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EFFECT OF IN OVO INJECTION BY NUTRITIVE SOLUTIONS AND POST HATCH EARLY FEEDING ON HATCHABILITY, GROWTH PERFORMANCE AND PHYSIOLOGICAL RESPONSE OF LOCAL STRAIN CHICKS

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ABSTRACT: This study included two experiments which conducted to investigate the effect of in ovo injection by nutritive solutions and early feeding in the hatcher on hatchability, growth performance, weights of some body parts, small intestine development, as well as some immune organs and some blood serum constituents in local Sinai strain chicks. A total of 750 hatching eggs used were divided into 6 equal treatments (125 eggs per each). At 18th day of incubation each egg in all treatments except treatment 1 was injected with 0.3 ml solution (1% concentration), of different compounds into amniotic sac through the air sac as follows: negative control without injection (treatment 1), sterile distilled water alone (treatment 2), glucose (treatment 3), methionine (treatment 4), bee bread (treatment 5) and ascorbic acid (treatment 6). Hatched chicks of each treatment were subdivided into two equal groups and reared till 28 days of age. Chicks of first group were fed starter diet in hatcher (early feeding), whereas, chicks of second group were fed same diet after their access to poultry farm (late feeding). All birds were reared till 28 days of age, which recorded live weight and feed intake as well as calculated weight gain and feed conversion during the periods, 0-2, 2-4 and 0-4 weeks of age. Slaughter test was carried out at 5 and 28 days of age for determining some weight of body parts and blood constituents. Results obtained could be summarized as follows:

1- Hatchability of fertile eggs was significantly improved by ovo injection with nutritive solutions as compared to the control.
2- Live weight and feed intake as well as weight gain and feed conversion ratio were significantly improved by early feeding as compared to late feeding, whereas, the

Key Words: Injection, hatch., early feeding, growth, immune organs and small intestine.

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same traits were significantly improved by in ovo injection with nutritive solutions as compared to the control during the experiment periods.

3- Body weight for early feeding group was significant heavier than late feeding group by 8.7%, during overall experimental period (0-28 days of age)

4- Early feeding resulted in a significant improvement in carcass weight as well as edible parts as compared to late feeding, whereas, the same traits were significantly higher for injected groups with nutritive solutions comparing to the control.

5- Lengths of small intestine parts were significantly developed by early feeding as compared to late feeding, whereas, in ovo injection by nutritive solutions resulted in a significant improvement in small intestine lengths as compared to the control.

6- Early feeding resulted in a significant improvement in serum proteins level comparing to late feeding and recorded improvement in injection groups by nutritive solutions comparing to the control.

7- Serum content of total lipids and cholesterol was significantly decreased in chicks which fed in hatcher (early feeding) comparing with chicks fed at their access to poultry farm (late feeding), whereas, in ovo injection by nutritive solutions resulted in same of result comparing by the control.

8- Early feeding resulted in significantly higher of blood hemoglobin level as well as white blood cells count.

Previous results illustrated that it can be by in ovo injection with nutritive solutions at 18th day of incubation and early feeding in the hatcher improved hatchability and nutrition advantage of chicks produced by improving growth and digestion and absorption in the small intestine. Also the best nutrition solutions used were glucose, methionine, bee bread, and ascorbic acid solutions, respectively.

INTRODUCTION

The perinatal period (pre-and post-hatch period) is a critical period in the development of the chick embryo because of its high caloric demand to fuel hatching process and basal metabolism (Ferket and Uni, 2006).

Advancing the use of in ovo injection technology has become a "hot spot" in research today. Beyond vaccines, any number of nutrients or compounds can be provided to the developing embryo via this rout of administration. In ovo injection have created new opportunities to improve the health and development of broiler chickens. Employing the same technology as with vaccination, it is possible to provide developing embryos with exogenous nutrients in a process developed by Uni and Ferket (2003) known as "in ovo feeding". Supplying embryos with exogenous nutrients in ovo may improve hatchability, increase hatched chick weight, and /or the final body weight of broiler through modulating embryo gut morphology (Uni and Ferket, 2003).

One of the major physiological processes occurring during the prenatal period is the maintenance of glucose homeostasis. The glycogen reserves are withdrawn as embryos go through the hatching process (Christensen et al., 1982; Lu et al., 2007). Insufficient glycogen forces the embryo to mobilize more muscle protein for gluconeogenesis, thereby reducing early growth and development (Vieira and Moran, 1999a, b) until the glycogen reserves begin to be replenished when the newly hatched chicks have full

access to feed (Moran, 2007). In birds, the pectoral muscle is the predominant source of protein mobilized to supply amino acids for gluconeogenesis if energy reserves are depleted after hatch (Donaldson., 1995; Lu et al., 2007 and de Oliveira et al., 2009). Bhanja et al. (2005) who found that in ovo glucose injection group of chicks had higher chick weight than sham and un-injected ones. Amitav et al. (2007) showed that chick weight was significantly higher when glucose was deposited either in the yolk sac or amniotic sac than un-injected control group. Glucose injection into egg can be considered as a good solution for using better and easier than other sources of energy for the fantail, therefore, this action causes to reduce the consumption of protein muscle as energy and increasing of newly- hatched chicks (Uni et al., 2005).

Methionine is the first limiting essential amino acid in maize and soybean-based diets (Fancher and Jensen1989) for poultry. Chickens are unable to synthesize methionine in amounts necessary to sustain life and growth. Egg albumen and yolk contain amino acids for the developing embryo. Thus, early provision of nutrients not only affects immediate embryo survival and disease resistance, but also the ultimate attainment of genetic potential. In ovo injection of amino acids may also spare those antibodies from utilization as protein source during embryonic and neonate stage (Ohta et al., 2001and Bhanja et al., 2004). Accelerated enteric development and improved nutritional status afforded by in ovo feeding improved hatching weight, growth rate (Al-Murrani 1982, Ohta et al., 1999 and Bhanja et al., 2004), immune responses (Konashi et al., 2000, Bhanja and Mandal, 2005), gastro-intestinal development (Uni and Ferket, 2004) and meat yield. Bhanja and Mandal (2005) conducluded that in ovo injection of specific amino acids may act as immune modulators and their role in gastrointestinal development needs further research.

Ascorbic Acid (AA) as an anti-stress agent is the most important vitamin (Brake and Pardue, 1998). Chick embryos may be subjected to stress caused by excessive production of heat during the latter stage of egg incubation (Tullett, 1990). Therefore, it may be expected that the injection of AA (3mlg /egg) may be beneficial for compensating embryonic stress (Zakaria and Al-Anezi, 1996)

Bee bread contains practically all the essential amino acids for humans - (phenylalanine, leucine, valine, isoleucine, arginine, histidine, lysine, methionine, proline, threonine, tryptophan), vitamins - (A, B_1, B_2, B_3, B_6, C, E, biotin, folic acid, rutin) and minerals - (calcium, iron, potassium, phosphorus, sodium). Awad et al. (2013) found that Sinai chickens fed 0.5 and 1.0g bee bread /kg diet had significantly heavier body weights as compared to the control group

In commercial poultry operations, chicks hatch over a 2 day period and are transferred from the incubator when majority of them have hatched. Other treatments, such as sexing and vaccination are carried out before the chicks are transported to farms. Thus, under practical conditions, many birds do not have access to feed until 36 to 48 hour after hatching and during this time, chicks weight decreases (Noy and Sklan, 1998). Thus, most hatchlings are fasted for 48 h or more before they reach their first access to feed and water. Holding hatchlings without food and water for more than 24 h has long-lasting negative effects on both broilers and turkeys (Uni and Ferket, 2004; Lu et al., 2007). Vieira and Moran (1999a) reported that newly hatched chicks require a source of energy because there are risks of developing ketosis, dehydration and energy loss with holding time. It has been shown

that residual yolk at 24 hrs. after hatch supplies chicks with only 50% of total energy needs and 43% of protein (Murakami et al., 1988). Therefore, a delay in access to feed and water post-hatch ultimately delays intestinal development and nutrient utilization. Several authors have reported that chicks and poults receiving nutrients immediately upon hatch show enhanced growth (Noy and Sklan, 1998) which was attributed to more rapid gastrointestinal and muscular development in the immediate post hatch period (Noy et al., 1996). The negative effects of delayed post-hatch feeding on the growth performance of broilers were adequately demonstrated by several studies (Halevy et al., 2003 and Uni et al., 2003).

