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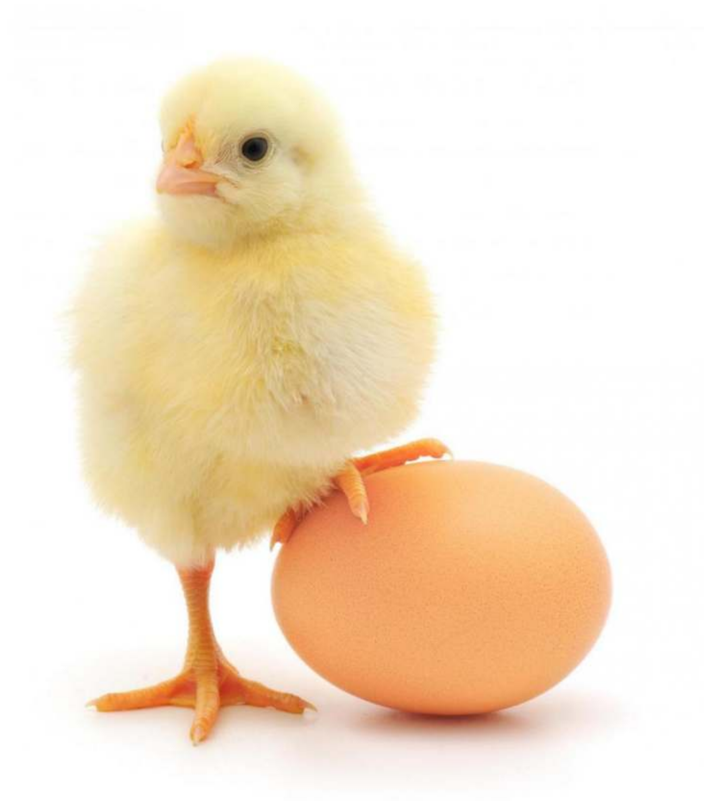

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Influence of Fasting or Early Feeding on Broiler Performance

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Abstract: Three experiments were designed to investigate the effect of early feeding on yolk sac absorption and enhance the gastrointestinal tract development in neonatal broiler chicks. Experiment I, was designed to answer the question about the extent of yolk sac absorption and survivability in newly hatched chicks with held feed (for 1, 2, 3, 4, 5 or 6 days then switch to control diet), but have access to water. Two hundred and eighty unsexed day-old Arbor Acres broiler chicks were divided equally into 7 treatments of 40 chicks each in four replicates (10 chicks each). Diets were formulated to contain 23% CP and 3200 Kcal ME/kg (Starter) and 20% CP and 3200 Kcal ME/kg (grower). Experiment II, was designed to answer the question about the feed utilization, yolk sac absorption and gastrointestinal tract maturation in newly hatched chicks when fed different treatments (ground yellow corn, soybean meal flour, yolk sac, fresh egg yolk, low protein diet and control diet) for two days then switched to control diet A total number of 240 unsexed day old, Arbor Acres broiler chicks was randomly assigned to 6 treatments of 40 chicks each in four replicates (10 chick per replicate). Exp. III, was designed to answer the question about supplementation of some nutrients in water (glucose, amino acid (Meth and Lys), amino vit, vitamins soluble in water, electrolyte and tap water) and effects on yolk sac absorption and gastrointestinal tract maturation in newly hatched chicks. A Total number of 280 unsexed day old, Arbor Acres broiler chicks were randomly assigned to 7 treatments of 40 chicks each in four replicates (10 chicks per replicate). Results obtained are as follows: Yolk was rapidly utilized in fed than in fasting chicks at 1st and 2nd days of age. However, the lowest CP% of yolk sac was recorded at 4th day of fasting and better absorption of nutrients from yolk sac after 72h of life was observed in group fasting compared with the group which was fed. Moreover, Starvation over the first 2-d post-hatch period retards growth, reduces ultimate meat yield and weight loss after 5 day starvation resulted in completely death of all chicks. Starvation in the early period (0-7d) significantly ($P<0.01$) decrease BWG and poor feed conversion (FC) compared to the control group at 3 and 6 weeks of age. Chicks fed control diet (23%CP) for 48hrs, 7 days, 3 or 6 weeks of age recorded significantly ($P<0.01$) the highest body weight and body weight gain (Exp. II and III). Furthermore, starvation of chickens significantly ($P<0.01$) reduced weight of liver, heart, proventriculus with gizzard and length of intestine and two cecum at first week of chick's life compared to those with early access to feed. Chicks fed yolk sac or fresh egg yolk for 48hrs recorded the lowest liver weight and length of intestine and two cecum compared with the other experimental treatments (Exp.II). Chicks fed control diet (23% CP) for 48hrs or 7 days recorded significantly ($P<0.01$) the highest internals organs compared with the other treatments (Exp. III). However, no significant differences in abdominal fat and immune response between different treatments (Exp. I, Exp. II and III). In conclusion, starvation over the first 2-ds post-hatch period retard growth performance and yolk utilization was rapid in fed than in fasting chicks at 1st and 2nd day of age. This study indicates that early feeding complete diet results in considerable performance benefits.

Key words: Early feeding, gastrointestinal tract, yolk utilization

Introduction

Early feeding has a great effect in triggering the right momentum of growth in broiler hatchings. The residual yolk fast utilized less, but increases body weight gains and enhances the gastrointestinal tract development in neonatal broiler chicks. Chickens may use parallel two sources of nutrients: residues accumulated in the yolk sac and taken from feed, which consumption varied from 10g/day/chick in 1st day to 35g in 7th day old chicks (Pisarski *et al.*, 2003). Delayed access to nutrients can result in depressed immune response, increased early mortality and reduced overall performance (Juul-Madsen *et al.*, 2004).

