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Effect of Fasting and Early Feeding by Using Hydro-Gel 95 after Hatching on the Growth Parameters of Broiler Chicks

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تأثير التصويم والتغذية المبكرة باستخدام الهلام (Hydro-Gel 95) 95 بعد الفقس في صفات النمو لإفراخ فروج اللحم

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ABSTRACT

Determining the optimal time of fasting and early feeding for broiler chicks is of great importance to improve subsequent productive performance. The purpose of this study is to assess the effect of fasting and early feeding by using Hydro-Gel 95 after hatching on the growth parameters of broiler chicks. A completely randomized design (CRD) has been used for this experiment with a total of 240 one-day-old broilers (Ross 308) divided into four groups. The first group (T1) was a control group that was fed the starter diet after hatching with no supplementation of Hydro-Gel 95. The second group (T2) was fed Hydro-Gel 95 after hatching for two hours only and was then fed the starter diet. The third group (T3) was fed Hydro-Gel 95 after hatching for four hours and was then fed the starter diet. The fourth group (T4) was fed Hydro-Gel 95 after hatching for six hours and was then fed the starter diet. The results of the present experiment indicated that feeding chicks with Hydro-Gel 95 had a significant ($P<0.05$) improvement on the live body weight (LBW), cumulative weight gain, and cumulative feed consumption. The best production index (PI) and economic figure (EF) values at the age of 35 days were found in T4, while T2 and T3 indicated the highest total feed conversion ratios compared to T1 and T4. However, T3 recorded the lowest mortality rate during the total rearing period. The results suggest that feeding Hydro-Gel 95 to broiler chicks for six hours after hatching could improve their growth parameters.

الملخص

يعد تحديد الوقت الأمثل لتصويم أفراخ فروج اللحم (أفراخ الدجاج اللاحم) او التغذية المبكرة ذو أهمية كبيرة لتعزيز الاداء الانتاجي اللاحق، لذا أجريت هذه الدراسة لمعرفة تأثير التصويم والتغذية المبكرة في صفات النمو لفروج اللحم، صممت هذه التجربة باستخدام التصميم العشوائي الكامل (CRD) و استخدم في هذه التجربة 240 فرخا لفروج الحم نوع Ross 308 بعمر يوم واحد , وزعت الأفراخ على 4 معاملات (3 مكررات / معاملة) (20 طير/ مكرر)، وكما يلي: T1: تصويم افراخ هذه المجموعة لمدة 6 ساعات بعد خروجها من ماكنة التفقيس, T2 : قدم لأفراخ هذه المجموعة بعد خروجها من ماكنة التفقيس الجل المغذي (Hydrogel 95) لمدة 2 ساعتين فقط بعد ذلك قدم لها العلف (عليقة البادئ), T3 : قدم لأفراخ هذه المجموعة بعد خروجها من ماكنة التفقيس الجل المغذي (Hydrogel 95) لمدة 4 ساعات فقط بعد ذلك قدم لها العلف (عليقة البادئ), T4 : قدم لأفراخ هذه المجموعة بعد خروجها من ماكنة التفقيس الجل المغذي (Hydrogel 95) لمدة 6 ساعات فقط بعد ذلك قدم لها العلف (عليقة البادئ). أشارت نتائج التحليل الاحصائي الى تفوق طيور المعاملة T4 معنوياً ($P<0.05$) على جميع معاملات التجربة بإعطائها اعلى معدل وزن حي وزيادة وزنية تراكمية ومعدل استهلاك العلف التراكمي وافضل قيم للدليل الإنتاجي والمؤشر الاقتصادي عند عمر 35 يوم، في حين سجلت طيور المعاملتين T2 و T3 افضل معامل تحويل غذائي كلي مقارنة بالمعاملتين T1 و T4, كما سجلت المعاملة T3 اقل نسبة هلاكات خلال مدة التربية الكلية. هذه الدراسة توصي بأهمية استخدام (Hydrogel 95) في تغذية الافراخ بعد خروجها من ماكنة التفقيس لمدة 6 ساعات فقط لأهميته في تحسين الاداء الانتاجي اللاحق للإفراخ الفاقسة.

