Journal of Animal and Veterinary Advances 9 (2): 406-413, 2010
ISSN: 1680-5593

Effect of Fasting or Post-Hatch Diet's Type on Chick Development

[1]S.A. Tabedian, [1]A. Samie, [1]J. Pourreza and [2]Gh. Sadeghi
[1]Department of Animal Science, Isfahan University of Technology, Isfahan, Iran
[2]University of Kurdistan, Sanadaj, Iran

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 were 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 7-21 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 (1-42 days) feeding E48 or EG48 resulted in higher weight gain than control group. Feed intake was not different for the experimental groups at 7-21 days of age. At 21-42 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. At 21 days of age, feeding G diet for 48 h resulted in longer duodenum and ileum than other treatments. In addition, longer ($p<0.05$) jejunum length was found in chicks who received the GE diet in the first 48 h. Feeding E diet for 48 h did increase ileum weight significantly. At day 42, the 24G diet fed chick was found to have the highest duodenum and ileum weight. The results for morphological parameters show that feeding a diet containing egg powder and glucose syrup for 48 h resulted in higher duodenum Crypt Depth (CD) in comparison to chicks fed with diet containing egg powder for 48 h. No access to feed for 48 h decreased duodenum Villous Height (VH) and increased ($p<0.05$) duodenum CD and subsequently decreased VH:CD ratio on day 7. Feeding a diet containing egg powder and glucose syrup for 24 h resulted in longer VH and lower CD and subsequently higher VH:CD ratio in duodenum on day 7. On day 21, none of experimental treatments could affect the morphometric parameters of duodenum and ileum. Feeding EG diet for 48 h resulted in longer ($p<0.05$) ileum VH and higher VH:CD than chicks fasted for 24h on day 7. Chicks with no access to feed showed a comparable reduction in residual yolk suck weight as fed chicks. Feeding egg powder, glucose syrup and egg powder plus glucose syrup had no significant effect of yolk suck utilization by chicks during the first 24 or 48h post-hatch. 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 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 h post-hatch is beneficial for post-hatch growth and considerable performance benefits than control.

Key words: Fasting, early diet, broiler, performance, glucose syrup, feed

INTRODUCTION

In commercial operations, chicks hatch over a 48 h period and are removed from the incubator only when the maximum number of the birds have completely cleared the shell (Noy and Sklan, 1999; Batal and Parsons, 2002). 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 takes 24-48 h to deliver the chicks to grow out facility and offer the first feed and water to newly hatched chicks. Immediately after hatching the nutrient intake of chicks can greatly influence their subsequent performance characteristics. It has been shown that early access to feed and/or protein results in more rapid gastro-intestinal and muscular development in the immediate post hatch period (Noy and Sklan, 2001), investment in the chick's immune system (Brink and Rhee, 2007) and faster utilization of yolk suck (Noy *et al*., 1996).

Body weight of poultry decreased linearly after hatch in the hatching trays between 0.14 and 0.17 g h^{-1}

Corresponding Author: S.A. Tabedian, Department of Animal Science, Isfahan University of Technology, Isfahan, Iran

(Sklan *et al*., 2000) and delaying placement increases this body weight reduction (Pinchasov and Noy, 1993). Therefore, it is extremely important for the chicks to consume nutrients as close to hatch as possible.

Diet composition could interact with yolk suck utilization and different sources of energy and protein have variable impact on poultry (Lilburn, 1998) showing a need for more digestible nutrients. The post-hatch chicks have different physiological conditions in comparison with older chicks and this may impact on 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. The usual starter diets have complex components and more digestible and simple feed components such as glucose syrup or egg powder may be more suitable for first days post-hatch. Thus, this study was carried out to evaluate the effect of feed type and fasting over the first 48 h immediately following hatch on performance, gastrointestinal morphology and carcass characteristic of broiler chickens.

MATERIALS AND METHODS

A total of newly hatched 540 Ross 308 male broiler chicks were obtained from a commercial hatchery. The chicks were divided into nine groups corresponding with eight treatments and one control group included in the study. The average of each group had approximately similar initial weight and weight distribution. The nine groups were identified based on their experimental diets as: control-feeding a corn-soybean meal based diet (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 diet containing 15% egg powder and 20% glucose syrup for 24 h (24EG) or 48 h (48EG). All experimental diets (Table 1) were semi-moist with a moisture content of 30%. After 24 or 48 h all the chicks were fed with commercial starter (up to 21 days) and grower (22-42 days) diets. The diets (Table 2) were formulated to meet nutrient requirements according to NRC (1994).