Under practical conditions, chickens that hatch as the first in a batch do not have access to feed or water until 36 to 48hrs after hatch. Therefore, sufficient absorption of essential trace elements and maternal antibodies from the yolk sac is critical for the early stage of the chickens' survival. The residual yolk is usually used up within 4 days after hatching (Noy and Sklan, 1999) and recent results indicate that the residual yolk is used up more quickly in chickens that have access to feed immediately after hatch than in those that are fasted for 48hrs (Juul-Madsen *et al.*, 2004). The newly hatched chicks need to transit from dependence on yolk to exogenous nutrients after hatch (Sklan and Noy, 2000). Because the digestive organs are not well development at hatch, the source of nutrients determines their maximum availability to the chick (Liburn, 2002). Since our knowledge of early nutrition for broiler chicks is mostly based on corn/soybean meal diets, while the effect of early feeding of these materials "corn ground, soybean meal flour, yolk sac, glucose, amino acid or electrolyte" on broiler performance need to be defined.

The experiment was designed to answer the question about the extent of yolk sac absorption and survivability in newly hatched chicks with held feed, but have access to water.

Materials and Methods

Three experiments were carried out at El-Kanater El-Khayria Poultry Research Station and Poultry Nutrition Department, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt. Chicks were housed in gas heated batteries and kept under similar conditions of management during an experimental period, which lasted until 42 days of age.

Exp. I was designed to answer the question about the extent of yolk sac absorption and survivability in newly hatched chicks with held feed, but have access to water. A total number of 280 unsexed day old, Arbor Acres broiler chicks were individually weighted, wing banded, assigned to 7 treatment of 40 chicks each in four replicates (10 chicks per replicate).The average one day old weight was 43 gm. The experimental treatments were as follows:

The Experimental Design (Exp. I)

		Period per days	
		Exp. (T2-T7)	Fed control diet
T1	Control diet (23/20% CP) (NRC, 1994)	0-7	8-42
T2	Fasting for 1d then switch to control diet.	0-1	2-42
T3	Fasting for 2d then switch to control diet.	0-2	3-42
T4	Fasting for 3d then switch to control diet.	0-3	4-42
T5	Fasting for 4d then switch to control diet.	0-4	5-42
T6	Fasting for 5d then switch to control diet.	0-5	6-42
T7	Fasting for 6d then switch to control diet.	0-6	7-42

The control diet (Table, 1) was formulated using linear programming to be iso-nitrogenous and iso-caloric, containing 23% CP and 3200 kcal ME/kg (starter) and 20% CP and 3200 kcal ME/kg (grower).

Exp. II Was designed to answer the question about the feed utilization, yolk sac absorption and gastrointestinal tract maturation in newly hatched chicks when fed different treatments for two days then switched to control diet.

A total number of 240 unsexed day old, Arbor Acres broiler chicks was randomly assigned to 6 treatments of 40 chicks each in four replicates (10 chick per replicate). The experimental treatments were as follows:

The Experimental Design (Exp. II)

		Period per days	
		Exp. (T2-T6)	Fed control diet
T1	Control diet (23/20% CP) (NRC,1994)	0-7	8-42
T2	Ground yellow corn.	0-2	3-42
T3	Soybean meal flour.	0-2	3-42
T4	Yolk sac (removed from newly hatched chicks (SPF) specific pathogenic free.	0-2	3-42
T5	Fresh egg yolk.	0-2	3-42
T6	Low protein diet (21%CP) and energy (2950 Kcal ME/Kg diet).	0-7	8-42

Exp. III was designed to answer the question about supplementation of some nutrients in water and effects on yolk sac absorption and gastrointestinal tract maturation in newly hatched chicks.

A total number of 280 unsexed day-old, Arbor Acres broiler chicks was randomly assigned to 7 treatments of 40 chicks each in four replicates (10 chicks per replicate). The experimental treatments were as follows:

The Experimental Design (Exp. III)

		Period per days	
		Exp. (T2-T6)	Fed control diet
T1	Control diet (23/20% CP) (NRC,1994)	0-7	8-42
T2	Glucose in water.	0-2	3-42
T3	Amino acid soluble in water (methionine and lysine).	0-2	3-42
T4	Vitamins soluble in water.	0-2	3-42
T5	Aminovit soluble in water.	0-2	3-42
T6	Electrolyte soluble in water.	0-2	8-42
T7	Tap water.	0-2	8-42

* T1, supplemented with Met + Lys to meet the requirements of 23/20% CP according to NRC, 1994.

Table 1: Composition of the experimental diets

Ingredients,%	23% CP	20% CP	21% CP
Yellow Corn ,	50.42	57.63	59.87
Soybean meal, 44%	34.95	32.5	34.50
Corn gluten meal, 60%	3.70	-	-
Soybean oil	7.05	6.5	02.00
Di-calcium phosphate	1.70	1.20	01.75
Lime stone	1.33	1.38	00.98
Salt	0.42	0.42	00.40
Premix*	0.30	0.30	00.30
DL- methionine, 99%	0.13	0.07	00.20
L- Lys- HCl ,98%	-	-	-
Total	100.00	100.00	100.00
Determined:			
CP, %	23.00	20.00	21.10
DL- methionine	0.50	0.39	0.50
Cystine	0.40	0.33	0.40
Methionine+Cystine	0.90	0.72	0.90
L- Lysine	1.10	1.05	1.10
Calculated:			
ME K,cal/ kg	3200	3200	2950
C / P ratio	137	159	140
Ca, %	1.00	0.90	0.90
Av. P,%	0.45	0.36	0.45

*Supplied per kg of diet: Vit. A, 12000 IU; Vit. D_3, 2200 ICU; Vit. E, 10 mg; Vit K_3, 2mg; Vit. B_1, 1mg; Vit. B_2 5mg; B_6 1.5MG; B_{12} 10 mcg; Nicotinic acid 30mg; Folic acid 1mg, Pantothenic acid 10mg; Biotein 50mcg; Choline 250mg; Copper 10mg; Iron 30mg; Manganese 60mg; Zinc 50mg; Iodine 1mg; Selenium 0.1mg; Cobalt 0.1mg.

