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The effects of *in ovo* injection of glucose on characters of hatching and parameters of blood in broiler chickens

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ABSTRACT

The aim of this study was to investigation the effects of in ovo injection of glucose on characters of hatching and parameters of blood in broiler chickens. 576 fertile eggs were divided to four groups; 1) control group (without injection), 2) group including 0.5 ml deionized water (sham group), 3) group including 0.5 ml glucose 20% in deionized water, 4) group including 0.5 ml glucose 25% in deionized water with four replicates per treatment and 36 eggs per replicate. After hatching, characters of hatching and concentration of blood's glucose, triglyceride and cholesterol were determined. Results showed that control group had significantly higher percent of hatching than other groups, but group glucose 20% and 25% as compared with control group and sham group had significantly higher the weight of newly-hatched chickens ($p<0.01$). Amount of blood's glucose on the first, 21st and 42nd had significant difference in group glucose 20% and 25% than other groups ($p<0.01$). In 21 day, group including 0.5 ml glucose 20% had higher amount of blood's triglyceride than other groups ($p<0.01$), but amount of blood's cholesterol hadn't significant difference in broilers. In 42 day, amount of triglyceride and cholesterol hadn't significant difference in broilers. Data Suggest, in ovo injection can be reduced hatchability and increase weight in newly-hatched chickens.

Key words: *In ovo* injection, glucose, characters of hatching, newly-hatched chicks

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INTRODUCTION

Glucose is the major energy source of living organisms [19]. Maintenance of glucose homeostasis during few days pre and post hatch is a great challenge in a chick's life [11]. Establishment of a stable and sufficient glucose status is critical for the late-term embryonic developmental hatching process and posthatch development of poultry until feed consumption is initiated. Toward the end of incubation embryos use their energy reserves to meet the high demand for glucose for fuel hatching activities [7, 10, 12, and 13]. The primary source of glucose needed for hatching activities

is the liver and gluconeogenesis from protein of amnion and muscle. Glycolysis rather than fatty acid oxidation is needed at hatching to provide energy as oxygen supply is limited during the transition from chorioallantois to pulmonary respiration [11]. Hence, the shortage if energy drives of critical body resources (primarily muscle) to provide the energy needed for maintenance, causing decreased body weight (BW), pectoral is reduction and organ weight decline [18]. Therefore, the final days of incubation and the first few days after hatching are a critical period for survival and development of late-term embryos and neonates in poultry because of considerable energy catabolism. Glucose storage as glycogen was demonstrated to be very important energy resource in maintaining the normal metabolism and body growth during pre and post hatching days [6]. To reduce the use of liver glycogen reserves and the depletion of muscle protein we hypothesized that administration of glucose in the albumen of eggs prior to hatch would support the energy status of the hatching by elevating the glycogen reserves, moderating the use of muscle proteins, and thus contributing to enhanced body weight newly-hatched chicks. It has been observed that *in ovo* feeding of carbohydrates into the amnion increase hatching weight in broilers and turkeys [9]. Owing to the importance of *in ovo* feeding and its role in improving the hatching weight, a study was undertaken to examine the effect of *in ovo* injection of glucose on the hatchability characters in broiler breeder eggs.

MATERIALS AND METHODS

This study was carried out Poultry Educational and Research Center of Islamic Azad University, Shabestar branch from 2 July to 29 September 2010. 576 fertile eggs used in the experimental were obtained from (Cobb-500) broiler breeder strain at 28 weeks 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 60 ± 1 g were incubated at 37.8 °C and %63 RH. Then, the eggs were divided to four groups; 1) control group (without injection), 2) group including 0.5 ml deionized water (sham group), 3) group including 0.5 ml glucose 20% in deionized water, 4) group including 0.5 ml glucose 25% in deionized water with four replicates per treatment and 36 eggs per replicate. After hatching, characters of hatching and concentration of blood's glucose, triglyceride and cholesterol were determined. Pure glucose was supplied from Merck Co) Item Catalog Number1 08337.0250). On the 6^{th} day of incubation, the eggs were candled, and the infertile ones or those containing only dead embryos were removed. Then, the injection was carried out on the 7^{th} day in the albumen of eggs. The control group was kept in the same environmental conditions during treatments. The objective of this *in ovo* injected was to determined hatching traits and blood glucose concentration in newly-hatched chicks. After hatching, Percent hatchability was calculated by considering the ratio of chicks hatched to the mortality embryos. Chick hatch weight was determined by weighing all chicks hatched one by one. Blood was collected in non-heparirized blood collection tubes from 24 randomly selected chickens (6 per group) at the age of 1, 21 and 42 days. The blood samples were centrifuged at 3200 g for 5 min, and the serum was transferred into vials and stored at -20 °C until use. The serum samples were analyzed for glucose, cholesterol and triglycerides. All the data obtained were analyzed by using the GLM procedure of SAS software [17]. As per variance, significant differences among treatment means were determined by Duncan's multiple range tests [8].