Measurements: Live weight and feed intake were measured for each experimental unit at 7, 21 and 42 days of age for the purposes of calculating weight gain and amount feed intake change.

Intestinal morphology: At 24 and 48 h, 7 and 21 days one bird from each replicate was killed to collect the small intestine. The intestines were removed and segments of duodenum (from the pylorus to the distal point of entry of the bile ducts), jejunum (from entry of the bile ducts to Meckel's diverticulum) and ileum (from Meckel's diverticulum to the ileocecal junction) and then were gently flushed twice with physiological saline solution to remove the intestinal content. For morphological analysis, approximately 5 cm of the middle portion of the duodenum, jejunum and ileum was excised and fixed in 10% formalin. Six cross sections of 70% ethanol preserved segments for each sample were then prepared for staining with hematoxylin and eosin using standard paraffin embedding procedures (Uni *et al*., 1995). Villus Height (VH) and Crypt Depth (CD) were measured using the Image-Pro Plus as described by Touchette *et al*. (2002) and VH:CD Ratio (VCR) were calculated.

Carcass characteristics: At 24-48 h and 7 days of age one bird (different from the birds selected for intestinal extraction) from each replicate was killed and residual yolk weight was determined. On days 21 and 42 of experiment an additional chick from each replicate was slaughtered

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

Feed ingredients	Control	E	G	EG
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
$CaCo_3$	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	2.5	2.5	2.5	2.5
Vitamin premix	2.5	2.5	2.5	2.5
Calculated nutrients				
Metabolizable energy (MJ kg^{-1})	12.13	11.30	12.75	11.30
Crude protein (g kg^{-1})	230.00	240.00	183.00	250.00

Table 2: Composition and calculated nutrient content of starter and grower diets

Feed ingredients	Starter (up to 21 days)	Grower (22-42 days)
Corn	535.00	583.00
Soybean meal	357.00	320.00
Fish meal	50.00	30.00
Mono-calcium phosphate	5.70	5.00
$CaCo_3$	12.50	14.10
NaCl	3.50	3.00
Soybean oil	30.00	40.00
DL-methionin	0.80	0.10
Mineral premix[1]	2.50	2.50
Vitamin premix[2]	2.50	2.50
Calculated nutrients		
Metabolizable energy (MJ kg^{-1})	12.55	12.97
Crude protein (g kg^{-1})	215.60	193.70
Met (g kg^{-1})	4.40	3.40
Met + Cys (g kg^{-1})	8.40	7.00
Lys (g kg^{-1})	13.20	11.50
Ca (g kg^{-1})	9.30	8.70
AP[3] (g kg^{-1})	4.20	3.40

[1]Supplemented (mg kg^{-1} of diet): Mn, 1200; Fe, 60; Zn, 120; Cu, 12; I, 1.2; Se, 0.24; [2]Supplemented (mg or IU kg^{-1} of diet): Vit. A, 10800 IU; D_3, 2400 IU; E, 21.6 IU; K_3, 2.4 IU;B_1, 2.16; B_2, 7.9; B_5, 12; B_5, 3.6; B_9, 1.2; B_{12}, 0.015; Biotin, 0.12; choline chloride, 600 and adequate anti oxidant; [3]AP: Available Phosphorus

for carcass analysis including duodenum, jejunum, ileum and small intestine weight and length and 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. Statically different means were separated using Duncan's multiple range test ($p<0.05$).

RESULTS AND DISCUSSION

Growth performance: Delayed access to feed for 24 (24F) or 48 h (48F) resulted to lower weight gain in first 7 days of age compared to the control group. However, the chicks receiving the feeding diets containing egg powder for 24 or 48 h (24 and 48E), glucose syrup for 24 and 48 h (24 and 48G) and both egg powder and glucose syrup for 24 h (24EG) resulted to higher ($p<0.05$) weight gain than the control birds in first 7 days of age (Table 3). At 7-21 days of age, the chicks who were fed a diet containing both egg powder and glucose syrup for 48 h (48EG) resulted to higher ($p<0.05$) weight gain than both the control and the other experimental groups (Table 3). There was no significant difference in weight gain between experimental groups from 22-42 days of age. However, in entire experimental period (1-42 days) feeding diets contains egg powder (E48) or both egg powder and glucose syrup (EG48) for 48 h resulted in higher weight gain than control group (Table 3).