Table 2: Chemical and amino acids composition (%) of yolk sac, corn, corn gluten meal and soybean meal

Contents	Yolk sac	Yellow corn	Corn gluten meal	Soy bean meal	Soy bean meal flour
Moisture %	47.90	11.5	10.1	10.0	9.0
Ether extract %	26.5	2.0	9.1	5.2	9.1
Crude fiber %	ND*	2.3	2.0	7.3	7.3
Ash %	9.20	1.0	2.1	6.0	6.1
Crude Protein %	26.5	8.71	66.03	46.05	48.62
Methionine %	2.22	0.18	1.34	0.66	0.83
Cystine %	0.11	0.20	1.11	0.76	0.76
Methionine+Cystine%	2.33	0.38	2.45	1.42	1.59
Lysine %	4.23	0.26	1.16	2.76	1.81
Therionine %	3.41	0.32	2.01	1.79	1.67
Tryptophan %	ND*	ND*	ND*	ND*	ND*
Arginine %	4.02	0.39	1.96	3.17	2.35
Isoleucine %	3.33	0.28	2.32	2.08	1.88
Leucine %	5.92	1.01	8.79	3.48	5.06
Valine %	4.43	0.38	2.57	2.12	2.03

* ND: Not determined.

Feed and water were offered ad-libitum. Live body weight (BW) and feed intake (F1) was recorded daily (during the first week) and weekly. Body weight gain (BWG) and feed conversion ratio (FC) were calculated. Mortality was daily recorded and the economic efficiency was calculated at the end of the experiment. The tested raw materials analyzed for Kjeldahl nitrogen by the methods outlined by Official Methods of Analysis (A.O.A.C. 1990). Amino acid concentrations in corn, soybean meal, soybean meal flour, corn gluten meal and yolk sac were analyzed with Biochrom 20 Amino Acid Analyzer based on the described method of Spackman *et al.* (1958). Methionine and cystine were determined in samples oxidized with performic acid.

Immunity trails: At 4 weeks of age, ten birds from each treatment were immunized by intravenously injection with 1.0 ml of suspension of sheep red blood cells (SRBC's) 7% in sterile saline. Seven days following antigen challenge, blood samples were collected. Approximately 2.0 ml of blood was drawn from brachial vein of each bird. It was allowed to clot to provide serum for antibody titer. Humoral immune response to SRBC's was measured by using microtiter technique.

Carcass traits: Every day (for 7 days) one chick's from each replicate was weighted and slaughter then the yolk sac removed and the internal organs (such as: liver, heart and gizzard) were weighted to the nearest gram and the length of small intestine and two cecum were measured.
At the end of the experiment (6 weeks of age), four birds from each treatment were taken around the average of the treatment for slaughter test and values were calculated as percentage of live body weight.

Statistical analysis: The data were subjected to one way analysis of variance, using General Linear Model of SAS® Software (SAS Institute, 1990). Significant means were separated by Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Chemical and amino acids composition of the experimental ingredients: The chemical and amino acids composition of the experimental ingredients are summarized in Table 2. The crude protein values of yellow corn, soybean meal (SBM) and corn gluten meal (CGM) are within the normal range of NRC (1994). Amino acids profile of soybean meal and soybean meal flour are rich in lysine, but deficient in methionine. Furthermore, CGM was rich in leucine and valine, but deficient in lysine (Mohamed, 1992). However, yolk sac was rich in lysine and methionine compared with SBM or CGM.

Experimental I: The crude protein (CP %) values and weight of yolk sac (Table 3) were significantly ($P<0.01$) reduced at the 2nd, 3rd and the 4th days of life as reported by Wertelecki (2006). The least CP % of yolk sac was recorded at 4th day of fasting and the better absorption of nutrients from yolk sac after 72hrs of life was observed in fasted (96.65%) compared with the group which was fed (90.51%). However, yolk utilization was more rapid in fed chick, than in fasted chicks at 1st and 2nd days of age as reported by Noy *et al.* (1996). This may be attributed to the diet which supplements the chicks with the essential nutrients needed for growth and the chicks in feeding group dependent on the

Table 3: Effect of deprived or feeding system on residual yolk sac weight and absorption (Exp. I)

	Days of fasting			Days of feeding	
Days of life	Crude protein%	Yolk sac weight (g)	% of losing or absorption	Yolk sac weight (g)	% of losing or absorption
Arrival day	26.5±0.11[c]	5.373±0.26[a]	-	5.373±0.26[a]	-
1st	29.56±0.01[a]	3.29±0.28[b]	38.77	3.16±0.01[b]	41.19
2nd	26.83±0.05[b]	1.23±0.01[c]	77.10	1.09±0.01[c]	79.72
3rd	22.26±0.01[d]	0.18±0.005[d]	96.65	0.51±0.01[d]	90.51
4th	16.04±0.01[e]	0.07±0.01[d]	98.70	0.16±0.005[e]	97.02
5th	-	0.04±0.005[d]	99.26	0.09±0.005[e]	98.32
6th	-	0.00±0.00[d]	100	0.01±0.001[e]	99.81
7th	-	0.00±0.00[d]	100	0.002±0.001[e]	99.96

Table 4: Effect of dietary treatments on residual yolk sac weight (Exp. II)

	Treatments						
	Control (T1)	Ground corn (T2)	Soybean meal flour (T3)	Yolk Sac (T4)	Fresh Yolk Sac (T5)	Low Protein diet (T6)	$P\leq 0.05$
Yolk sac weight (g) Arrival day	5.36	5.41	5.39	5.36	5.37	5.38	
Yolk sac weight (g) 1st day	3.16 ± 0.04^{cd}	3.10 ± 0.01^{d}	3.71 ± 0.03^{b}	3.95 ± 0.01^{a}	3.23 ± 0.03^{c}	3.21 ± 0.02^{c}	0.0001
Yolk sac weight (g) 2nd day	1.05 ± 0.03^{c}	0.93 ± 0.01^{d}	1.16 ± 0.01^{b}	1.22 ± 0.01^{a}	1.22 ± 0.01^{a}	1.01 ± 0.01^{c}	0.0001
Yolk sac weight (g) 7th day	0.01 ± 0.01^{a}	0.004 ± 0.001^{c}	0.004 ± 0.003^{c}	0.026 ± 0.003^{a}	0.00 ± 0.00^{c}	0.00 ± 0.00^{c}	0.0001

Table 5: Effect of dietary treatments on residual yolk sac weight (Exp. III)