Therefore, the present study was conducted to evaluate the effect of in ovo injection by nutritive solutions and early feeding in hatcher on hatchability, growth performance, development of small intestine, weights of some body parts and blood constituents of local Sinai strain chicks.

MATERIALS AND METHODS

This experimental research was carried out at El-Serw Poultry Research Station, Agricultural Research Center. The experiment was started in February and terminated in April 2014. This study included two experiments which conducted to investigate the effect of in ovo injection by nutritive solutions and early feeding in the hatcher on hatchability, growth performance, small intestine development, weights of some body parts and blood constituents as well as some immune organs in local Sinai strain chicks. A total of 750 hatching eggs were produced from Sinai hens at 50 wks of age. All eggs were collected from the same breeder flock and weighed on a balance with 0.1 g precision and eggs with a weight of 52 ± 1 g were incubated at 37.8 °C and 63% RH. At the 7^{th} and 14^{th} day of incubation, the eggs were candled, and the infertile ones or those containing early dead embryos were recorded then their remove. At the 18^{th} day of incubation each egg of all treatments except treatment 1 was injected with 0.3 ml solution (1% concentration) of different compounds into amniotic sac through the air sac (blunt end of the egg) as follow: negative control without injection (treatment 1), sterile distilled water alone (treatment 2), glucose (treatment 3), methionine (treatment 4), bee bread (treatment 5), ascorbic acid (treatment 6). Eggs were injected through the air cell with a blunt-tip injector needle [18.4 mm length and 1.27 mm bore width (outside diameter)] to target the amnion. The needle provided an injection depth of approximately 2.49 cm from the top of the large end of the egg. The injection whole area was disinfected with an ethyl alcohol; the pinhole site was sealed with sterile paraffin wax immediately after injection. The injected eggs were transferred to the hatcher after the injection. At the 21^{th} day of incubation, late dead embryos were recorded. Hatched chicks of each treatment were divided into two equal groups. Chicks of first group were fed starter diet and water with fluorescent light continuously in hatcher from the 20^{th} day of incubation (early feeding), whereas, holding hatchlings of second group without food and water for more than 24 h to their access to poultry farm which fed same diet (late feeding). Also, chicks each group were weighted at their access to poultry farm. Composition and calculated analysis of the basal starter diet are shown in Table (1). Embryonic mortality (%) was calculated a number of dead embryos as a percentage of fertile eggs, whereas, hatchability (%) was estimated a number of healthy hatched chicks as a percent of fertile eggs. All birds were reared till 28 days of age. All birds were reared till 28

days of age under similar hygienic and managerial conditions. Bird live body weight (LBW) and feed consumption (FC) were recorded for replicates then were averaged and expressed in grams per chick/ 2 wks throughout the experimental periods: 0-2, 2-4 and the overall experimental period (0-4 wks of age). Body weight gain (BWG) and feed conversion ratio (FCR) were calculated during the same periods. At 5 and 28 days of age 4 birds were randomly selected from each treatment group and were slaughtered. Blood samples were collected from jugular vein (3-ml) in heparinized tubes, while anther non-heparinized blood was centrifuged (3500 rpm) for 15 minutes to obtain blood serum. . The following biochemical markers were assayed in blood serum: glucose, cholesterol (Ellefson and Caraway, 1976), triglycerides (Bucolo and David, 1973) and total protein (Peters, 1968). These biochemical determinations of blood serum were performed calorimetrically by using commercial kits. Heamatogical parameters: differential weight blood cells (WBC) counts were performed by using standard avian guidelines introduced by (Ritchie et al. 1994). Total white blood cells were determined by the Unopett method (Campbell, 1995). Leucocyte cells (heterophils (H) and lymphocytes (L)) were counted in different microscopic fields in a total of 200 WBC by the same person, and the H: L ratios were calculated (Gross and Siegel, 1986). After slaughter and complete bleeding, the birds were dressed and the carcass and some other components (liver, gizzard, heart, bursa of Fabricius, spleen, and pancreas) were weighed and the lengths of small intestine parts (duodenum, jejunum and ileum) were record. Dressing percentage = [(Dressed carcass weight/Live body weight) × 100). Relative organ weights were calculated as percentages of body weight = [(Organ weight/Body weight) × 100].

Statistical analysis:

Data obtained were statistically analyzed using the General Liner Model of SAS (2004). Significant differences among means were tested by Duncan's Multiple Range Test Duncan (1955) at 5% level of significance.

All data collected were analyzed by two-way analysis of variance, considering the feeding time and injection treatments as the main effect, using the following model: $Y_{ijk} = \mu + T_i + R_j + (TR)_{ij} + e_{ijk}$ where: Y_{ijk} =an observation; μ = Overall mean; T_i = effect of feeding time (i =1 and 2); R_j = effect of in ovo injection treatments (j = 1, 2, 3…. and 6); $(TR)_{ij}$ = effect of interaction feeding time T_i by in ovo injection treatments R_j and e_{ijk} = random error. The data of hatching were analyzed by one-way analysis of variance using fixed model: $Y_{ij} = \mu + R_j + e_{ij}$ where: Y_{ij} =an observation; μ = Overall mean; R_j = effect of in ovo injection treatments (j =1, 2, 3…. and 6); and e_{ij} = random error.

RESULTS AND DISCUSSION

Hatchability and Embryonic Mortality:

The effects of in ovo injection by nutritive solutions on the hatchability and embryonic mortality results are given in Table (2). Early embryonic mortality (%) (dead embryos at the end of the first and second week of incubation) were 2.34, 2.66, 1.83, 2.50, 2.17 and 2.34 % for the control$^-$, control$^+$, glucose, methionine, Bee bread and Ascorbic acid treatments, respectively. The differences among the groups were not significant. The effect of in ovo injection on the late embryonic mortality (%) (Dead embryos at the end of the third week of incubation) was found to be significant ($P \leq 0.001$). The lowest embryonic mortality during this period was 4% in the glucose treatment group while the highest value 13.17% was recorded for control$^+$ treatment. Control$^-$, control$^+$ and

Methionine treatments did not differ significantly but the difference between control^{+} and other treatments from one side are significant.

The effect of treatment on the hatchability of fertile eggs was found to be significant ($P \leq 0.001$). The highest hatchability record was obtained for the glucose injection group and the lowest are from control^{+}. This result is in accordance with the results of Ingram et al. (1997b), who reported that glucose applied at levels lower than 25 mg increased the hatchability of fertile eggs.

Live body weight and body weight gain:

The effect of feeding time (early or late) for Sinai chicks on some growth performance parameters are shown in Table (3). The data indicated significant differences in body weight at different ages. Average body weight values at 4 weeks of age were 290.6 and 251.7 g for early and late feeding groups respectively. The results of our experiment are in agreement with their reported by Pinchasov (1991) who mentioned that delayed feeding is the main factor affecting growth in broiler chicken. Body weight was increased by 68.5% for early feeding groups, while late feeding groups were increasing by 59.9%.From another point of view, Body weight for early feeding group was significant heavier than late feeding ones by 8.7% during overall experimental period (28 days of age). Moreover, the difference between early and late feeding time were significant differed for body weight gain at different experimental ages. Body weight gain was 253.6g and 215.7 g for early and late feeding times respectively from 0-4 weeks. This result is supported by Kidd et al. (2007) who mentioned that delayed feeding in the first few days of life reduces final body weight. Also, results obtained by Noy and Sklan (1999a) indicated that providing early feeding supplements has been shown to improve body weights, increase satellite cell proliferation (Halevy et al., 2003). Also, the delay in the access to feed and water has been documented to increase susceptibility to pathogens and weight loss leading to poorly starting flocks with reduced weight gains (Noy and Sklan, 1999a); Dibner et al,. 1998). Early feed is important for the development of the digestive and the immune system. It appears to stimulate the development of the gastrointestinal tract (crop, small and large intestine) and to increase the growth performance of birds (Speake et al., 1998).

The effects of in ovo injection by nutritive solutions on body weight and body weight gain results are given in Table (3). The differences among the injection treatments were significant ($P \leq 0.001$). The highest records of live body weight for glucose treatment at different ages were 37.6, 143.9, 311.2 g at 0, 2, 4 weeks respectively, while the lowest values were 35,118.2 and 231.9 g in control^{+} group. The difference between methionine and Bee bread at 4 weeks of age was not significant but between other treatments was significant. This finding is in accordance those reported with by Bhanja et al. (2008) who concluded that glucose injected into eggs gave higher chick weight than sham and un-injected control. Also, Amitav et al. (2007) showed that chick weight was significantly higher when glucose is deposited either in the yolk sac or amniotic sac than un-injected control group.