The finding of lower weight gain in fasted chicks during the first week of life is consistent with reports by Batal and Parsons (2002) and Boersma *et al.* (2003). Lower weight gain in fasted groups could be attributed to lower feed intake and poor development of digestive tract. Most of the energy and nutrients consumed by birds <4 weeks goes toward growth (Tabler, 2008). When feed consumption starts soon after hatch, the nutrients provided by feed are complementary to the yolk nutrients (Murakami *et al.*, 1992). Initiation of feed consumption as close to hatch as possible is essential to support early muscle development, which may ultimately affect meat yield.

The results show that feeding a semisolid diet containing the egg powder and glucose syrup for 48 h resulted to higher weight gain in birds. This likely occurred for two reasons: first, the treatment diet was higher in protein and lower in energy than control and other treatments (Table 1) and second, the chicks in this group had the highest levels of feed intake (Table 3). Molenar *et al.* (2009) 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 also have shown that body weight gain during the first weeks increased with increasing protein levels (Sklan and Noy, 2003; Wijtten *et al.*, 2004).

Other indicators of growth are affected by early diet as well. Sklan and Noy (2003) suggested that chicks might have a high protein requirement for the development of specific tissues post-hatch. For example it has been reported that the small intestines grow rapidly in the post-hatch period (Nitsan *et al.*, 1991; Sklan, 2001). In the current study, increasing the energy source by feeding glucose syrup in a semi-solid diet did not result to higher post-hatch performance. This may have been due to immature development of digestive enzyme secretion. Until the system is fully developed it may be that glucose is absorbed with no additional enzymatic activity, which yields no stimulation of intestinal processes.

Feed intake: In 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 h (EG48) resulted in higher ($p<0.05$) feed intake than control (Table 3). Feed intake was not

Table 3: 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 day^{-1})				Feed intake (g day^{-1})				Feed conversion ratio (g g^{-1})			
	1-7	7-21	21-42	1-42	1-7	7-21	21-42	1-42	1-7	7-21	21-42	1-42
Diets	days											
Control	10.7d	23.7bc	65.1	40.5c	13.1b	29.4	117.1b	70.5b	1.04abc	1.63b	1.91	1.74
F24*	9.9e	26.7b	67.1	42.5abc	8.9c	33.1	119.0b	72.0ab	0.77d	1.55b	1.85	1.69
EG24	11.4c	25.9b	70.5	43.9ab	14b	33.6	124.7ab	75.9ab	1.04abc	1.71ab	1.88	1.73
E24	11.5c	25.6b	68.7	42.9abc	13.5b	30.8	128.5a	76.8ab	1.00bc	1.57b	1.97	1.79
G24	11.4c	25.8b	69.0	43.1abc	13.9b	29.0	120.1ab	72.3ab	1.04abc	1.45b	1.81	1.68
F48	8.1f	21.7c	68.0	41.2bc	5.6d	37.8	122.0ab	74.5ab	0.60e	2.18a	1.88	1.80
EG48	12.8a	31.7a	68.1	44.6a	17.4a	38.8	123.ab	77.4a	1.18a	1.58b	1.94	1.74
E48	12.0b	26.2b	70.6	44.0ab	13.1b	36.2	121.8ab	75.1ab	0.93c	1.82ab	1.81	1.71
G48	10.6d	23.7bc	67.9	41.9abc	14b	33.1	118.8b	72.8ab	1.13ab	1.76ab	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

Table 4: Effect of fasting a or type of post-hatch diet on weight (body weight %) and length (cm) of small intestine at 21 and 42 days of chick's life