1. Introduction

Providing water and feeding immediately after hatching has been shown to be an important factor during the first few days after hatching, as it is known to be one of the most important factors in reaching target weight. It is known that the process of hatching in commercial hatcheries extends for approximately 24–48 hours until all the chicks are hatched and that the chicks stay in the hatch machines without water and feeding as a result. Moreover, the process of vaccination and packing in the cages and of transferring the chicks to the production fields lead to delayed provision of water and feeding for more than 24–48 hours. These delays expose the chicks to the stresses of hunger and tissue dehydration, which affects their normal growth (Batal and Parsons, 2002; Tweed, 2005). Consequently, companies have developed new dietary systems for chicks while they are still in the hatching machines. This system is known as early feeding and provides essential nutrients—energy, vitamins, and minerals—that play a significant role in increasing intestinal activity, which is reflected in the chicks' health (Griffiths *et al.,* 1977; Fayyad *et al.,* 2010; Prabakar *et al.,* 2015). Several methods of early feeding have been used, such as spraying food crumbs as pellets at the chicks or mixing the required nutrients with a gel to form a paste and sticking it to the corners of the cages (Naji *et al.,* 2009). Hydro-Gel 95 contains approximately 95% water and nutrients that have been specially designed for poultry chicks to increase their ability to overcome the stress in hatcheries or in transportation from the hatchery to the farm. For this reason, the present study aims to determine the effect of early feeding with Hydro-Gel 95, as well as the optimum duration of early feeding, on the growth parameters of broiler chicks.

2. Materials and Methods

This experiment was conducted at the poultry farm of the Department of Animal Production, Faculty of Agriculture, University of Kufa, for a five-week period from January 15 to February 18, 2018. It was designed using a completely randomized design (CRD) with a total of 240 one-day-old Ross 308 broiler chicks, which were collected from the Al-Anwar Hatchery private company in Babylon, with a primary weight of approximately 42g. The chicks were randomly divided into four cages after they left the hatching machine—counting each cage as one treatment—with 60 chicks per cage, and each cage was divided into three sections, each with 20 birds:

- The first group (T1) was a control group given the starter diet immediately after hatching.
- The second group (T2) was given Hydro-Gel 95 immediately after hatching for two hours only, followed by the starter diet.
- The third group (T3) was given Hydro-Gel 95 immediately after hatching for four hours only, followed by the starter diet.
- The fourth group (T4) was given Hydro-Gel 95 immediately after

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hatching for six hours only, followed by the starter diet.

The Hydro-Gel 95, produced in the USA, was provided by the company's official agent in Saudi Arabia. Every 100g of Hydro-Gel 95 contains 25.6 Kcal ME, 0.3g crude protein, 2.2g carbohydrate, 0.4g sugar, 1.6g crude fiber, 1.9g fat, 95% water, 1.5mg calcium, 0.2mg phosphorus, 54.5mg potassium, and 26.1mg sodium. The chicks were divided into 12 pens—200cm × 150cm per pen—upon their arrival to the farm. A pellet food was used in this experiment provided by Middle Euphrates for poultry food in Najaf.

Table 1: Composition of the basal diets (%).

Ingredient %	Diets	
	Starter	Finisher
Yellow Corn	40	39.45
Wheat	20.5	29.6
Wheat Bran	2.95	3.35
Soybean Meal (48%)	31.3	21
Premix[1]	2.5	2.5
Limestone	0.7	0.7
Salt	0.2	0.2
Dicalcium Phosphate	1.15	1.2
Vegetable Oil	0.7	2
Total	100	100
Calculated nutrient levels %	(NRC, 1994)	
Crude Protein %	22.89	19.12
Energy (Kcal ME/kg)	2958.80	3117.25
Crude Fat %	2.62	3.96
Crude Fiber %	3.97	3.83
Calcium %	1.00	0.82
Available Phosphorus %	0.52	0.39
Methionine %	0.52	0.46
Lysine %	2.35	1.91
Cysteine %	0.44	0.09
Vitamin A (IU/kg feed)	12000	10000
Vitamin D3 (IU/kg feed)	5000	4000
vitamin B2 (Mg /kg feed)	8.60	3.00
vitamin B12 (Mg/kg feed)	17.00	10.00
Vitamin E (IU/kg feed)	6.00	40.00
Vitamin K3 (Mg/kg feed)	3.20	2.00
Energy/Protein Ratio	129.26	163.05

[1]One kg of premix contained 2200 Kcal metabolizable energy (ME)/kg, 45% crude protein, 8% crude fat, 3% crude fiber, 6% calcium, 0.12% phosphorus, 3% lysine, 2% methionine, 2.5% methionine + cystine, 130.000 IU vitamin A, 30.000 IU vitamin D3, 500mg vitamin E, 40mg vitamin K, 30mg vitamin B1, 75mg vitamin B2, 60mg vitamin B6,120mg pantothenic acid, 15mg folic acid, 400mg niacin, 1500mg biotin, 1.7% choline, 1.5% sodium, 450mg ferrous sulfate, 70% copper sulfate, 600mg zinc sulfate, 5mg potassium iodine, 1mg cobalt, and 1mg selenium.