Body weight gain was significantly differ among between all injection treatments except between methionine and Bee bread from 0 to 4 weeks of age. The body weight gain was higher in glucose treatment than the control^{+} by 39%. Interaction between feeding time and injection treatments had no significant effect on live body weight and body weight gain at different ages except at 0-2 weeks for BWG. Although, early feeding live

body weight and body weight gain were higher than late feeding.

The important role of glycolysis for energy production during the period of embryonic development is well known. Glucose injection into eggs can be a good solution for using better and easier than the sources of energy. Therefore, this action causes to reduce the consumption of protein of muscle as energy, which results in turn the increasing of newly-hatched chick's weight.

Feed consumption (FC) and feed conversion ratio (FCR):

Feed consumption and feed conversion ratio of chicks as affected by feeding time, in ovo injection treatments and their interactions are shown in Table (4). It could be noticed that early feeding chicks consumed significantly higher amount of feed than late feeding chicks at all studied ages. Feed consumption of early feeding was significantly increased by about 8.7% more than those for late feeding during the overall period (0-4wks).The control$^-$ group chicks consumed lower feed (509.2g/chick) than those for other injection treatments during experimental period, while the highest value was recorded with Ascorbic acid injection (532 g/ chick). The differences between control$^-$ and other injection treatments were significant except that for control$^+$ group during all experimental periods. Feed consumption was significantly affected by the interaction between feeding time and injection treatments throughout all experimental periods except that at 0-2 wks of age. Feed conversion ratio was significantly affected by feeding time during all experimental periods (Table 4). It is apparent that chicks of early feeding had significantly better feed conversion ratio than those for late feeding during all experimental periods. The improvement of feed conversion ratio for early feeding group was 7.23% over than late feeding during 0-4 wks of age. In ovo injection treatments had significant ($P \leq 0.001$) effect on feed conversion ratio during all periods. The best result of feed conversion ratio had been realized with ovo injection of glucose compared to other treatments during all experimental periods. Feed conversion ratio was not significantly affected by the interaction between feeding time and injection treatments during all the experimental periods except that at 0-2 wks of age.

Weights of some body parts:

Results of Table (5) show the effect of feeding time; in ovo injection treatments and their interactions on relative weight of breast and thigh (%) of Sinai chicks. Breast and thigh percentages were significantly affected due to early and late feeding time at 5 and 28 days of age. Breast and thigh percentages were significantly higher by 43.37 and 4.93 % respectively for early feeding than that for late feeding at 5 days of age, whereas it appears highly significantly by 15.38 and 3.06% respectively at 28 days of age. Relative weights of breast and thigh (%) were significantly affected by in ovo injection (Table 5). Breast weight was significantly increased by 28.26, 18.48, 14.13 and 7.6% for glucose, methionine, Bee bread and ascorbic acid in ovo injection treatments, respectively as compared to control$^-$. In ovo injection of glucose treatment represented significantly high breast and thigh percentages than other injection treatments at 5 and 28 days of age, while, breast and thigh percentage were significantly low with control$^+$. Thigh percentages were significantly affected by the interaction between feeding time and in ovo injection at 5 and 28 days of age while it is not significant with breast percentage.

Data in Table (6) show that the effect of feeding time, in ovo injection

treatments and their interactions on some digestive system organ weights (%) at 5 and 28 days of age for Sinai chicks. Liver, pancreas and gizzard percentages were significantly differed due to feeding time (early and late) which was significantly higher by 4.83, 30.77 and 2.74 % respectively for early feeding than late feeding at 5 days of age. Moreover these differences were higher in early feeding than late feeding by 3.63, 6.17 and 4.12 % respectively at 28 days of ages. Digestive organs were significantly affected by in ovo injection treatments (Table 6). The high values were recorded with glucose injection at 5 and 28 days of age while the lowest values were detected for control^{+} group at the same mentioned ages. The difference between control^{-}, control^{+}, glucose and methionine were significant for pancreas percentage at 5th day, but the differences did not significant between methionine, Bee bread and ascorbic acid from one side.

Pancreas and gizzard percentages were significantly affected by interaction between feeding time and in ovo injection at 28 days old chicks, while the interactions between feeding time and in ovo injection treatments did not represent any significant difference for liver, pancreas, gizzard at 5 days and for liver at 28 days old chicks.

Some immune organs:

Data manifested in Table (6) clarify some immune organs percentages as affected by feeding time, in ovo injection and their interactions. Bursa and Spleen percentages were significantly ($P\leq0.001$) higher in early feeding chicks than those for late feeding by 4.14 and 41.8 % respectively at 5 days, while, it was significantly higher by 11.07 and 8.5 % at 28 days old. Appropriate nutrition and access to exogenous nutrients immediately after hatch accelerated the development of immune system. It was observed that fasting chicks stimulated the secretion of corticosteroids, which inhibited the immune cell proliferation resulting in low immune response (Dibner et al., 1998).

In ovo injection of glucose resulted in a significant higher Bursa and Spleen percentage than other injection treatments at 5 and 28 days old, while, the low percentage of Bursa and Spleen was obtained with control^{+}. The interaction between feeding time and in ovo injection for Bursa and Spleen at 5 and 28 days old were not significant.

Lengths of small intestine parts:

Data of Table (7) detected that lengths of small intestine (cm) of Sinai chicks for early feeding were significantly higher than those for late feeding system during the experimental periods. This means that small intestine lengths for chicks in early feeding had been increased by 5.58 and 4.9 % more than that for late feeding at 5 and 28 days respectively, This improvement in development of gastro-intestinal tract plays an important role in the growth of chick during early stages as reported by Nir et al. (1996) because immediate access to nutrients stimulated the production of digestive enzymes. Post-hatch deprivation of feed for 24 h delayed the development of jejunum (Bigot et al., 2003).

Regardless of feeding time, in ovo injection treatments seem to have significant ($P\leq0.001$) effect on lengths of small intestine parts during experimental periods (Table 7), where, glucose injection had significantly higher than other treatments. Lengths of duodenum and jejunum were not significantly affected by interaction between feeding time and injection in ovo treatments, but the interaction was significant for length of ileum at 5 days of age, although the interaction with the total small intestine length was significant. On the other hand,

at 28 days old, Lengths of total small intestine was significantly affected by interaction between feeding time and injection treatments although the interaction for duodenum and ileum were not significant.

Some blood constituents:

Effect of feeding time on serum proteins level of Sinai chicks showed significant influence, as early feeding time increased total protein, albumin, and globulin (g/dl) by 7.10, 5.88 and 8.44%, respectively (Table 8). Moreover, the ratio between albumin and globulin were decreased significantly by 1.79% than late feeding at 5 days of age. On the other hand, at 28 days of age, the effect of feeding time on A/G ratio was not significant, while, other studied serum constituents were significantly higher(i.e. total protein, albumin and globulin by 5.76, 4.91 and 6.71% respectively) as compared to late feeding. A significant effect of in ovo injection was noticed on all serum constituents during of all experimental periods (Table 8). Glucose injection had significant higher serum proteins than other treatments at 5 and 28 days of age, while the low values were recorded with control^{+}. The interaction between feeding time and injection treatments was not significantly affected for all studied serum protein constituents.

