had significantly ($p<0.05$) higher duodenum weight on day 3, higher duodenum, jejunum and ileum weight on day 21 and higher duodenum weight on day 42, in comparison to chicks of small eggs. Improved performance observed here in chicks hatched from medium eggs may be due to better development of small intestine and consequently increased absorptive area. Moran (1988) reported same results with chicks hatched from medium and small eggs. Moran (1998) concluded that better performance of chicks from medium eggs was probably due to higher available yolk sac and enhanced intestinal development compared to small eggs hatched chicks. Glucose injection solely didn't show any significant effect on none of the parameters measured in our study, but there was a significant interaction (data not shown) between egg weight and glucose injection which chicks from small eggs with glucose injection had significantly ($p<0.05$) lower weight gain, feed intake and feed efficiency than those from same weight category with no injection. Several studies have shown a stimulatory effect of presence of solid or semi-solid feed on GI development (Moran, 1990; Noy and Sklan, 1997, 1998b). Since glucose injection supply only glucose as energy source for animal and don't have any effect on GI development, injection of 0.3 mL glucose didn't create any consistence improvement in this study. Administration of glucose solely didn't show a beneficial effect on the bird's performance in the experiments of Moran (1988, 1990). Chicks from small eggs will clear shell earlier and thus suffer more time without access to feed and water in Hatcher. In other hand they will suffer a more severe stress and either will respond more severely to stressor factors (such as injection). Same to results of other experiment immediate access to feed improved WG (Table 2), breast meat yield and small intestine development. Studies have indicated that chicks and poults receiving nutrient immediately after hatch show enhanced growth (Moran, 1990; Pinchasov and Noy, 1993, Noy and Sklan, 1999b; Batal and Parsons, 2002; Bigot *et al*., 2003). Hatching supplements (e.g., Oasis used in our study) are currently being produced and used during shipping to allow newly hatched chicks access to nutrient prior to placement on feed and water in production facilities. Immediate access to feed will stimulate both small intestine development and enzyme secretion (Skaln and Noy, 2000; Geyra *et al*., 2001; Noy *et al*., 2001) and either Satellite cell mitotic activity which are crucial for muscle fiber growth (Halvey *et al*., 2003; Moore *et al*., 2005). It seems better performance observed in our study in chick with immediate access to Oasis caused by mentioned factors. Comparison of Oasis fed and holds chicks show a significant difference in duodenum and jejunum relative weight on day 3 (Table 4) and duodenum on day 42 (Table 6). Feed efficiency was not influenced by early feeding, as it was not influenced in experiment of (Noy and Sklan, 1999a; Skaln *et al*., 2000). Length of different segment of small intestine didn't show any significant differences. According to Table 3, yolk weight was significantly ($p<0.05$) lower in chicks with immediate access to Oasis. It shows an enhanced utilization of yolk in fed birds. Increased utilization of yolk in the presence of exogenous feed have also reported by Noy and Sklan (1998a), Noy *et al*. (1996) and Chamblee *et al*. (1992). This may be due to increased intestinal mechanical (antiperistaltic) activity. Chicks receive starter diet at arrival to house had significantly higher WG on 7 days of age (Table 2) compared to those hold for an additional 12 h, but it didn't remain during the later stages. Results of this study show no beneficial effect of glucose injection whereas immediate access to feed in posthatch chicks improved performance.

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