The chicks were housed on floor cages and artificial lighting was provided for 23 hours a day during the experimental period. All chicks were fed the starter diet—22.89% crude protein and 2958.80 Kcal ME/kg—during their first three weeks of life (days 1–21). Then the finisher diet—19.12% crude protein and 3117.25 Kcal ME/kg (Table 1) —was used during the second phase, from days 22–35. A mixture of vitamins and minerals was added to cover the dietary requirements of the chicks in accordance with the Ross 308 broiler management guide. Food and water were offered ad libitum during the experimental period. All four groups were kept under the same management system. Diets were formulated according to the NRC (1994). Mortality was recorded daily, while live body weights (LBWs) and feed intake were recorded at 7, 14, 21, 28, and 35 days of age. Both the body weight gain and the feed conversion ratio were calculated weekly. The production index (PI) and economic figure (EF) values were calculated in accordance with Naji *et al.* (2009):

$$PI = \frac{\text{Average live weight (kg) x Per cent livability (100 - Mortality ratio [%])}}{\text{Feed efficiency (Total quantity of feed consumed (kg)/Total body weight (kg)} \times \text{Growing period (days)} \times 10}$$

$$EF = \frac{\text{Total weight of sold birds (kg)}}{\text{Number of birds at the beginning x Feed efficiency x Growing period (days)}}$$

The data obtained from the study was tested for significance with one-way ANOVA using the SAS (2012) GLM procedures. Differences among treatment means were separated using Duncan's multiple range test (Steel and Torrie, 1980).

3. Results and Discussion

Fasting and early feeding improved the LBW of the chicks; the mean LBW showed a significant difference ($P<0.05$) during the experimental period. In the second week of the experiment, T4 recorded the highest body weight, while T3 had the lowest. No significant difference was found between T1 and T2, as shown in Table 2. In the third week, the LBW of T4 was significantly higher ($P<0.05$) in comparison with all other treatments; no differences were found between T1, T2, and T3. In the fourth and fifth weeks, T4 was superior to all other treatments, reaching 1522g and 2164g/bird, respectively. T1 recorded the lowest LBW weight of 1444g and 2012g/bird, respectively.

Table 2: Effect of fasting and early feeding on LBW of Ross 308 broilers (Mean ± standard error).

Treatments (1)	First week	Second week	Third week	Fourth week	Fifth week
T1	177.66± 0.881	441.0± 0.577 b	899.0± 3.464 b	1444.0± 1.154 d	2012.0± 1.154 d
T2	177.33±1.201	440.0± 1.732 b	904.0±1.154 b	1467.0±0.577 c	2099.0± 0.577 c
T3	181.0± 2.309	433.0± 1.732 c	904.0± 0.577 b	1479.3±1.452 b	2110.0± 2.886 b
T4	178.0± 0.577	453.0± 1.732 a	962.0± 1.154 a	1522.0±1.154 a	2164.0± 1.154 a
Level of sig. (2)	NS	*	*	*	*

(1) T1 was a control group and was given the starter diet immediately after hatching. T2 was given Hydro-Gel 95 immediately after hatching for two hours, followed by the starter diet. T3 was given Hydro-Gel immediately after hatching for four hours, followed by the starter diet. T4 was given Hydro-Gel immediately after hatching for six hours, followed by the starter diet.

(2) * P<0.05: the same letters in the columns mean they were not significantly different.

NS: No significant differences.

Table 3 shows the effect of fasting and early feeding on body weight gain. The results of the statistical analysis indicated significant differences ($P<0.05$) in body weight gain during the second week of life. T4 had a higher percentage of weight gain, recording 275g, while T3 had the lowest, recording 253g. There was no difference between T1 and T2. In the third week, T4 was significantly higher than all other treatments and there were no significant differences between T1, T2, and T3. Additionally, in the fourth week, T4 recorded higher body weight gain, while T1 recorded the lowest rate. The results in the fifth week and in the overall period indicated that T4 was superior over all other treatments; however, T1 recorded the lowest rate of body weight gain. Overall, feeding the newly hatched chicks with Hydro-Gel 95 immediately after hatching for six hours then continuing with the starter diet provided the best weight gain for 35 days. This feeding protocol can be used by poultry companies. The weight gain of the chicks fed with this system dominated the other treatments throughout the five weeks of this study.

Table 3: Effect of fasting and early feeding on body weight gain (g) for Ross 308 broilers (Mean ± standard error).