Serum constituents for chicks of both early and late feeding times were estimated to show the metabolic status and consequently the health of Sinai chicks as affected by in ovo injection and their interactions. Results in Table 9 show no significant effect of feeding time on LDL level, while other studied metabolites were significantly affected. Early feeding chicks had significantly higher serum glucose and HDL concentrations by 3.04 and 1.63% respectively, while late feeding chicks had significantly higher triglyceride and cholesterol values by 2.34 and 2.04%, respectively, at 5 days old chicks. In 28 days old chicks, no significant effect of feeding time on triglyceride and LDL values while glucose, cholesterol and HDL level in serum were significantly affected. Early feeding chicks had significantly higher glucose and HDL values by 2.24and 1.48% respectively; compared with those for late feeding; on the other hand, early feeding resulted in significant lower cholesterol by 1.08%. These results are supported by the findings of Bhanja et al. (2008) who reported that in day-old chicks in ovo injection of glucose had significantly higher levels of serum glucose in broilers. Effect of in ovo injection on some blood metabolites of Sinai chicks were significantly ($P \leq 0.001$) for traits under study except LDL during experimental periods. Serum glucose value was significantly higher in glucose injection treatment at 5 and 28 days old than other treatments, while, triglyceride and cholesterol values were significantly higher for control^{+} treatment at 5 and 28 days, the high value of HDL was recorded with glucose injection at 5 and 28 days old .The interaction between feeding time and in ovo injection had not affected on all studied parameters

Blood hematological traits:

Results of Table (10) indicated that blood hematological traits of Sinai chicks were significantly affected by feeding time at 5 and 28 days of age, early feeding resulted in a significant increase in hemoglobin, total white blood cells count, heterophils and ratio between heterophils to lymphocytes ratio (H/L) by 5.39, 2.80, 3.09 and 6.67% respectively, while lymphocytes (%) was significantly decreased by 0.94% than late feeding at 5 days old. On the other hand , hemoglobin where total blood cells count , heterophils and H/L ratio were significantly higher than late feeding time

by 4.68, 2.77, 2.89 and 3.23% respectively, but lymphocytes (%) was significantly decreased by 0.88% than late feeding at 28 days old. Table 10 shows also that in ovo injection feeding had significant ($P \leq 0.001$) effect on all blood hematological traits under study. The lowest values were recorded with control^{+} for all traits except lymphocyte, it was lower in glucose at 5 and 28 days old, while the highest values were recorded with glucose injection for all traits except lymphocyte, it was higher in control^{+} at 5 and 28 days old. The interaction between feeding time and in ovo injection was not significant for all studied traits of blood hematology, except H/L ratios were significantly affected at both 5 and days of age.

CONCLUSION

In conclusion, in ovo injection with nutritive solution such as glucose, methionine, bee bread and ascorbic acid or early feeding of the chicks in the hatcher could be used for improving hatchability percentage and growth performance through increasing intestinal lengths and immune response.

Table (1): Composition and calculated analysis of the basal diet

Ingredients %	Starter (0-4wks)
Yellow Corn	64.00
Soybean meal (44 %)	32.10
Di-calcium phosphate	1.80
Limestone	1.40
Vit. & Min. premix[1]	0.30
NaCl	0.30
DL. Methionine	0.10
Total	100
Calculated Analysis [2]	
Crude protein %	19.11
ME (Kcal / kg)	2863
Ether extract . %	2.91
Crude fiber %	3.82
Calcium (%)	1.06
Av. phosphorus (%)	0.47
Lysine %	1.10
Methionine %	0.43
Methio + Cyst %	0.75
Sodium	0.13

1- Each 3 kg of the Vit and Min. premix manufactured by Agri-Vit Company, Egypt contains: Vitamin A 10 MIU, Vit. D 2 MIU, Vit E 10 g, Vit. K 2 g, Thiamin 1 g, Riboflavin 5 g, Pyridoxine 1.5 g, Niacin 30 g, Vit. B12 10 mg, Pantothenic acid 10 g, Folic acid 1.5 g, Biotin 50 mg, Choline chloride 250 g, Manganese 60 g, Zinc 50 g, Iron 30 g, Copper 10 g, Iodine 1g, Selenium 0. 10 g, Cobalt 0.10 g. and carrier CaCO3 to 3000 g..

2- According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Effect of in ovo injection by nutritive solutions on hatchability traits of local Sinai hen eggs

Injection treatments[2]	Parameters, %			
	Hatchability of fertile eggs	EEM[1]	LEM[1]	Total EM
C $^{-}$	85.83^{de}	2.34	11.83^{ab}	14.17^{ab}
C $^{+}$	84.17^{e}	2.66	13.17^{a}	15.83^{a}
G	94.17^{a}	1.83	4.00^{e}	5.83^{e}
Met	87.50^{cd}	2.50	10.00^{bc}	12.50^{bc}
BB	90.83^{b}	2..17	7.00^{d}	9.17^{d}
AA	88.33^{c}	2.34	9.33^{c}	11.67^{c}
±SEM[3]	±0.83	±0.11	±0.77	±0.83
Sig.	***	NS	***	***

[1]EEM& LEM = early and late embryonic mortality where: EEM is dead embryos at the end of the first and second week of incubation; LEM is dead embryos at the end of the third week of incubation.

[2]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.

[3]SEM is based on a pooled estimate of variance.

a,bc,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).

Sig. = significance; NS = not significant; *** = $P \leq 0.001$.

Table (3): Live body weight (LBW) and body weight gain (BWG) of chicks as affected by feeding time, in ovo injection treatments and their interactions

Traits / Independent variables		L B W (g) (wks)			BWG (g) (wks)		
		0	**2**	**4**	**0-2**	**2-4**	**0-4**
Feeding time							
Early[1]		37.0^{a}	136.5^{a}	290.6^{a}	99.4^{a}	154.1^{a}	253.6^{a}
Late[2]		36.0^{b}	122.5^{b}	251.7^{b}	86.5^{b}	129.2^{b}	215.7^{b}
±SEM[3]		±0.17	±1.06	±1.96	±1.07	±1.34	± 1.70
Sig.		***	***	***	***	***	***
Injection treatments[4]							
C^{-}		35.5^{c}	119.4^{d}	243.0^{d}	83.8^{d}	123.6^{d}	207.5^{d}
C^{+}		35.0^{c}	118.2^{d}	231.9^{e}	83.2^{d}	113.7^{e}	196.9^{e}
G		37.6^{a}	143.9^{a}	311.2^{a}	106.4^{a}	167.3^{a}	273.6^{a}
Met.		37.2^{ab}	136.1^{b}	287.7^{b}	98.9^{b}	151.6^{b}	250.5^{b}
BB		37.2^{ab}	132.7^{b}	284.8^{b}	95.5^{bc}	152.1^{b}	247.6^{b}
AA		36.5^{b}	126.6^{c}	268.3^{c}	90.1^{c}	141.7^{c}	231.8^{c}
±SEM		±0.30	±1.84	±3.05	±1.86	±2.31	±2.95
Sig.		***	***	***	***	***	***
Interaction							
Early	C^{-}	36.3	122.4	259.3	86.0^{ef}	136.9	222.9
	C^{+}	35.6	127.6	246.8	92.0^{de}	119.1	211.2
	G	37.5	154.5	335.7	117.0^{a}	181.2	298.2
	Met.	37.9	144.0	307.4	106.2^{b}	163.4	269.5
	BB	37.3	138.8	306.5	101.5^{bc}	167.7	269.2
	AA	37.7	131.5	288.1	93.8^{cde}	156.6	250.4
Late	C^{-}	34.7	116.3	226.7	81.6^{fg}	110.4	192.0
	C^{+}	34.4	108.8	217.0	74.1^{g}	108.2	182.6
	G	37.7	133.4	286.8	72.4^{cd}	153.4	249.1
	Met.	36.6	128.1	267.9	95.7^{de}	139.9	231.4
	BB	37.1	126.6	263.1	91.5^{def}	136.5	226.0
	AA	35.3	121.8	248.6	86.4^{ef}	126.8	213.2
±SEM		±0.42	±2.60	±4.31	±2.63	±3.27	±4.17
Sig.		NS	NS	NS	*	NS	NS

[1]Early = in hatcher.
[2]Late = after their access to poultry farm.
[3]SEM is based on a pooled estimate of variance.
[4]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,b,c,e,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; *** = $P \leq 0.001$

Table (4): Feed consumption (FC) and feed conversion ratio (FCR) of chicks as affected by feeding time, in ovo injection treatments and their interactions