	Treatments							
	Control (T1)	Glucose (T2)	Amino acid (T3)	Vitamins (T4)	Amino-vit (T5)	Electrolyte (T6)	Tap water (7)	$P\leq 0.05$
Yolk sac weight (g) Arrival day	5.36	5.41	5.39	5.36	5.37	5.38	5.35	
Yolk sac weight (g) 1st day	3.16 ± 0.04^{de}	3.38 ± 0.02^{bc}	3.69 ± 0.02^{a}	3.22 ± 0.05^{d}	3.42 ± 0.01^{b}	3.04 ± 0.01^{e}	3.25 ± 0.10^{cd}	0.001
Yolk sac weight (g) 2nd day	1.05 ± 0.03^{bc}	0.95 ± 0.01^{cd}	0.96 ± 0.01^{cd}	1.27 ± 0.04^{ab}	0.91 ± 0.01^{cd}	0.70 ± 0.22^{d}	1.40 ± 0.05^{a}	0.005
Yolk sac weight(g) 7th day	0.01 ± 0.01	0.00 ± 0.00	0.003 ± 0.001	0.00 ± 0.00	0.004 ± 0.001	0.00 ± 0.00	0.004 ± 0.001	0.51

external supplementation of nutrients in additive to those from yolk sac. The complete absorption of nutrients from yolk sac was recorded at the 5th day of life. This confirms the results reported by Panda *et al.* (2006) who mentioned that the residual yolk is usually used up within four days of hatching. This postulator agreed with that reported by Murakami *et al.* (1992) who reported that re-sorption rate in yolk sac of chickens over 72 hrs of life dependent on individual difference in metabolic status of birds possibility of adaptation to feed intake. Moreover, the deeper yolk sac re-sorption is correlated with better stimulation of post hatch development of chicks and better immunoglobulin transfer from yolk to blood and lymphoid tissues (Noy and Sklan, 1998).

Experimental II and III: The weight of yolk sac (Tables 4 and 5) was significantly (P<0.01) reduced at the 1st and 2nd day of age of life as reported by Wertelecki (2006). Yolk utilization was more rapid in chicks fed control diet, ground yellow corn or low protein diet than in chicks fed fresh egg yolk, yolk sac or soybean meal flour at the 1st and 2nd days of age (Experimental II). Yolk utilization (Table 5) was more rapid in chicks fed electrolyte, control diet, glucose, amino-vit, or amino acids than in chicks fed vitamins, or tap water at the 1st and 2nd days of age (Experimental III). The complete absorption of nutrients from yolk sac was recorded at the 5th day of life. This confirms the results reported by Panda *et al.* (2006) who found that the residual yolk is usually used up within four days of hatching.

Growth performance

Exp. I: Results in Table 6 are depriving of feed with excess of water from post-hatch chickens significantly (P<0.01) reduced body weight (BW) and body weight gain (BWG) compared with the control group in the different periods (1, 2, 3, 4, 5, 6 or 7 day). The severe reduction in BW was observed after the 3rd day and the mortality rate was 35%, 65%, 80% and 100% at 4th, 5th, 6th and 7th days, respectively. These results agreed with those reported by Panda *et al.* (2006) and Nilipour *et al.*, (1998) who mentioned that a 22-25% weight loss after 5 days starvation resulted in death of all chicks. Moreover, Brink and Rhee (2007) showed that fed chicks loose less weight due to dehydration after both 24 and 48 hrs, compared to those that do not receive feed. This may be attributed to the delayed access to nutrients can results in depressed immune response (Casteel *et al.*, 1994) and the immune system is not fully developed at hatch and is not ready for environment challenge (Dibner *et al.*, 1998a,b). Starvation or the absence of feed over the first 2-d post-hatch period retards growth and reduces ultimate meat yield. Furthermore, the reduction in ultimate meat yield observed after 48 hrs of early post-hatch starvation has been associated with a reduction in satellite cell proliferation (Halevy *et al.*, 2000). Short-term reductions in satellite cell proliferation juvenile muscle, such as may occur in delayed post-hatch feeding, result ultimately in a reduction in mature muscle size (Mozdziak *et al.*, 1996).

Results in Table 6 showed that starvation or the absence of feed for 1, 2, 3, 4, 5, 6 or 7 day significantly (P<0.01) reflected by the decrease in body weight gain (BWG) and poor feed conversion (FC) compared with the control group at 3and 6 weeks of age. The severe reduction in BW and poorer FC was observed with

Table 6: Body weight (BW) of chickens and total BW gain at first week of life, (g)

Days of life Treatments	Weight of arrival (g)	1st day	2nd day	3rd day	4th day
Control	43.40±0.02	51.30±0.11[a]	63.29±0.71[a]	72.03±1.15[a]	85.17±1.01[a]
1st day of fast	43.35±0.09	41.04±0.57[b]	51.18±0.35[b]	60.70±1.18[b]	68.64±1.86[b]
2nd day of fast	43.43±0.05	41.42±0.25[b]	39.71±0.27[c]	53.28±3.17[c]	58.77±1.58[c]
3rd day of fast	43.43±0.02	41.58±0.15[b]	39.75±0.19[c]	38.34±0.15[d]	45.03±1.57[d]
4th day of fast	43.35±0.11	41.76±0.32[b]	40.52±0.19[c]	38.43±0.19[d]	36.87±0.25[e]
5th day of fast	43.40±0.06	41.89±0.36[b]	40.52±0.33[c]	37.91±0.28[d]	36.57±0.22[e]
6th day of fast	43.35±0.06	41.02±0.16[b]	40.05±0.22[c]	37.65±0.50[d]	36.23±0.72[e]

Table 6: (continued)