	21 days								42 days							
Diets	SIW*	DW	JW	IW	SIL	DL	JL	IL	SIW	DW	JW	IW	SIL	DL	JL	IL
Control	7.86b	1.80	3.45b	2.61b	109.50ab	22.00b	42.75ab	44.75ab	4.77ab	0.92ab	1.96	1.89b	187.50	29.50	76.50ab	81.50
F24**	11.2ab	2.14	4.81a	4.25ab	118.00ab	22.00b	50.00ab	46.00ab	4.68ab	0.90ab	1.90	1.88b	196.25	32.50	79.75ab	84.00
EG24	9.48ab	1.76	4.33ab	3.39ab	96.25b	23.50b	36.25b	36.50b	4.64ab	0.81ab	1.97	1.86b	196.75	29.75	85.50a	81.50
E24	9.74ab	1.77	4.33ab	3.64ab	115.00ab	21.50b	46.00ab	47.50ab	4.01b	0.80b	1.60	1.61b	186.50	29.75	77.75ab	79.00
G24	10.35ab	2.26	4.03ab	4.06ab	101.25ab	20.50b	37.50ab	43.25ab	5.69a	1.00a	2.20	2.49a	199.25	32.25	81.50ab	85.50
F48	10.63ab	2.01	4.64ab	3.98ab	115.75ab	21.00b	46.00ab	48.75ab	4.34ab	0.87ab	1.73	1.74b	183.50	32.50	74.00ab	77.00
EG48	9.98ab	1.86	3.98ab	4.14ab	127.00ab	22.50b	53.50a	51.00ab	4.26ab	0.86ab	1.77	1.63b	187.00	31.00	77.75ab	78.25
E48	11.33a	1.88	4.52ab	4.93a	116.75ab	19.75b	48.00ab	49.00ab	4.60ab	0.98ab	1.76	1.86b	184.25	32.50	70.00b	81.75
G48	10.27ab	2.31	4.11ab	3.85ab	128.00a	28.50a	44.50ab	55.00a	4.21ab	0.90ab	1.77	1.54b	183.25	32.00	73.75ab	77.50
SEM	0.324	0.069	0.127	0.210	3.2320	0.660	1.699	1.665	0.159	0.020	0.073	0.073	2.3994	0.525	1.433	1.103

*SIW: Small Intestine Weight; DW: Duodenum Weight; JW: Jejunum Weight; IW: Ileum Weight; SIL: Small Intestine Length; DL: Duodenum Length; JL: Jejunum Length; IL: Ileum Length; **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

different for the experimental groups at 7-21 days of age. At 21-42 days of age, feeding diet contains egg powder for 24 h (E24) did result to higher feed intake than control (Table 3). Over the entire experimental period, the chicks fed both egg powder and glucose syrup had significantly higher ($p<0.05$) feed intake than control (Table 3). Feed intake levels were not however significantly higher in comparison with the other diet groups. 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 (Noy and Sklan, 2002; Plavnik *et al*., 1997). 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 (Nichelmann and Tzschentke, 2002). However, in this experiment, birds were kept in a similar brooding system.

In first week of age, feed conversion ratio reduced ($p<0.05$) in the chicks that had no access to feed for either 24 or 48 h (Table 3). After first week, no significant differences in feed conversion ratios occurred among the treatment diet groups. This finding is in agreement with research of Noy and Sklan (1998a, 1999), Corless and Sell (1999), Batal and Parsons (2002) and Saki (2005).

Intestine development and morphology: The effects of fasting or type of post-hatch diet on weight and length of small intestine are tabulated in Table 4. At 21 day of age, fasting for 24 or 48 h had no significant effect on small intestine lengths, however, small intestine lengths were significantly higher in chicks receiving either the G or EG diet for 48 h compared with chicks receiving the EG diet for 24 h. Feeding G diet for 48 h resulted in longer duodenum and ileum than other treatments. In addition, longer ($p<0.05$) jejunum length was found in chicks who received the GE diet in the first 48 h. These findings are consistent with those of Brink and Rhee (2007) who showed that chicks with access to a semi-moist diet for 48 h showed significantly longer intestines compared with both the non-fed chicks and the chicks fed dry feed. It has been suggested that the yolk sac provides 50% of the chick's energy on the first day after hatch and is negligible by the fourth days being only about 2% (Nitsan *et al*., 1991). During the post-hatch period, the small intestine develops at a faster rate than the body mass (Sell *et al*., 1991; Sklan, 2001). Hence, providing a complete diet with high energy content (G 48 diet) or high protein content and suitable protein source such as egg powder with a good profile of amino acids may be explain the better development of the GIT in chicks.

Duodenum and jejunum weight was not influenced by the experimental diets. However, feeding E diet for 48 h did increase ileum weight significantly ($p<0.05$).

At day 42, the 24G diet fed chick was found to have the highest duodenum and ileum weight. Small intestine, duodenum, jejunum and ileum lengths did not differ across treatments. This suggests that GIT development mainly in first weeks of bird's age in the last weeks the GIT growth to body growth is less and dose not affect by diet.