Traits / Independent variables		FC (g/ chick) (wks)			FCR (g feed/ g BWG) (wks)		
		0-2	2-4	0-4	0-2	2-4	0-4
Feeding time							
Early[1]		199.0^{a}	345.5^{a}	544.5^{a}	2.02^{b}	2.28^{b}	2.18^{b}
Late[2]		179.9^{b}	320.8^{b}	500.7^{b}	2.09^{a}	2.52^{a}	2.35^{a}
±SEM[3]		±0.87	±1.34	±2.03	±0.02	±0.02	±0.01
Sig.		***	***	***	*	***	***
Injection treatments[4]							
C $^{-}$		184.7^{c}	324.5^{c}	509.2^{c}	2.20^{ab}	2.65^{b}	2.46^{b}
C $^{+}$		186.5^{bc}	326.7^{bc}	513.2^{cb}	2.26^{a}	2.88^{a}	2.61^{a}
G		191.6^{a}	337.3^{a}	530.0^{a}	1.82^{d}	2.03^{e}	1.95^{e}
Met.		189.7^{ab}	332.8^{ab}	522.5^{ab}	1.93^{c}	2.20^{d}	2.09^{d}
BB		191.5^{a}	338.3^{a}	529.9^{a}	2.01^{c}	2.24^{d}	2.15^{d}
AA		192.7^{a}	339.3^{a}	532.0^{a}	2.14^{b}	2.41^{c}	2.30^{c}
±SEM		±1.50	±2.32	±3.52	±0.03	±0.03	±0.02
Sig.		**	***	***	***	***	***
Interaction							
Early	C $^{-}$	194.7	335.0^{bc}	529.7^{bc}	2.26^{b}	2.45	2.38
	C $^{+}$	195.0	335.0^{bc}	530.0^{bc}	2.12^{cde}	2.81	2.51
	G	198.2	344.7^{b}	542.9^{b}	1.70^{h}	1.91	1.82
	Met.	198.4	343.5^{b}	541.9^{b}	1.87^{g}	2.10	2.01
	BB	202.7	355.7^{a}	558.4^{a}	2.00^{efg}	2.12	2.08
	AA	205.1	359.3^{a}	564.4^{a}	2.19^{bc}	2.30	2.26
Late	C $^{-}$	174.7	314.0^{e}	488.7^{e}	2.14^{bcd}	2.85	2.55
	C $^{+}$	178.0	318.3^{e}	496.3^{e}	2.39^{a}	2.94	2.72
	G	185.0	330.0^{cd}	515.0^{cd}	1.94^{fg}	2.15	2.07
	Met.	181.0	322.0^{de}	503.0^{de}	1.98^{efg}	2.31	2.17
	BB	180.3	321.0^{de}	501.3^{de}	2.02^{def}	2.35	2.22
	AA	180.3	319.3^{e}	499.7^{de}	2.09^{cde}	2.52	2.34
±SEM		±2.12	±3.28	±4.98	±0.04	±0.04	±0.03
Sig.		NS	**	**	***	NS	NS

[1]Early = in hatcher.
[2]Late = after their access to poultry farm
[3]SEM is based on a pooled estimate of variance.
[4]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,b,c,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Table (5): Relative weights of breast and thigh of Sinai chicks as affected by feeding time, in ovo injection treatments and their interactions

Traits / Independent variables		Relative weights of some body parts (%)					
		at 5 days old chicks			at 28 days old chicks		
		PSW[1], g	Breast	Thigh	PSW, g	Breast	Thigh
Feeding time							
Early[2]		50.6[a]	11.9[a]	17.0[a]	262.0[a]	22.5[a]	20.2[a]
Late[3]		43.9[b]	8.3[b]	16.2[b]	253.7[b]	19.5[b]	19.6[b]
±SEM[4]		±0.30	±0.08	±0.08	±1.49	±0.09	±0.09
Sig.		***	***	. ***	***	***	***
Injection treatments[5]							
C $^{-}$		45.4[de]	9.2[e]	16.2[d]	240.8[e]	20.5[d]	19.0[e]
C $^{+}$		44.1[d]	8.3[f]	14.0[e]	218.8[f]	19.6[e]	17.9[f]
G		51.4[a]	11.8[a]	18.5[a]	300.2[a]	22.3[a]	22.1[a]
Met.		48.8[b]	10.9[b]	17.7[b]	274.3[b]	21.7[b]	20.9[b]
BB		47.4[bc]	10.5[c]	16.9[c]	262.7[c]	21.2[c]	20.2[c]
AA		46.3[cd]	9.9[d]	16.5[d]	250.4[d]	20.9[cd]	19.4[d]
±SEM		±0.51	±0.14	±0.13	±2.59	±0.16	±0.15
Sig.		***	***	***	***	***	***
Interaction							
Early	C $^{-}$	48.9	10.8	16.6[ef]	245.7	21.8	19.0[gh]
	C $^{+}$	47.0	10.2	15.2[h]	223.2	21.5	18.7[h]
	G	56.3	13.8	18.7[a]	309.0	23.7	22.6[a]
	Met.	52.1	12.5	17.9[bc]	278.6	23.1	21.1[bc]
	BB	50.1	12.2	17.0[de]	264.5	22.5	20.3[de]
	AA	49.4	11.7	16.8[e]	251.0	22.3	19.6[fg]
Late	C $^{-}$	42.0	7.5	15.8[gh]	235.9	19.1	18.9[h]
	C $^{+}$	41.2	6.3	12.9[i]	214.5	17.6	17.0[i]
	G	46.4	9.8	18.2[ab]	291.4	20.8	21.7[b]
	Met.	45.6	9.3	17.4[cd]	270.0	20.2	20.7[cd]
	BB	44.7	8.8	16.8[e]	260.9	19.9	20.0[ef]
	AA	43.2	8.1	16.1[fg]	249.7	19.5	19.3[gh]
±SEM		±0.72	±0.19	±0.19	±3.66	± 0.23	±0.21
Sig.		NS	NS	***	NS	NS	*

[1] PSW = Pre-slaughter weight

[2] Early = in hatcher.

[3]Late = after their access to poultry farm

[4]SEM is based on a pooled estimate of variance.

[5]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.

a,bc,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).

NS = not significant; * = $P \leq 0.05$; *** = $P \leq 0.001$.

Table (6): Digestive and some immune system organs weight (% of live weight) of Sinai chicks as affected by feeding time, in ovo injection treatments and their interactions

Traits / Independent variables		Digestive organs wt. (%)					
		at 5 days old chicks			at 28 days old chicks		
		Liver	Pancreas	Gizzard	Liver	Pancreas	Gizzard
Feeding time							
Early[1]		4.34[a]	0.493[a]	6.00[a]	4.57[a]	0.396[a]	3.79[a]
Late[2]		4.14[b]	0.377[b]	5.84[b]	4.41[b]	0.373[b]	3.64[b]
±SEM[3]		±0.03	±0.003	±0.02	±0.02	±0.002	±0.01
Sig.		***	***	***	***	***	***
Injection treatments[4]							
C $^{-}$		3.80[f]	0.406[d]	5.61[e]	4.24[e]	0.340[e]	3.48[e]
C $^{+}$		3.48[e]	0.373[e]	5.32[f]	3.89[f]	0.292[f]	3.15[f]
G		5.22[a]	0.491[a]	6.59[a]	5.07[a]	0.486[a]	4.28[a]
Met.		4.61[b]	0.461[b]	6.19[b]	4.73[b]	0.427[b]	3.99[b]
BB		4.32[c]	0.446[bc]	5.99[c]	4.57[c]	0.388[c]	3.77[c]
AA		4.04[d]	0.434[c]	5.82[d]	4.43[d]	0.373[d]	3.62[d]
±SEM		±0.06	±0.007	±0.03	±0.04	±0.004	±0.02
Sig.		***	***	***	***	***	***
Interaction							
Early	C $^{-}$	3.88	0.458	5.73	4.30	0.350[f]	3.52[gh]
	C $^{+}$	3.59	0.433	5.42	4.03	0.301[h]	3.34[i]
	G	5.46	0.563	6.73	5.20	0.511[a]	4.38[a]
	Met.	4.63	0.519	6.24	4.78	0.431[c]	4.03[c]
	BB	4.40	0.501	6.02	4.62	0.399[d]	3.83[d]
	AA	4.08	0.487	5.85	4.47	0.385[de]	3.66[ef]
Late	C $^{-}$	3.73	0.354	5.49	4.17	0.331[g]	3.44[h]
	C $^{+}$	3.36	0.314	5.23	3.76	0.284[i]	2.97[j]
	G	4.98	0.420	6.44	4.94	0.461[b]	4.17[b]
	Met.	4.58	0.403	6.14	4.68	0.423[c]	3.96[c]
	BB	4.23	0.391	5.95	4.52	0.378[e]	3.71[e]
	AA	3.99	0.381	5.79	4.39	0.361[f]	3.58[fg]
±SEM		±0.08	±0.007	±0.04	±0.05	±0.005	±0.03
Sig.		NS	NS	NS	NS	*	***

[1]Early = in hatcher.