Days of life Treatments	5th day	6th day	7th day	Total BW gain(g)	Mortality rate
Control	96.43±1.90[a]	104.80±3.51[a]	128.73±3.00[a]	85.32±2.97[a]	1/40
1st day of fast	78.92±1.48[b]	87.81±0.90[b]	103.59±1.50[b]	60.24±1.4[b]	1/40
2nd day of fast	68.00±1.71[c]	76.39±1.70[c]	89.97±4.67[c]	46.54±4.62[c]	0/40
3rd day of fast	49.32±1.17[d]	55.11±0.51[d]	64.77±1.32[d]	21.34±1.41[d]	2/40
4th day of fast	44.44±2.56[e]	48.11±3.62[e]	55.88±4.77[e]	12.53±4.69[e]	14/40
5th day of fast	33.23±0.14[f]	33.00±1.00f	00.00±0.00[f]	00.00±0.00[f]	26/40
6th day of fast	34.33±1.20[f]	29.00±0.57[f]	00.00±0.00[f]	00.00±0.00[f]	32/40

chicks fasted over the first 2-d post-hatch period at 3 and 6 weeks of age (Table 7). These results agreed with those reported by Juul-Madsen *et al.* (2004) who found that feed deprivation for 48hrs decreases growth up to 6weeks. This may be due to depression of feed intake and metabolism that lasts to the point of slaughter at 6 weeks of age.

Exp. II: Tabulated in Table 8 showed that chicks fed control diet (23%CP) or low protein diet (21% CP) for 48hrs recorded significantly (P<0.01) higher body weight compared with the other treatments. Moreover, chicks fed control diet for 7 days recorded significantly (P<0.01) the highest body weight and body weight gain. The lowest body weight at 48hrs or 7 days was recorded for chicks fed yolk sac for 48hrs then switched to the control diet. Feeding only residual yolk retarded early body weight gains. This may be interpreted basis on the yolk was so rich and heavy that they simply has not eaten because they were already internally saturated with lipids (the endogenous source of yolk). These results agreed with those reported by Turro *et al.* (1994) who found that the endogenous yolk is not digested in the intestine, but transported directly into circulation. Because yolk is extremely high in lipids, it may have been difficult to digest. This became apparent when a large number of chicks fed an exogenous source of yolk are died. It was extremely difficult for the chicks fed yolk to gain body weight. If the digestion of the exogenous source of yolk had enhanced weight gain or feed efficiency in the early stages of chick development, then a possible implication for industry would be to synthetically devise a yolk diet. In addition, Huey *et al.* (1982) reported that when allowed to select from two diets, chickens will choose the diet which supplies the nutrients which allow more efficient maintenance. Besides, chicks fed ground yellow corn for 48hrs then switched to the control diet recorded lower body weight compared with those fed the control diet; this confirmed with results of Hess, (1999) who mentioned that body weight was reduced in chicks fed ground yellow corn for 4 days compared with those fed complete broiler starter diet. The author concluded that yolk protein and amino acid levels were not sufficient to maintain growth levels. Chicks fed the control diet significantly recorded the highest BWG and the best FC compared with the other treatments at 3 and 6 weeks of age (Table, 7). The reduction in body weight at 48hrs or 7 days is still significant at 3 and 6 weeks of age. These results generally agreed with those reported by Hess (1999). This may be due to depression of feed intake and metabolism that lasts to the point of slaughter at 6 weeks of age.

Exp. III: Presented in Table 8 are chicks fed the control diet (23%CP) for 48hrs or 7 days recorded significantly (P<0.01) the highest body weight and body weight gain compared with the other treatments. Body weight was decreased for chicks given tap water, glucose, electrolyte, amino acids, amino-vit or vitamins at 48hrs or 7 days of age. The absence of feed over the first 2-d post-hatch period retards growth and reduces ultimate meat yield (Halevy *et al.*, 2000). These results agreed with that reported by Noy and Sklan (1999) who found that chicks given water at hatch, body weight was enhanced in the days immediately post hatch, but this effect was transient compared to that feeding nutrients. These results disagreed with those reported by Thaxton and Parkhursl (1976) who found that addition of sucrose to the initial drinking water of broilers resulted in improved overall performance. These authors postulated that early intake of carbohydrates is essential to initiation of growth. Donaldson and Liou (1976) corroborated this hypothesis and gave newly hatched

Table 7: Effect of experimental treatments on growth performance of broiler chicks at 3 and 6 week of age (Exp. I, II and III)

	Growth performance (Exp. I)						
Treatments	Control (T1)	1st day of fasting (T2)	2nd day of fasting (T3)	3rd day of fasting (T4)	4th day of fasting (T5)	5th day of fasting (T6)	$P\leq 0.05$
Body weight gain, 3 week old (g)	610±5.60^{a}	581±9.03^{b}	552±5.89^{c}	472±11.03^{d}	426±3.21^{e}	335±5.17^{f}	0.0001
Feed conversion, 3 week old (g feed/g gain)	1.41±0.01^{e}	1.46±0.01^{d}	1.50±0.01^{cd}	1.55±0.01^{b}	1.54±0.02^{bc}	1.69±0.01^{a}	0.0001
Body weight gain, 6 week old (g)	1830±42.7^{a}	1711±17.8^{b}	1676±7.5^{bc}	1620±14.4^{c}	1478±1.20^{d}	1378±17.4^{e}	0.0001
Feed conversion, 6 week old (g feed/g gain)	1.97±0.02^{d}	2.08±0.00^{cd}	2.14±0.01^{bc}	2.14±0.01b^{c}	2.33±0.01^{ab}	2.22±0.01^{a}	0.0005
	Growth performance (Exp. II)						
Treatments	Control (T1)	Ground corn (T2)	Soybean meal flour (T3)	Yolk Sac (T4)	Fresh Yolk Sac (T5)	Low Protein diet (T6)	$P\leq 0.05$
Body weight gain, 3 week old (g)	610±5.60^{a}	577±2.74^{c}	591±1.90^{b}	572±3.81^{c}	573±3.61^{c}	596±2.98^{b}	0.0001
Feed conversion, 3 week old (g feed/g gain)	1.41±0.01^{b}	1.42±0.02^{b}	1.46±0.01^{b}	1.44±0.01^{b}	1.50±0.02^{ab}	1.56±0.05^{a}	0.0240
Body weight gain, 6 week old (g)	1830±42.7^{a}	1726±15.0^{b}	1726±16.8^{b}	1754±21.71^{c}	1751±12.79^{b}	1763±2.14^{ab}	0.0580
Feed conversion, 6 week old (g feed/g gain)	1.97±0.02^{b}	2.08±0.01^{a}	2.10±0.003^{a}	1.98±0.01^{b}	2.06±0.03^{a}	2.07±0.01^{a}	0.0085