Treatments (1)	First week	Second week	Third week	Fourth week	Fifth week	Total period
T1	134.0± 0.57	263.0± 1.73 b	458.0± 14.34 b	545.0± 0.57 c	568.0±2.30 c	1968±4.61c
T2	134.0±2.30	262.0± .15 b	464.0±1.15 b	563.0±1.73 b	632.0±0.57 b	2055±17.3 b
T3	136.6±2.02	253.0±2.30 c	471.0±0.57 b	575.0±2.88 a	631.0±0.57 b	2066±5.77 b
T4	134.0±1.00	27 5.0±2.86 a	509.0±2.30 a	560.0±0.57 b	642.0±1.15 a	2120± 8.66 a
Level of sig. (2)	NS	*	*	*	*	*

(1) T1 was a control group and was given the starter diet immediately after hatching. T2 was given Hydro-Gel 95 immediately after hatching for two hours, followed by the starter diet. T3 was given Hydro-Gel immediately after hatching for four hours, followed by the starter diet. T4 was given Hydro-Gel immediately after hatching for six hours, followed by the starter diet.

(2) * P<0.05: the same letters in the columns mean they were not significantly different.

NS: No significant differences.

The feed consumption by the four groups varied largely throughout the five weeks of this study, changing each week. T4 had the highest feed consumption in three weeks of the study, while T1 had the

lowest in three weeks. The four groups exchanged their feed consumption each week (Table 4). At the end of the five weeks, T4 had the highest feed consumption, 2120g, which was significantly different at P<0.05 in comparison with the other groups, while T1 had the lowest at 1968g. It was obvious that the use of Hydro-Gel 95 enhanced the metabolic activity of the newly hatched chicks, as T4 consumed more food and accomplished the highest weight.

Table 4: Effect of fasting and early feeding on feed consumption (g) for Ross 308 broilers (Mean ± standard error).

Treatments (1)	First week	Second week	Third week	Fourth week	Fifth week	Total feed consumption
T1	162± 1.15 b	374± 2.3a	645± 2.88 b	915± 2.88 c	1092± 1.15 d	3188± 0.577d
T2	155± 0.57c	364± 2.3 ab	641± 0.57 b	931± 0.57 b	1148± 0.57 c	3288± 0.577 c
T3	161± 1.15 b	357± 4.0 b	644± 2.30 b	939± 1.73 a	1152± 1.15 b	3253± 0.577 b
T4	165± 0.57a	373± 3.4 a	697± 0.57a	930± 2.88 b	1193±0.57 a	3358± 0.577 a
Level of sig. (2)	*	*	*	*	*	*

(1) T1 was a control group and was given the starter diet immediately after hatching. T2 was given Hydro-Gel 95 immediately after hatching for two hours, followed by the starter diet. T3 was given Hydro-Gel immediately after hatching for four hours, followed by the starter diet. T4 was given Hydro-Gel immediately after hatching for six hours, followed by the starter diet.

(2) * P<0.05: the same letters in the columns mean they were not significantly different.

Therefore, it is worthwhile to try a longer Hydro-Gel 95 treatment, alone or in combination with the starter diet.

The effects of fasting and early feeding on the feed conversion ratio for Ross 308 broilers during this study are presented in Table 5. There was a significant (P <0.05) improvement in the feed conversion ratio for experimental treatments T2, T3, and T4 compared with T1. The results also showed a significant (P <0.05) increase in the values of the total feed conversion ratio of treatments T2 and T3, which were recorded at 1.576 and 1.575, respectively, compared with T4, which was recorded at 1.585, and T1, which was recorded at 1.620.

Table 5: Effect of fasting and early feeding on the feed conversion ratio for Ross 308 broilers (Mean ± standard error).

Treatments (1)	First week	Second week	Third week	Fourth week	Fifth week	Total feed conversion ratio
T1	1.208± 0.0005 b	1.427 ± 0.006 a	1.408± 0.0005 a	1.676 ± 0.001 a	1.923 ± 0.0005 a	1.620 ± 0.000 a
T2	1.157± 0.001 c	1.389 ± 0.001 b	1.381± 8.51 b	1.654 ± 0.001 c	1.816 ± 0.0005 d	1.576 ± 0.0005 c
T3	1.157± 0.001 c	1.417 ± 1.508 a	1.367± 0.001 c	1.633 ± 0.001 d	1.827 ± 0.0005 c	1.575 ± 0.0005 c
T4	1.231± 0.0005 a	1.356 ± 0.003 c	1.369± 0.001 c	1.661 ± 0.0005 b	1.858 ± 0.0005 b	1.585 ± 0.0005 b
Level of sig. (2)	*	*	*	*	*	*

(1) T1 was a control group and was given the starter diet immediately after hatching. T2 was given Hydro-Gel 95 immediately after hatching for two hours, followed by the starter diet. T3 was given Hydro-Gel immediately after hatching for four hours, followed by the starter diet. T4 was given Hydro-Gel immediately after hatching for six hours, followed by the starter diet.
(2) * P<0.05: the same letters in the columns mean they were not significantly different.