[2]Late = after their access to poultry farm

[3]SEM is based on a pooled estimate of variance.

[4]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.

a,bc,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).

NS = not significant; * = $P \leq 0.05$; *** = $P \leq 0.001$.

Cont. Table (6):

Traits / Independent variables		Some immune organs wt. (%)			
		at 5 days old chicks		at 28 days old chicks	
		Bursa	Spleen	Bursa	Spleen
Feeding time					
Early[1]		0.327[a]	0.181[a]	0.381[a]	0.485[a]
Late[2]		0.314[b]	0.128[b]	0.343[b]	0.447[b]
±SEM[3]		±0.003	±0.001	±0.004	±0.005
Sig.		***	***	***	***
Injection treatments[4]					
C^-		0.260[e]	0.142[e]	0.296[e]	0.358[e]
C^+		0.226[f]	0.132[f]	0.201[f]	0.296[f]
G		0.463[a]	0.178[a]	0.503[a]	0.643[a]
Met.		0.381[b]	0.169[b]	0.430[b]	0.555[b]
BB		0.310[c]	0.160[c]	0.391[c]	0.486[c]
AA		0.284[d]	0.147[d]	0.349[d]	0.456[d]
±SEM		±0.006	±0.002	±0.007	±0.008
Sig.		***	***	***	***
Interaction					
Early	C^-	0.267	0.169	0.309	0.373
	C^+	0.235	0.160	0.222	0.315
	G	0.465	0.203	0.542	0.677
	Met.	0.391	0.194	0.444	0.570
	BB	0.315	0.187	0.401	0.498
	AA	0.292	0.175	0.366	0.475
Late	C^-	0.253	0.115	0.283	0.342
	C^+	0.217	0.103	0.179	0.278
	G	0.461	0.154	0.465	0.609
	Met.	0.371	0.143	0.416	0.539
	BB	.305	0.133	0.382	0.474
	AA	.276	0.120	0.332	0.438
±SEM		±0.008	±0.002	±0.010	±0.011
Sig.		NS	NS	NS	NS

[1]Early = in hatcher.
[2]Late = after their access to poultry farm
[3]SEM is based on a pooled estimate of variance.
[4]C^- = control negative, C^+ =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,bc,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; *** = $P \leq 0.001$.

Table (7): Lengths of small intestine parts (cm) of Sinai chicks as affected by feeding time, in ovo injection treatments and their interactions

Traits / Independent variables		Lengths of small intestine parts (cm)							
		at 5 days old chicks				at 28 days old chicks			
		Duod.	Jej.	Ileum	Total	Duod.	Jej.	Ileum	Total
Feeding time									
Early[1]		11.8^{a}	23.1^{a}	21.8^{a}	56.7^{a}	19.5^{a}	39.3^{a}	37.5^{a}	96.3^{a}
Late[2]		11.3^{b}	21.9^{b}	20.6^{b}	53.7^{b}	18.5^{b}	38.0^{b}	35.3^{b}	91.8^{b}
±SEM[3]		±0.09	±0.12	±0.13	±0.23	±0.07	±0.24	±0.21	±0.35
Sig.		***	***	***	***	***	***	***	***
Injection treatments[4]									
C $^{-}$		10.9^{c}	20.3^{e}	20.3^{c}	51.5^{e}	17.6^{e}	35.2^{d}	32.8^{e}	85.5^{e}
C $^{+}$		10.0^{d}	18.8^{f}	18.1^{d}	46.9^{f}	16.3^{f}	32.7^{e}	27.8^{d}	76.8^{f}
G		13.3^{a}	26.0^{a}	24.8^{a}	64.1^{a}	22.3^{a}	45.3^{a}	44.8^{a}	112.3^{a}
Met.		12.0^{b}	24.3^{b}	22.0^{b}	58.3^{b}	20.3^{b}	41.2^{b}	39.4^{b}	100.9^{b}
BB		11.8^{b}	23.3^{c}	21.5^{b}	56.6^{c}	18.9^{c}	39.4^{c}	37.8^{c}	96.1^{c}
AA		11.2^{c}	22.3^{d}	20.4^{c}	53.9^{d}	18.5^{d}	38.3^{c}	35.9^{d}	92.6^{d}
±SEM		±0.15	±0.21	±0.22	±0.39	±0.12	±0.41	±0.36	±0.61
Sig.		***	***	***	***	***	***	***	***
Interaction									
Early	C $^{-}$	11.0	20.6	20.8^{de}	52.3^{e}	17.8^{fg}	36.0	33.7^{e}	87.4
	C $^{+}$	10.3	19.7	18.7^{g}	48.6^{g}	17.0^{h}	33.2	30.0^{g}	80.2
	G	14.0	26.6	26.2^{a}	66.8^{a}	22.8^{a}	45.7	45.7^{a}	114.1
	Met.	12.1	24.8	22.3^{c}	59.2^{c}	20.6^{c}	41.7	40.5^{c}	102.8
	BB	12.0	24.3	22.0^{c}	58.3^{c}	19.6^{d}	40.5	38.0^{d}	98.1
	AA	11.3	22.8	20.8^{def}	55.0^{d}	19.0^{e}	39.0	37.0^{d}	95.0
Late	C $^{-}$	10.8	20.0	19.8^{f}	50.7^{f}	17.5^{g}	34.3	31.8^{f}	83.7
	C $^{+}$	9.7	18.0	17.5^{h}	45.2^{h}	15.7^{i}	32.2	25.7^{h}	73.5
	G	12.6	25.5	23.4^{b}	61.5^{b}	21.8^{b}	44.8	43.8^{b}	110.5
	Met.	12.0	23.8	21.7^{cd}	57.5^{c}	20.0^{d}	40.7	38.3^{d}	99.0
	BB	11.7	22.3	20.9^{de}	54.8^{d}	18.3^{f}	38.3	37.5^{d}	94.1
	AA	11.1	21.7	20.0^{ef}	52.8^{e}	18.0^{fg}	37.5	34.8^{e}	90.3
±SEM		±0.22	±0.30	±0.31	±0.55	±0.16	±0.58	±0.50	±0.86
Sig.		NS	NS	*	*	*	NS	*	NS

[1]Early = in hatcher.

[2]Late = after their access to poultry farm

[3]SEM is based on a pooled estimate of variance.

[4]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid,

Met. = methionine, BB= bee bread.

a,bc,.. : means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).

NS = not significant; * = $P \leq 0.05$; *** = $P \leq 0.001$.

Table (8): Effect of feeding time, in ovo injection treatments and their interactions on serum proteins level of Sinai chicks

Traits / Independent variables		Serum proteins level							
		at 5 days old chicks				at 28 days old chicks			
		T. proteins (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A/G ratio	T. proteins (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A/G ratio
Feeding time									
Early[1]		3.47[a]	1.80[a]	1.67[a]	1.10[b]	3.30[a]	1.71[a]	1.59[a]	1.10
Late[2]		3.24[b]	1.70[b]	1.54[b]	1.12[a]	3.12[b]	1.63[b]	1.49[b]	1.11
±SEM[3]		±0.05	±0.02	±0.019	±0.01	±0.04	±0.02	±0.02	±0.01
Sig.		*	***	***	**	**	**	**	NS
Injection treatments[4]									
C -		2.83[d]	1.57[c]	1.26[b]	1.25[b]	2.68[c]	1.49[c]	1.19[b]	1.25[a]
C +		2.76[d]	1.54[c]	1.22[b]	1.27[a]	2.63[c]	1.47[c]	1.16[b]	1.26[a]
G		3.78[a]	2.01[a]	1.76[a]	1.14[b]	3.65[a]	1.94[a]	1.71[a]	1.14[b]
Met.		3.72[ab]	1.97[a]	1.75[a]	1.12[b]	3.59[a]	1.89[a]	1.70[a]	1.12[b]
BB		3.55[bc]	1.71[b]	1.84[a]	0.93[d]	3.40[b]	1.63[b]	1.77[a]	0.92[d]
AA		3.52[c]	1.72[b]	1.80[a]	0.96[c]	3.33[b]	1.62[b]	1.71[a]	0.95[c]
±SEM		±0.09	±0.03	±0.034	±0.01	±.06	±0.03	±0.03	±0.01
Sig.		***	***	***	***	***	***	***	***
Interaction									
Early	C -	2.90	1.61	1.29	1.24	2.75	1.52	1.23	1.23
	C +	2.78	1.56	1.23	1.27	2.64	1.48	1.16	1.27
	G	3.90	2.05	1.85	1.11	3.75	1.98	1.77	1.11
	Met	3.88	2.05	1.83	1.12	3.72	1.96	1.76	1.12
	BB	3.70	1.77	1.93	0.91	3.49	1.68	1.81	0.92
	AA	3.68	1.77	1.90	0.93	3.46	1.68	1.78	0.94
Late	C -	2.76	1.54	1.22	1.26	2.61	1.46	1.15	1.27
	C +	2.74	1.53	1.21	1.26	2.62	1.45	1.16	1.25
	G	3.65	1.97	1.68	1.17	3.54	1.90	1.64	1.16
	Met	3.56	1.88	1.68	1.13	3.46	1.82	1.63	1.12
	BB	3.39	1.64	1.75	0.94	3.30	1.58	1.72	0.92
	AA	3.35	1.66	1.69	0.98	3.20	1.57	1.64	0.96
±SEM		±0.13	±0.05	±0.05	±0.01	±0.09	±0.05	±0.05	±0.01
Sig.		NS	NS	NS	NS	NS	NS	NS	NS