	Growth performance (Exp. III)							
Treatments	Control (T1)	Glucose (T2)	Amino acid (T3)	Vitamins (T4)	Amino-vit (T5)	Electrolyte (T6)	Tapwater (7)	$P\leq 0.05$
Body weight gain, 3 week old, (g)	610±5.60^{a}	490±9.28^{c}	468±3.96^{c}	473±10.82^{c}	551±7.04^{b}	487±9.28^{c}	472±5.19^{c}	0.0001
Feed conversion, 3 week old, (g feed/g gain)	1.41±0.01^{e}	1.62±0.03^{ab}	1.51±0.02^{c}	1.49±0.01^{cd}	1.43±0.03^{bc}	1.56±0.01^{bc}	1.64±0.02^{a}	0.0001
Body weight gain, 6 week old (g)	1830±42.7^{a}	1729±12.688^{b}	1708±9.60b	1702±5.32^{b}	1719±4.77^{b}	1706±0.04^{b}	1672±1.06^{b}	0.0005
Feed conversion, 6 week old (g)	1.97±0.02^{c}	2.03±0.01^{b}	2.56±0.01^{ab}	2.02±0.01^{ab}	2.01±0.01^{bc}	2.02±0.01^{bc}	2.08±0.01^{a}	0.005

Table 8: Effect of experimental treatments on body weight of broiler chicks at 2 and 7 day of age

	Treatments (Exp.II)							
Item	Control (T1)	Ground corn (T2)	Soybean meal flour (T3)	Yolk Sac (T4)	Fresh Yolk Sac (T5)	Low Protein diet (T6)		$P\leq 0$
BW at 2nd day	63.29±0.11^{a}	50.79±0.71^{b}	48.24±1.05^{b}	43.86±1.03^{c}	51.07±1.67^{b}	65.27±1.34^{a}		0.0001
BW at 7th day	128.73±3.00^{a}	105.72±1.43^{bc}	111.36±2.38^{b}	99.45±4.70^{c}	108.9±3.7^{bc}	113.38±0.51^{b}		0.0004
Items	Treatments (EXP.III)							
	Control (T1)	Glucose (T2)	Amino acid (T3)	Vitamins (T4)	Amino-vit (T5)	Electrolyte (T6)	Tap water (7)	$P\leq 0$
BW at 2nd day	63.29±0.11^{a}	40.33±0.74^{c}	40.04±0.41^{c}	40.50±0.28^{c}	40.13±0.21^{c}	47.52±0.88^{b}	40.49±0.68^{c}	0.0001
BW at 7th day	128.73±3.0^{a}	93.16±2.39^{bc}	82.92±4.44^{de}	81.31±1.78^{e}	99.03±3.77^{b}	90.57±1.21^{bcd}	88.50±0.94^{cde}	0.0001

Table 9: Effect of deprived or feeding on weight of liver, heart, and proventriculus with gizzard and length of intestine and two cecuim at the first week of chick's life

Days of life	Starvation				
Treatments	Liver weight (g)	Heart weight (g)	Proventriculus with Gizzard weight (g)	Intestine length (cm)	Length of two cicum
Arrival day	1.40^{a}	0.29^{c}	2.99^{a}	37.00^{c}	2.25^{c}
1st day of fasting	1.40^{a}	0.39^{a}	4.67^{b}	48.94^{a}	2.99^{b}
2nd day of fasting	1.29^{a}	0.34^{b}	4.64^{c}	48.60^{a}	3.13^{a}
3rd day of fasting	0.96^{b}	0.32^{bc}	4.16^{e}	42.66^{b}	2.28^{c}
4th day of fasting	1.05^{b}	0.29^{c}	3.96^{f}	41.55^{b}	1.99^{e}
5th day of fasting	1.04^{b}	0.23^{d}	3.54^{g}	37.99^{c}	2.08^{d}
6th day of fasting	0.00^{c}	0.00^{e}	0.00^{g}	0.00^{d}	0.00^{f}
7th day of fasting	0.00^{c}	0.00^{e}	0.00^{g}	0.00^{d}	0.00^{f}
Days of life	Feeding				
Treatments	Liver weight (g)	Heart weight (g)	Proventriculus with Gizzard weight (g)	Intestine length (cm)	Length of two cicum
Arrival day	1.40^{g}	0.29^{g}	2.99^{g}	37.00^{g}	2.25^{g}
1st day of fasting	1.69^{f}	0.37^{f}	5.17^{f}	49.66^{f}	3.66^{f}
2nd day of fasting	2.08^{e}	0.42^{e}	6.11^{e}	58.17^{e}	3.77^{e}
3rd day of fasting	2.69^{c}	0.51^{d}	6.45^{d}	64.44^{d}	4.02^{d}
4th day of fasting	2.59^{d}	0.50^{d}	6.45^{d}	64.66^{d}	4.41^{c}
5th day of fasting	2.73^{c}	0.56^{c}	6.98^{c}	68.73^{c}	4.39^{c}
6th day of fasting	2.81^{b}	0.68^{b}	7.87^{b}	75.33^{b}	4.85^{b}
7th day of fasting	2.88^{a}	0.76^{a}	8.64^{a}	81.80^{a}	5.16^{a}

Table 10: Effect of deprived or feeding on weight of liver, heart and proventriculus with Gizzard and length of intestine and two cecum at first week of chick's life (EXP II)