The results for morphological parameters (Table 5-7) show that feed deprivation or feeding different feed type had no effect on duodenum, jejunum and ileum Villous Height (VH), Crypt Depth (CD) and VH:CD ratio in chicks during the first 24 h after hatch. However, feeding a semi-moist diet containing egg powder and glucose syrup for 48 h resulted in higher duodenum CD in comparison to chicks fed with diet containing egg powder for 48 h. No access to feed for 48 h decreased duodenum VH and increased ($p<0.05$) duodenum CD and subsequently decreased VH:CD ratio on day 7. Feeding a semi-solid

Table 5: Effects of fasting or type of post-hatch diet on morphological parameters (μ) of duodenum in broiler chickens

	24 h			48 h			7 days			21 days		
Diets	VH*	CD	VH/CD	VH	CD	VH/CD	VH	CD	VH/CD	VH	CD	VH/CD
Control	300	65	5.49	565	75ab	7.53b	1049ab	130b	8.07abc	1585	190	8.34
F24**	620	50	12.44	-	-	-	1029ab	165ab	6.31bc	1690	265	6.57
EG24	695	90	9.18	-	-	-	1243a	120b	11.04a	1720	215	8.07
E24	895	105	9.25	-	-	-	1180ab	110b	10.80ab	1650	235	7.38
G24	625	45	14.12	-	-	-	1114ab	145b	7.93abc	1905	200	9.54
F48	-	-	-	615	80ab	7.90b	997b	210a	4.70c	1615	215	7.52
EG48	-	-	-	860	95a	9.08b	1003b	110b	9.11abc	1525	190	8.05
E48	-	-	-	785	55b	14.36a	1123ab	120b	9.70ab	1700	220	7.71
G48	-	-	-	480	65ab	6.82b	1064ab	120b	8.86abc	1680	155	11.74
SEM	70.2	11.4	1.355	61.4	5.4	1.010	24.3	8.6	0.564	38.4	10.7	0.523

*VH: Villous Height; CD: Crypt Depth; VH/CD: Villous Height to Crypt Depth; **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; EG: 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

Table 6: Effects of fasting or type of post-hatch diet on morphological parameters (μ) of ileum in broiler chickens

	24 h			48 h			7 days			21 days		
Diets	VH*	CD	VH/CD	VH	CD	VH/CD	VH	CD	VH/CD	VH	CD	VH/CD
Control	220	35	6.28	285	55ab	5.20	367bcd	80	4.59b	525	165	3.67
F24**	280	45	6.80	-	-	-	527b	70	8.19ab	490	145	3.48
EG24	295	55	5.49	-	-	-	367bcd	75	4.98b	620	170	3.62
E24	315	50	6.09	-	-	-	473bc	110	4.30b	560	120	4.63
G24	410	45	9.12	-	-	-	281d	75	3.80b	795	140	5.57
F48	-	-	-	230	45b	5.11	312cd	75	4.55b	445	120	3.71
EG48	-	-	-	325	60ab	5.42	1069a	110	10.56a	690	145	4.93
E48	-	-	-	290	45b	6.37	465bc	95	4.88b	700	100	6.98
G48	-	-	-	290	75a	4.10	393bcd	75	5.24b	665	90	7.67
SEM	27.6	3.7	0.560	21.4	4.5	0.405	55.4	5.4	0.612	45.5	10.4	0.458

*VH: Villous Height; CD: Crypt Depth; VH/CD: Villous Height to Crypt Depth; **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; EG: 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

Table 7: Effects of fasting or type of post-hatch diet on morphological parameters (μ) of jejunum in broiler chickens

	24 h			48 h			7 days			21 days		
Diets	VH*	CD	VH/CD	VH	CD	VH/CD	VH	CD	VH/CD	VH	CD	VH/CD
Control	385	40	9.61	315	65b	4.87	321f	90ab	3.86b	925ab	165	5.89
F24**	420	60	7.04	-	-	-	355ef	110ab	3.22b	1075ab	145	9.03
EG24	305	50	6.07	-	-	-	913a	110ab	8.71a	1025ab	170	6.12
E24	400	55	7.44	-	-	-	624bc	100ab	6.30ab	900ab	150	6.26
G24	335	45	7.76	-	-	-	546bcd	110ab	5.49ab	1150a	0.175	6.52
F48	-	-	-	350	55b	7.02	502bcde	100ab	5.28ab	955ab	160	6.11
EG48	-	-	-	455	80b	5.84	462def	80ab	6.22ab	665b	175	3.74
E48	-	-	-	500	175a	2.94	639b	120a	5.35ab	810ab	160	5.05
G48	-	-	-	275	50b	5.42	472cdef	50b	6.26ab	975ab	200	4.54
SEM	19.4	2.3	0.575	65.2	15.6	0.688	41.8	6.8	0.455	45.4	9.0	2.831