[1]Early = in hatcher.
[2]Late = after their access to poultry farm
[3]SEM is based on a pooled estimate of variance.
[4]C^- = control negative, C^+ =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,bc :means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Table (9): Effect of feeding time, in ovo injection treatments and their interaction on some blood metabolites of Sinai chicks

Traits / Independent variables		Some blood metabolites at 5 days old chicks				
		Glucose (mg/dl)	Trigly. (mg/dl)	Chole. (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
Feeding time						
Early[1]		216.8^{a}	102.6^{b}	171.3^{b}	46.6	87.4^{a}
Late[2]		210.4^{b}	105. 0^{a}	174.8^{a}	47.2	86.0^{b}
±SEM[3]		±1.14	±0.60	±0.61	±0.39	±0.39
Sig.		***	*	***	NS	*
Injection treatments[4]						
C $^{-}$		184.3^{e}	126.1^{a}	182.8^{a}	47.8	82.4^{d}
C $^{+}$		180.0^{e}	127.1^{a}	184.7^{a}	47.9	82.3^{d}
G		251.0^{a}	75.9^{e}	154.4^{e}	46.2	91.7^{a}
Met.		234.5^{b}	85.8^{d}	164.9^{d}	46.4	89.1^{b}
BB		223.5^{c}	98.5^{c}	174.0^{c}	46.4	88.3^{bc}
AA		208.5^{d}	109.4^{b}	177.6^{b}	46.6	86.5^{c}
±SEM		±1.97	±1.04	±1.06	±0.68	±0.67
Sig.		***	***	***	NS	***
Interaction						
Early	C $^{-}$	188.0	125.4	180.5	47.4	82.97
	C $^{+}$	184.0	126.8	183.3	47.6	83.04
	G	254.0	73.9	152.9	45.8	92.61
	Met	240.0	83.8	163.4	46.1	89.73
	BB	225.0	97.0	170.9	46.0	89.03
	AA	210.0	108.7	176.5	46.4	87.17
Late	C $^{-}$	180.7	126.7	185.0	48.1	81.90
	C $^{+}$	176.0	127.3	186.0	48.3	81.64
	G	248.0	77.9	155.9	46.5	90.88
	Met	229.0	87.8	166.4	46.8	88.44
	BB	222.0	100.0	177.0	46.7	87.63
	AA	207.0	110.0	178.6	46.8	85.77
±SEM		±2.79	±1.47	±1.50	±0.96	±0.95
Sig.		NS	NS	NS	NS	NS

[1]Early = in hatcher.
[2]Late = after their access to poultry farm
[3]SEM is based on a pooled estimate of variance.
[4]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,bc :means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Cont. Table (9):

Traits / Independent variables		Some blood metabolites at 28 days old chicks				
		Glucose (mg/dl)	Trigly. (mg/dl)	Chole. (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
Feeding time						
Early[1]		150.5[a]	81.8	118.7[b]	37.9	75.5[a]
Late[2]		147.2[b]	82.2	120.0[a]	38.3	74.4[b]
±SEM[3]		±0.46	±0.31	±0.28	±0.40	0.35
Sig.		***	NS	**	NS	*
Injection treatments[4]						
C^-		124.5[e]	86.1[ab]	125.1[a]	40.0	64.0[e]
C^+		123.5e	87.4[a]	126.1[a]	39.0	65.0[e]
G		180.0[a]	72.9[e]	113.8[c]	36.9	84.0[a]
Met.		167.5[b]	78.8[d]	115.0[c]	37.2	81.8[b]
BB		153.0[c]	81.6[c]	117.4[e]	38.2	78.9[c]
AA		144.5[d]	85.1[b]	118.7[e]	38.2	76.0[d]
±SEM		±0.80	±0.54	±0.48	±0.70	±0.60
Sig.		***	***	***	NS	***
Interaction						
Early	C^-	126.0	85.9	124.3	38.6	64.5
	C^+	125.0	87.1	125.6	38.8	65.3
	G	183.0	72.6	113.0	36.8	85.0
	Met	169.0	78.5	114.7	37.1	82.3
	BB	154.0	81.1	116.8	37.8	79.9
	AA	146.0	85.3	117.7	38.0	76.2
Late	C^-	123.0	86.2	126.0	39.4	63.6
	C^+	122.0	87.7	126.5	39.1	64.6
	G	177.0	73.2	114.6	37.0	83.0
	Met	166.0	79.1	115.4	37.4	81.3
	BB	152.0	82.1	118.0	38.6	78.0
	AA	143.0	84.8	119.6	38.4	75.8
±SEM		±1.13	±0.77	±0.68	±0.99	±0.85
Sig.		NS	NS	NS	NS	NS

[1]Early = in hatcher.
[2]Late = after their access to poultry farm
[3]SEM is based on a pooled estimate of variance.
[4]C^- = control negative, C^+ =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,bc :means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Table (10): Blood hematological traits of Sinai chicks as affected by feeding time, in ovo injection treatments and their interaction

Traits / Independent variables		Blood hematology at 5 days old chicks				
		HB (g/dl)	WBC ($x10^3/mm^3$)	Hetero. (%)	Lymph. (%)	H/L
Feeding time						
Early[1]		10.95[a]	24.59[a]	22.36[a]	70.74[b]	0.32[a]
Late[2]		10.39[b]	23.92[b]	21.69[b]	71.41[a]	0.30[b]
±SEM[3]		±0.10	±0.14	±0.14	±0.14	±0.003
Sig.		***	**	**	**	**
Injection treatments[4]						
C^-		9.93[d]	22.40[d]	20.17[d]	72.93[a]	0.28[d]
C^+		9.33[e]	22.28[d]	20.05[d]	73.05[a]	0.28[d]
G		11.70[a]	26.55[a]	24.32[a]	68.78[d]	0.35[a]
Met		11.30[ab]	25.50[b]	23.27[b]	69.83[c]	0.33[b]
BB		11.15[b]	24.70[c]	22.47[c]	70.63[b]	0.32[c]
AA		10.60[c]	24.08[c]	21.85[c]	71.25[b]	0.31[c]
±SEM		±0.18	±0.25	±0.25	±0.25	±0.005
Sig.		***	***	***	***	***
Interaction						
Early	C^-	10.20	22.50	20.27	72.83	0.28[c]
	C^+	9.80	22.37	20.14	72.96	0.28[c]
	G	11.90	26.80	24.57	68.53	0.36[a]
	Met	11.60	26.60	24.37	68.73	0.36[a]
	BB	11.50	24.80	22.57	70.53	0.32[b]
	AA	10.70	24.47	22.24	70.86	0.31[b]
Late	C^-	9.67	22.30	20.07	73.03	0.28[c]
	C^+	8.87	22.20	19.97	73.13	0.27[c]
	G	11.50	26.30	24.07	69.03	0.35[a]
	Met	11.00	24.40	22.17	70.93	0.31[b]
	BB	10.80	24.60	22.37	70.73	0.32[b]
	AA	10.50	23.70	21.47	71.63	0.30[b]
±SEM		±0.25	±0.35	±0.35	±0.35	±0.006
Sig.		NS	NS	NS	NS	*

[1]Early = in hatcher.

[2]Late = after their access to poultry farm.