Items	Treatments Control (T1)	Ground yellow corn (T2)	Flour soy-bean (T3)	Yolk sac (T4)	Fresh egg yolk (T5)	Low protein diet 21% (T6)	P≤0.05
Liver at 2nd	2.31±0.19^{AB}	2.11±0.11^{ABC}	1.77±0.13^{C}	1.76±0.13^{C}	1.90±0.08^{BC}	2.52±0.15^{A}	0.0126
Heart at 2nd	0.46±0.02^{B}	0.38±0.00^{C}	0.34±0.02^{C}	0.35±0.02^{C}	0.37±0.01^{C}	0.54±0.01^{A}	0.0001
Gizzard at 2nd	5.48±0.25^{B}	4.38±0.11^{C}	2.64±0.14^{E}	3.96±0.05^{CD}	3.92±0.02^{D}	6.37±0.10^{A}	0.0001
Liver at 7th	6.30±0.02^{A}	3.60±0.05^{D}	4.47±0.01^{B}	3.62±0.05^{D}	3.81±0.04^{C}	3.80±0.02^{C}	0.0001
Heart at 7th	1.00±0.01^{A}	0.76±0.01^{E}	0.80±0.01^{D}	0.72±0.01^{E}	0.90±0.01^{B}	0.86±0.01^{C}	0.0001
Gizzard at7th	9.30±0.031^{A}	7.67±0.06^{D}	8.71±0.06^{B}	9.23±0.09^{A}	8.77±0.09^{B}	7.85±0.02^{C}	0.0001
Proventriculus at 2nd	0.78±0.02^{AB}	0.54±0.01^{C}	0.74±0.05^{B}	0.66±0.05^{B}	0.60±0.04^{C}	0.86±0.01^{A}	0.0007
Intestinal at 2nd	61.33±2.40	56.33±1.66	58.00.9	54.0±2.64	56.66±0.88	60.66±3.17	0.1974
Two cecum at 2nd	4.16±0.16^{A}	3.83±0.16^{AB}	3.33±0.16^{BC}	3.00±0.28^{C}	3.00±0.28^{C}	3.83±0.16^{AB}	0.0023
Proventriculus at 7th	1.64±0.01^{A}	1.59±0.02^{A}	1.30±0.05^{BC}	1.20±0.02^{C}	1.65±0.02^{A}	1.35±0.02^{B}	0.0001
Intestinal at 7th	94.00±1.15^{A}	93.00±1.73^{A}	92.66±1.76^{A}	86.00±1.15^{B}	91.00±0.57^{A}	90.00±1.73^{AB}	0.0205
Two cecum at 7th	6.33±0.16^{A}	6.16±0.16^{AB}	5.83±0.16^{ABC}	5.66±0.16^{BC}	5.50±0.28^{C}	6.33±0.16^{A}	0.0374

Table 11: Effect of deprived or feeding on weight of liver, heart, and proventriculus with Gizzard and length of intestine and two cecum at first week of chick's life (EXP III)

Items	Treatments Control (T1)	Glucose (T2)	Amino acid (T3)	Vitamins (T4)	Amino-vit (T5)	Electrolyte (T6)	Water (T7)	P≤0.05
Liver at 2nd	2.31+0.19^{A}	1.54+0.18^{B}	1.66+0.10^{B}	1.27±0.03^{B}	1.50+0.10^{B}	1.23+0.10^{B}	1.32+0.14^{B}	0.0008
Heart at 2nd	0.50±0.02^{A}	0.32±0.03^{B}	0.31±0.01^{B}	0.33±0.02^{B}	0.32±0.02^{B}	0.33±0.02^{B}	0.31±0.02^{B}	0.0016
Gizzard at 2nd	5.48+0.25^{A}	2.89+0.13^{C}	3.14±0.16^{BC}	4.08±0.38^{B}	3.42±0.21^{BC}	3.84±0.38^{BC}	3.96±0.55^{BC}	0.0023
Liver at 7th	5.30±0.02^{A}	4.10±0.04^{B}	3.68±0.04^{CD}	3.62±0.01^{C}	3.74±0.05^{CD}	3.62±0.01^{D}	3.62±0.01^{D}	0.0001
Heart at 7th	1.00±0.01^{B}	1.11±0.01^{A}	0.70±0.01^{D}	0.71±0.01^{D}	0.60±0.01^{E}	0.90±0.01^{C}	0.87±0.01^{C}	0.0001
Gizzard at7th	9.30±0.03^{A}	9.02±0.07^{B}	7.10±0.05^{E}	7.22±0.17^{E}	7.29±0.10^{E}	7.75±0.12^{D}	8.33±0.04^{C}	0.0001
Proventriculus2nd	0.78±0.02^{A}	0.48±0.01^{C}	0.58±0.04^{B}	0.50±0.02^{BC}	0.50±0.01^{BC}	0.46±0.02^{C}	0.48±0.02^{C}	0.0001
Intestinal at 2nd	61.33±2.40^{A}	42.66±1.45^{C}	48.66±2.60^{BC}	52.33±3.52^{B}	46.66±0.88^{BC}	45.00±1.15^{BC}	40.33±4.17^{C}	0.0010
Two cecum 2nd	4.16±0.16^{A}	3.00±0.001^{B}	3.00±0.28^{B}	2.66±0.44^{B}	3.06±0.06^{B}	2.33±0.16^{B}	2.66±0.16^{B}	0.0019
Proventriculus 7th	1.64±0.07^{A}	1.44±0.01^{B}	1.60±0.05^{A}	1.34±0.05^{BC}	1.04±0.01^{D}	1.70±0.05^{A}	1.24±0.03^{C}	0.0001
Intestinal at 7th	92.66±0.66^{B}	95.00±0.57^{A}	82.66±0.88^{C}	81.33±0.33^{C}	72.00±0.57^{D}	83.00±0.57^{C}	83.00±0.57	0.0001
Two cecum 7th	6.16±0.16^{AB}	6.50±0.001^{A}	5.66±0.16^{AB}	6.00±0.16B^{C}	5.16±0.16^{C}	5.33±0.16^{C}	5.23±0.14^{C}	0.0005

chicks single meals of amino acids, fatty acids, or simple sugars to assess activation of fatty acid transferase activity in liver. They found that sugars, but not amino acids and fatty acids, activated the fatty acid transferases. Moreover, glucose surprisingly produced a small response. This may occur because glucose is absorbed with no additional enzymatic activity, which yields no stimulation of intestinal processes and a growth advantage due solely to the energy intake. Chicks fed the control diet significantly recorded the highest BWG and the best FC compared with the other treatments at 3 and 6 weeks of age (Table, 7). The reduction in body weight at 48hrs or 7 days is still significant at 3 and 6 weeks of age. These results generally agreed with those reported by Hess (1999). This may be due to depression of feed intake and metabolism that lasts to the point of slaughter at 6 weeks of age.