RESULTS

As shown in Table 1, i*n ovo* injection of glucose had significantly lower percent hatchability than to control group ($P<0.01$). Chicks from eggs injected with 15% and 20% glucose had significantly higher body weight as compared to sham group and control group ($P<0.01$). *In ovo* injection glucose were higher levels of serum glucose as compared with group including 0.5 ml deionized

water and control group on 1st, 21st and 42nd day (P<0.01). On the 21st day of the experiment, group including 0.5 ml glucose 20% had higher amount of blood's triglyceride than other groups (p<0.01), but amount of blood's cholesterol hadn't significant difference in broilers (Table 2). *In ovo* injection glucose had no influence on serum cholesterol and triglyceride in 42 day old chicken (Table 3). Results suggest that *in ovo* injection of glucose at seven days of incubation can improve hatching weight.

Table 1. Effect of *in ovo* injection of glucose on chick weight, percent hatchability and blood glucose concentration in newly-hatched chickens

Groups	Chick weight (g)	Hatchability (%)	blood glucose concentration (mg/dl)
Control	39.22[b]	86[a]	177[b]
Group sham	39.25[b]	72[b]	174[b]
Glucose (20%)	40.36[a]	71[b]	231[a]
Glucose (25%)	40.32[a]	70[b]	235[a]
P-Value	0.0001	0.0008	0.0001
SEM	0.07	1.81	2.29

Table 2. Effect of *in ovo* injection of glucose on concentration of blood's glucose, triglyceride and cholesterol of twenty one-day old broiler chickens

Groups	Triglyceride (mg/dl)	Cholesterol (mg/dl)	Glucose (mg/dl)
Control	124[b]	132	229[b]
Group sham	123[b]	135	225[b]
Glucose (20%)	139[a]	138	243[a]
Glucose (25%)	122[b]	130	240[a]
P-Value	0.005	0.508	0.005
SEM	2.57	4.51	2.85

Table 3. Effect of *in ovo* injection of glucose on concentration of blood's glucose, triglyceride and cholesterol of forty two-day old broiler chickens

Groups	Triglyceride (mg/dl)	Cholesterol (mg/dl)	Glucose (mg/dl)
Control	41	125	124[b]
Group sham	46	113	120[b]
Glucose (20%)	45	127	136[a]
Glucose (25%)	43	120	134[a]
P-Value	0.35	0.475	0.002
SEM	1.94	6.74	2.24

DISCUSSION

Accelerated embryo development and improved nutritional status afforded by *in ovo* feeding have improved hatching weight, growth rate [2, 5 and 15]. Based on the results of this study,

injection of glucose solution in the albumin can be effective tool to increase the weight of newly-hatched chicks without negative effect on hatching rates in chicks was suggested. In the same study showed that injection of glucose in the albumin improved weight of newly-hatched chicks compared with the control group [4]. On the contrary, in the present study injection of glucose in the albumin, reducing the rate of hatching, probably the rate of hatching in treatments 2, 3 and 4 decreases, because of the injection of glucose solution in the albumin could partly cause allergic cavity, that is under the air sac had been causing stopped of breathing and death of developing fetal. Leitao et al. (2008) investigated the effect of *in ovo* injection of glucose in varying levels to broiler eggs on the hatchability, reported that the utilization of 0.6 ml of glucose decreased the hatching rate. Also, Adriana et al. (2006) found that decreased hatchability was observed when chick embryos received glucose *in ovo* injection at 16 days of incubation. Important role of glycolysis cycle is energy production during the period of embryonic. Glucose injection into eggs can be good solution for using better and easier than the source of energy for the fetal. Therefore, this action causes to reduce the consumption of protein of muscle as energy, in result; we will observe the increasing of newly-hatched chicks [20]. Bhanja et al., (2008) concluded that glucose injected into eggs had higher chick weight than sham and un-injected control. Amitav et al., (2007) showed that chick weight had significantly higher when glucose was deposited either in the yolk sac and amniotic sac than un-injected control group. In the current study, observed that was positively relationship between hatching body weight and blood glucose concentration (Table 1). Christensen et al., (2000) reported same results about hatching weights were highly significantly and positively correlated with blood glucose concentrations in newly-hatched chicks.

Bhanja et al., (2008) reported that in day-old chicks *in ovo* injection of glucose had significantly higher levels of serum glucose in broilers. Pilarski et al., (2005) reported that *in ovo* injection of sucrose at 12st days of incubation had no influence on serum cholesterol in 21st and 42nd day old broiler. Also, the content of triglyceride in experimental groups was statistically increased in 21st day old chicken in comparison to the control. However, this difference disappeared on the 42nd day. In the current study, results were corresponded with the reports of Pilarski et al. (2005) about cholesterol and triglycerides of blood broilers.

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