[3]SEM is based on a pooled estimate of variance.

[4]C^- = control negative, C^+ =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.

a,bc :means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).

NS = not significant; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Cont. Table (10):

Traits / Independent variables		Blood hematology at 28 days old chicks				
		HB (g/dl)	WBC (x10^3/mm^3)	Hetero. (%)	Lymph. (%)	H/L
Feeding time						
Early[1]		10.97^{a}	26.36^{a}	23.89^{a}	75.11^{a}	0.32^{a}
Late[2]		10.48^{b}	25.65^{b}	23.22^{b}	75.78^{b}	0.31^{b}
±SEM[3]		±0.13	±0.14	±0.14	±0.14	±0.003
Sig.		*	**	**	**	**
Injection treatments[4]						
C $^{-}$		9.98^{de}	24.00^{d}	21.70^{d}	77.30^{a}	0.28^{d}
C $^{+}$		9.36^{e}	23.88^{d}	21.58^{d}	77.42^{a}	0.28^{d}
G		11.90^{a}	28.45^{a}	25.85^{a}	73.15^{d}	0.35^{a}
Met		11.45^{ab}	27.30^{b}	24.80^{b}	74.20^{b}	0.335^{b}
BB		11.08^{bc}	26.50^{c}	24.00^{c}	75.00^{c}	0.32^{c}
AA		10.57^{cd}	25.88^{c}	23.38^{c}	75.62^{c}	0.31^{c}
±SEM		±0.22	±0.25	±0.25	±0.25	±0.004
Sig.		***	***	***	***	***
Interaction						
Early	C $^{-}$	10.26	24.10	21.80	77.20	0.28^{c}
	C $^{+}$	9.83	23.97	21.67	77.33	0.28^{c}
	G	12.10	28.80	26.10	72.90	0.36^{a}
	Met	11.75	28.40	25.90	73.10	0.35^{a}
	BB	11.27	26.60	24.10	74.90	0.32^{b}
	AA	10.58	26.27	23.77	75.23	0.32^{b}
Late	C $^{-}$	9.70	23.90	21.60	77.40	0.28^{c}
	C $^{+}$	8.88	23.80	21.50	77.50	0.28^{c}
	G	11.70	28.10	25.60	73.40	0.35^{a}
	Met	11.15	26.20	23.70	75.30	0.32^{b}
	BB	10.90	26.40	23.90	75.10	0.32^{b}
	AA	10.55	25.50	23.00	76.00	0.30^{b}
±SEM		±0.31	±0.35	±0.35	±0.35	±0.006
Sig.		NS	NS	NS	NS	*

[1]Early = in hatcher.
[2]Late = after their access to poultry farm.
[3]SEM is based on a pooled estimate of variance.
[4]C^{-} = control negative, C^{+} =control positive, G =glucose, AA = ascorbic acid, Met. = methionine, BB= bee bread.
a,bc :means in the same column within each item with different superscripts are significantly different ($P \leq 0.05$).
NS = not significant; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

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الملخص العربي

تأثير حقن بيض التفريخ بالمحاليل المغذية والتغذية المبكرة بعد الفقس على نسبة الفقس واداء النمو والاستجابه الفسيولوجيه فى كتاكيت سلاله محليه

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تضمنت هذه الدراسة تجربتان لبحث تأثير حقن بيض التفريخ بالمحاليل المغذية والتغذية المبكرة بالمفقس على نسبة الفقس وأداء النمو وتطور القناة الهضمية وصفات الذبيحة وبعض مكونات الدم وكذلك الاعضاء المناعية فى سلالة دجاج السينا المحلية. حيث استخدم ٧٥٠ بيضة تفريخ وزعت على ٦ معاملات بواقع ١٢٥ بيضه لكل معامله وعند اليوم ١٨ من التفريخ حقنت كل بيضة فى كل المعاملات فيما عدا المعاملة الاولى بـ ٠,٣ ملى محلول تركيز ١% من المركبات المختلفة فى كيس الامينيون من خلال الغرفة الهوائية كالتالى : مجموعه كنترول سالب بدون حقن (معامله ١) ، مجموعة كنترول موجب حقنت بماء مقطر معقم (معامله ٢) ، جلوكوز (معامله ٣) ، مثيونين (معامله ٤) ، خبز النحل (معامله ٥) ، الاسكوربيك (معامله ٦) وبعد الحقن تم إرجاع البيض إلى المفقس . وعند الفقس تم تقسيم الكتاكيت الناتجة من كل معامله إلى مجموعتين المجموعة الأولى تم تغذيتها بالمفقس (تغذيه مبكرة) والمجموعة الثانية تم تغذيتها بعد وصولها الى المزرعة (تغذيه متأخرة) وتم تربية الكتاكيت الناتجة لمدة ٢٨ يوم حيث تم تسجيل الوزن الحي للكتاكيت الناتجة وكذلك العليقه المستهلكة وحساب معدل الزيادة في الوزن الحي وكفاءة التحويل الغذائي خلال فترة التجربة ، وتم إجراء اختبار ذبح عند عمر ٥ أيام وفى نهاية فترة التجربة (٢٨ يوم من العمر) لأخذ قياسات الذبيحة وكذلك لمعرفة مدى تطور القناة الهضمية وبعض الاعضاء المناعية وتم اخذ عينات الدم خلال الذبح لتقدير بعض مكونات سيرم الدم .

ويمكن تلخيص أهم النتائج التى تم التوصل اليها فيما يلى :

١- تحسن معنوي في نسبة الفقس نتيجة الحقن بالمحاليل المغذية بالمقارنة بمجموعة الكنترول .
٢- تحسن معنوي في وزن الجسم ومعدل الزيادة الوزنيه للجسم وكمية العليقة المأكول لكل كتكوت و كذلك معدل التحويل الغذائي بالتغذية المبكرة بالمقارنة بالتغذية المتأخرة . كما تحسنت نفس الصفات معنويا بالحقن بالمحاليل المغذية المختلفة بالمقارنة بالكنترول خلال فترة التجربة .
٣- وزن الجسم كان اثقل معنويا بحوالى ٨,٧ % بالتغذية المبكرة عن التغذية المتأخرة خلال فترة التجربة (٠- ٢٨ يوم من العمر).
٤- التغذية المبكرة أدت إلى حدوث تحسن معنوي في وزن الذبيحة وكذلك الأجزاء المأكولة بالمقارنة بالتغذية المتأخرة كما أن هذه الصفات كانت اعلي في مجموعات الحقن بالمحاليل المغذية مقارنة بالكنترول.
٥- حدوث تطور ملحوظ في أطوال أجزاء الامعاء الدقيقة في حالة التغذية المبكرة مقارنة بمجموعة التغذية المتأخرة كما إن الحقن بالمحاليل المغذية أدى إلى تحسن معنوي في أطوال الامعاء الدقيقة بالمقارنة بالكنترول .
٦- التغذية المبكرة آدت إلى تحسن معنوي في مستوى بروتينات سيرم الدم مقارنة بالتغذية المتأخرة وتم تسجيل هذا التحسن الملحوظ في مجموعات الحقن بالمحاليل المغذية مقارنة بالكنترول .
٧- حدوث انخفاض معنوي في محتوى سيرم الدم في الكتاكيت التي تم تغذيتها بالمفقس (تغذيه مبكرة) من اللبيدات الكلية والكولسترول مقارنة بالكتاكيت المغذاة عند وصولها الى مزرعة الدواجن (تغذيه متأخرة) كما أن الحقن بالمحاليل المغذية أدى إلى نفس النتيجة مقارنة بالكنترول .
٧- التغذية المبكرة أدت إلى ارتفاع مستوى الهيموجلوبين وكذلك عدد كرات الدم البيضاء مقارنة بالتغذية المتأخرة كما أن الحقن بالمحاليل المغذية أدى إلى ارتفاع هيموجلوبين الدم وأيضا كرات الدم البيضاء مقارنة بمجموعة الكنترول

من النتائج السابقة يتضح انه يمكن وعن طريق الحقن بالمحاليل المغذية في البيضة مثل الجلوكوز والمثيونين وخبز النحل والاسكوربيك أوالتغذية المبكرة فى المفقس يمكن ان يستخدم فى تحسين نسبة الفقس وتحسين أداء النمو من خلال زيادة طول القناة الهضمية وزيادة الاستجابة المناعية للكتاكيت .