Carcass characteristics: Depriving of feed with excess of water from post-hatch chickens significantly (P<0.01) reduced weight of liver, heart, proventriculus with gizzard and length of intestine and two cecum at first week of age (Table 9) compared with those with early access to feed (Exp. I). These results agreed with those reported by Panda *et al.* (2006) who found that feed and water deprivation for 24, 48 and 72 hours after hatching affected gastro- intestinal tract (GIT) development. Moreover, Brink and Rhee (2007) showed that chicks with access to a semi-moist diet for 48 hrs showed significantly longer intestines compared with both the non-fed chicks and the chicks fed dry feed. Under these conditions, the normal increase in total enzyme activity may be delayed and contributed to relatively poor utilization of some dietary constituents. Some lipids, carbohydrates and proteins are utilized less efficiently during the first week or two weeks of age after hatch (Jin *et al.*, 1998; Bedford, 1996).

Early access to feed stimulates the growth of internals organs (liver, heart, proventriculus, gizzard and length of intestine and two cecum). Besides, the digestive and absorptive capacity of the intestine were being inhanced (Exp. I). It has been suggested that the nutrients from the yolk are used in development of the GIT of the embryo (Nitsan *et al.*, 1991b) and 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.*, 1991a); this may be explained why the chicks fed early have higher organs and development of the GIT than the fasting chicks. Results in Table 10 showed that

Table 12: Effect of experimental treatments on carcass characteristic and immune response of broiler chicks at 6weeks of age.

Items	Treatments (Exp.I) Control (T1)	1st day of fasting (T2)	2nd day of fasting (T3)	3rd day of fasting (T4)	4th day of fasting (T5)	5th day of fasting (T6)	P≤0.05
Dressing %	65.26±0.23[ab]	67.65±0.17[a]	65.86±1.30[ab]	67.81±0.95[a]	63.90±1.14[b]	63.79±0.72[b]	0.0216
Abdominal fat %	1.78±0.09	2.15±0.03	1.41±041	1.59±0.09	1.67±0.21	1.63±0.01	0.3520
Immune response	4.66±0.3	3.66±0	3.66±0.33	5.00±0.57	5.00±0.57	4.00±57	0.1120

	Treatments (Exp.II) Control (T1)	Ground corn(T2)	Soybean meal flour (T3)	Yolk Sac (T4)	Fresh Yolk Sac (T5)	Low Protein diet (T6)	P≤0.05
Dressing %	65.26±0.23	64.76±2.07	65.31±0.83	63.37±0.10	63.48±0.18	63.55±2.42	0.069
Abdominal fat %	1.78±0.09	1.57±0.29	1.87±048	1.89±0.31	1.84±0.63	2.03±0.26	0.975
Immune response	4.66±0.30	4.33±0.33	4.66±0.33	4.33±0.33	5.00±0.57	4.33±33	0.771

Items	Treatments (EXP.III) Control (T1)	Glucose (T2)	Amino acid (T3)	Vitamins (T4)	Amino-vit (T5)	Electrolyte (T6)	Tap water (7)	P≤0.05
Dressing %	65.26±0.23	63.00±0.27	63.87±1.07	64.03±1.14	64.63±0.47	64.14±1.15	62.57±0.49	0.3068
Abdominal fat %	1.78±0.09	1.72±0.08	1.81±0.03	1.84±0.14	2.04±0.03	1.69±0.06	1.76±0. 03	0.1417
Immune response	4.66±0.30	4.66±0.66	5.33±0.33	4.00±0.57	3.33±0.33	4.66±0.66	5.00±0.00	0.1377

chicks fed yolk sac or fresh egg yolk for 48hrs then switched to the control diet recorded the lowest liver weight and length of intestine and two cecum compared with the other experimental treatments (Exp. II). Results in Table 11 showed that chicks fed the control diet (23%CP) for 48hrs or 7days recorded significantly (P<0.01) the highest internals organs (liver, heart, proventriculus, with gizzard and length of intestine and two cecum) compared with the other treatments (Exp. III). The carcass characteristics at 6 weeks of age of different experimental treatments are listed in Table 12. The percentage of dressing weight was significantly (P<0.01) reduced by increasing days of fasting (Exp.I). Chicks which were fasting for 4th or 5th day recorded the lowest percentage of dressing weight. This may be due to the absence of feed over the first 2-d post-hatch period retards growth and reduces ultimate meat yield. Furthermore, the reduction in ultimate meat yield observed after 48 hrs of early post-hatch starvation has been associated with a reduction in satellite cell proliferation (Halevy *et al.,* 2000). However, no significant differences were observed in dressing percentage in Exp.II and Exp. III. In addition, no significant differences were observed in abdominal fat between different treatments of experiment I, II and III.

Chick immune response: The chick immune response for different experimental treatments is tabulated in Table 12. No significant differences in antibody titer against SRBC's for chicks deprived of feed for 1, 2, 3, 4, 5, 6 or 7 day in the Exp. I. The same trend was observed in Exp. II and Exp. III. This may be interpreted basis on day-old-chick, with inadequately developed immune system has to depend on the immunity passed by the mother (Larsson *et al.,* 1993). This short-lived immunity, which is often referred as 'passive immunity', is through the immunoglobulins passed on to the chick from mother. The success of passive immunity depends on adequate vaccination and antibody titer of breeding hens. Much of the protein derived from the residual yolk is maternal antibody used for resistance to various pathogens (Dibner *et al.,* 1998a, b).

In conclusion, starvation over the first 2-days post-hatch period retards growth performance and yolk utilization was rapid in fed than in fasting chicks at 1st and 2nd days of age. This study indicates that early feeding complete diet results in considerable performance benefits. Under practical conditions this may be carried out by placing feed in the incubator trays or transportation boxes, or by removing and feeding birds that hatch early.

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