There was a significant influence of early feeding with Hydro-Gel 95 in all experimental treatments T2, T3, and T4. The results in Table 6 demonstrate that increasing the Hydrogel 95 feeding period significantly (P<0.05) improved the PI and EF and decreased the total mortality ratio for all experimental treatments compared with the control group T1, which recorded the highest mortality ratio.

Table 6: Effect of fasting and early feeding on total mortality ratio, PI, and EF for Ross 308 broilers (Mean ± standard error).

Treatments (1)	Total mortality ratio	Production index	Economic figure
T1	5.000 a ± 0.577	337 c ± 0.577	374 d ± 2.309
T2	3.200 b ± 0.057	368 b ± 0.577	394 b ± 1.154
T3	1.600 c ± 0.057	377 a ± 0.577	389 c ± 0.577
T4	3.300 b ± 0.115	377 a ± 1.154	404 a ± 1.154
Level of sig. (2)	*	*	*

(1) T1 was a control group and was given the starter diet immediately after hatching. T2 was given Hydro-Gel 95 immediately after hatching for two hours, followed by the starter diet. T3 was given Hydro-Gel immediately after hatching for four hours, followed by the starter diet. T4 was given Hydro-Gel immediately after hatching for six hours, followed by the starter diet.
(2) * P<0.05: the same letters in the columns mean they were not significantly different.

The delay in the provision of feed and water to chicks leads to weight loss, which leads to use of glycogen in the liver and muscles for the processing of food and thermoregulation. This is reflected negatively in body weight and weight gain (Uni and Ferket, 2004), and the chicks may become infected with diseases, which leads to a high rate of mortality (Bar Shira *et al.,* 2005). In contrast, the early feeding of hatched chicks plays an important role in the speed of absorption of the yolk sac, which leads to the development of the gut (Juul-Madsen *et al.,* 2004; Panda and Reddy, 2007) and increases the LBW and body weight gain, which are positive indicators of the evolution of body systems (Sumaidaie, 2010). Chicks that were fed with Hydro-Gel 95—containing 95% water, energy, protein, minerals, and vitamin C that helps in the development of the gastrointestinal tract and improves intestinal absorption, increasing the efficiency of digestive system—showed improvement in their productivity performance and better growth (Zankana and Jasim, 2014). This result concurs with El-Husseiny *et al.* (2008), who indicated significant differences in the LBW of chicks fed a low protein diet within 48 hours after hatching compared to that of chicks that were fasted for the same period. This result is also consistent with that of Al-Diri (2011), who noted a significant increase in LBW, an improvement in the feed conversion ratio, and a decrease in the mortality ratio of chicks that were given a mixed feed consisting of gelatin, containing methionine, lysine, and sugar directly after hatching compared to birds fasted for 12 hours and 24 hours. The results of the study concur with Pourreza *et al.* (2012), who found a significant improvement in the body weight gain when feeding chicks with a diet containing eggs and sugar powder—glucose—during the first 48 hours after hatching compared with chicks that were fed a diet free of eggs or sugar and had been fasted for 48 hours. It also concurs with Zangana and Jasim (2014), who found a significant improvement in the performance of chicks that had been fed using the early feeding method compared to birds that were fasted during the transfer period. Additionally, it concurs with the findings of Prabakar et. al. (2015, 2016), who found that early feeding with egg powder increases the LBW of chicks.

In conclusion, feeding chicks with Hydro-Gel 95 directly after hatching for six hours improved the growth parameters of broiler chickens. When chicks suffer from dehydration in the first day of the post-hatching period, their growth parameters are reduced. This is a result of the exhaustion of the nutrients inside the body, in the yolk sack, or from outside the body, in their diet. When the chicks were fed early with Hydro-Gel 95 to side-step dehydration and foster yolk sac utilization, the intestines rapidly developed and the absorption of nutrients was enhanced. Consequently, the growth parameters were improved. Hydro-Gel 95 has not been used in any commercial feeding recipe in Iraq; therefore, this study strongly suggests its use in the early feeding of broiler chickens.

Biographies

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