*VH: Villous Height; CD: Crypt Depth; VH/CD: Villous Height to Crypt Depth; **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; EG: 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

diet containing egg powder and glucose syrup for 24 h resulted in longer VH and lower CD and subsequently higher VH:CD ratio in duodenum on day 7. On day 21, none of experimental treatments could affect the morphometric parameters of duodenum and ileum.

Feeding EG diet for 24 h resulted in longer ($p<0.05$) jejunum VH and higher VH:CD than other experimental groups on day 7. Feeding the early diet containing egg powder for 48 h increased the CD in comparison to chicks that fed with EG diet for 48 h.

Feeding EG diet for 48 h resulted in longer ($p<0.05$) ileum VH and higher VH:CD than chicks fasted for 24 h on day 7.

Although the digestive capacity begins to develop a few days before hatch, most of the development occurs post-hatch when the neonatal chick begins consuming feed (Ferket and Uni, 2009). The intestinal crypts are clearly defined several days post-hatch, increasing in both cell numbers and size (Geyra *et al*., 2001a; Uni *et al*., 2000). In agreement to this finding, previous studies have shown that feeding immediately post-hatch accelerates the morphological development of the small intestine (Noy and Sklan, 1998b). While, delay access to first feed for 24-48 h post-hatch have decreased villi length (Yamauchi *et al*., 1996), decreased crypt size and crypts per villi and decreased enterocytes migration rate (Geyra *et al*., 2001b).

Yolk suck utilization and carcass characteristics: Chicks with no access to feed showed a comparable reduction in residual yolk suck weight as fed chicks (Table 8). Feeding egg powder, glucose syrup and egg powder plus glucose syrup had no significant effect of yolk suck utilization by chicks during the first 24 or 48 h post-hatch. In agreement with findings of Murakami *et al*. (1992) and Dibner and Knight (2003), fasting, early feeding and early diet type did not change the rate of egg yolk utilization and this shows that fasted birds do not show accelerated use of their residual yolk as a way to compensate for a lack of feed.

However, results of Noy and Sklan (1998b, 2001) are not in line with this finding and they showed more utilization of yolk suck in fed chicks than fasted chicks.

The carcass characteristics at 21 and 42 days of age of different experimental treatments are shown in Table 9. 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 h feeding of GE and E diets could be associated with more satellite cell proliferation. Moore *et al*. (2005) 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 (Mozdziak *et al*., 2002; Halevy *et al*., 2003).

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 El-Husseiny *et al*. (2008) 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 8: Effect of Fasting or post-hatch diet type on residual yolk weight (g) by broiler chicks at 24-48 h and 7 days after hatch

	Time after hatch		
Diets	24 h	48 h	7 days
Control	2.65	2.60	0.22
F24*	2.73	2.25	0.05
EG24	2.77	2.16	0.01
E24	2.38	1.21	0.04
G24	2.54	1.08	0.51
F48	2.75	1.59	0.05
EG48	2.51	1.72	0.13
E48	2.29	1.68	0.00
G48	2.18	1.81	0.02
SEM	0.208	0.188	0.052

*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

Table 9: Effect of fasting or type of post-hatch diet on carcass characteristic of broiler chicks at 21 and 42 days of age

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

*CW: Carcass Weight; BW: Bursa Weight; SW: Spleen Weight; HW: Heart Weight; LW: Liver Weight; AF: Abdominal Fat pad; **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

CONCLUSION

This study indicates that early fasting affected GIT developments, however had no adverse effect on broiler performance. The results of this study also 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 h post-hatch is beneficial for post-hatch growth and considerable performance benefits than control.

ACKNOWLEDGEMENTS

The researchers are grateful to Dr. Kenneth J. Gruber at North Carolina A and T State University, Greensboro, North Carolina for his critical and constructive reading of the manuscript.

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