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THE EFFECT OF SUPPLEMENTATION DIFFERENT ADDITIONAL LEVELS OF CHOLINE TO DIET UPON THE PERFORMANCE OF JAPANESE QUAILS

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Abstract

The aim of the present study which was included two experiments investigation the effect of supplementation additional choline above the nutritional requirements (0.00, 10.0, 20.0 and 30.0%) upon the growth performance (first experiment) and egg production traits (the second experiment). Randomly distributed in the first experiment 112 unsexed quail chicks at 10 days age to four dietary treatments,1) basal diet (contained 2000 mg choline /kg diet), 2) basal diet + 200 mg choline / kg diet), 3) basal diet + 400 mg choline /kg diet and 4) basal diet + 600 mg choline /kg diet. The one was designed based on completely randomized designed and in every replicate (cage: 40*30* 30 cm^2) seven chicks were housed at battery system. In the second experiment 80 females of quail at 65days old were randomly distributed to four dietary treatments,1) basal diet contained 1500mg of choline/kg diet, 2) basal diet+150mg choline /kg diet,3) basal diet + 300mg choline / kg diet and 4) basal diet +450mg /kg diet. All the diets were iso energetic and iso nitrogenous. The Results showed the additional 400 and 600 mg of choline led to significant ($P \leq 0.05$) improve the live body weight (LBW) at 54 days old to that quails fed control diet (T1) , also results showed that addition 400mg of choline to the basal diet (T3) significantly ($P \leq 0.05$) enhancement the efficiency conversion ratio (ECR) of feed, protein, energy, methionine and lysine to the birds fed basal diet (T1). Supplementation 300 and 450 mg of choline/kg feed above the nutritional requirements of Japanese quail improved significantly ($P \leq 0.05$) egg production and egg mass.

***Key Word*:** Japanese quail, choline chloride, diet, Performance, cage

Introduction

Choline is a beta-hydroxyl trim ethyl ammonium hydroxide. Choline synthesis for use in the feed industry (Baker *et al*., 1983, Harms and Miles, 1984, Shrivastav *et al*., 2004, and Waldro up *et al*., 2006). The choline is an essential nutrient in the production of phosphatide choline (phosphatidyl choline) represents a large proportion of the body's store of choline (Zeisel, 2012). Phosphatidyl choline is one of the most important structural building blocks of a living cell (Wdhood, 2012). Phosphatidyl is a rrequired component of (VLDL) Particles and with out of adequate phosphatidyl, fat and cholesterol accumulate in the liver (Higdon, 2005). Choline is a precursor for acetyl choline synthesis, the Trans mission agent for impulse along the sympathetic nervous system (Workel *et al*., 2003). Choline is the back bone of a nervous system signal molecule of neuropterans miter called acetyl choline (Rafeeq *et al*., 2011a,b). Acetyl choline is indispensable for central and peripheral nervous system and choline aids fat metabolism in the liver, so preventing abnormal accumulation of fat with in hepatocytes-so-Called "Fatty liver" (Workel *et al*., 2004). It has been shown that choline chloride supplementation significantly decrease the fat accumulation of abdominal fat and liver in the Japanese quail hence prevent fatty liver syndrome in the Japanese quail (Fouladi *et al*., 2012). Several studies on supplementation of choline chloride indicated that dietary choline chloride supplementation at 750 mg/kg diet in broiler chickens had appositive impact on body weight gain , final body weight and conversion; Diet containing 2000 mg/kg feed could be recommended for feeding Japanese quail during the growing period with out adverse effects on growth performance and feed utilization (Alagawany *et al*., 2015). Choline and methionine are interrelated to each others and are possible methyl donors which play important roles in methylation reactions (Pesti *et al*., 1980; Lowry *et al*., 1987; Scharma and Gerrits, 2000; Omara, 2012 and Khairani *et al*., 2016). The aim of this experiment was to find the influence of using different additional levels of choline upon the growth performance parameter and egg performance traits of the Japanese quails.

Materials and Methods

This work was done in Agriculture College – Kirkuk University –Iraq. In the first experiment one hundred and twelve (n=112), at ten day's old, the birds into nutritional treatments were randomly distributed and 28 quail chicks were housed in the each replicate. The numbers of replicates (cages at battery system with demission: 40×30×30 cm for cage) for each treatment were 3.The design of this experiment was a complete randomized. The dietary treatments were supplemented to basal diet which contained 2000mg choline /kg diet

with four additional levels of choline: 0.00, 200mg /kg, 400mg/kg and 600mg/kg (as choline chloride 60%). The diet were enough for the nutritional requirements according to NRC (1994). Feed and water supplied for birds ad libitum. The percentages of the feed stuffs and calculated chemical composition were shown in the table (1) The growth performance traits were calculated recorded.

Table 1: Feed stuffs percentage and chemical composition calculated of experimental diets for growing period.

Feed Stuffs%	**T1(basal diet)**	**T2**	**T3**	**T4**
Ground wheat	59.07	59.04	59.00	58.97
Soybean meal	28.00	28.00	28.00	28.00
Meat and bone meal (40%c.p)	10.00	10.00	10.00	10.00
Sunflower oil	2.00	2.00	2.00	2.00
NaCl	0.20	0.20	0.20	0.20
Vit. And Min. premix	0.10	0.10	0.10	0.10
Enzymespremix	0.10	0.10	0.10	0.10
Chloride choline (60%)	0.33	0.36	0.40	0.43
Chemical composition calculated				
ME(Kcal/kg)	2900	2900	2900	2900
CP (%)	24	24	24	24
Calcium (%)	0.80	0.80	0.80	0.80
Available P(%)	0.30	0.30	0.30	0.30
Methionine (%)	0.50	0.50	0.50	0.50
Lysine (%)	1.30	1.30	1.30	1.30
choline(mg/kg)	2000	2200	2400	2600

In the second experiment 80 females quail at 65 days old and the birds in to nutritional treatments were distributed and four layer quail were housed in the each replicate. The numbers of replicates (cages at battery system with demission: 40*30*30 cm for cage) for each treatment were fife. The design of this experiment was a complete randomized. The dietary treatments (basal diet which contained 1500mg choline /kg diet) were supplemented with four additional levels of choline: 0.00, 150.0, 300.0 and 450.0 mg/kg diet. The diets were enough for the nutritional requirement a according to NRC (1994). Feed and water supplied for birds ad libitum. The percentages of the feed stuffs and calculated chemical composition were shown in table (2). The egg production performance were recorded.

Table 2 : Feed stuffs percentage and chemical composition calculated of experimental diets for egg production period.

Feed stuffs %	**T1(basal diet)**	**T2**	**T3**	**T4**
Ground wheat	62.74	62.71	62.69	62.66
Soybean meal	25	25	25	25
Sunflower oil	4	4	4	4
limestone	5.35	5.35	5.35	5.35
Dicalcium phosphate	1.96	1.96	1.96	1.96
NaCl	0.20	0.20	0.20	0.20
Vit. And Min. premix	0.10	0.10	0.10	0.10
Enzymespremix	0.10	0.10	0.10	0.10
Methionine (%)	0.18	0.18	0.18	0.18
Lysine (%)	0.12	0.12	0.12	0.12
Chloride choline(60%)	0.25	0.28	0.30	0.33
Chemical composition calculated				
ME(Kcal/kg)	2900	2900	2900	2900
CP (%)	20	20	20	20
Calcium (%)	0.80	0.80	0.80	0.80
Available P(%)	0.30	0.30	0.30	0.30
Methionine (%)	0.50	0.50	0.50	0.50
Lysine (%)	1.30	1.30	1.30	1.30
choline(mg/kg)	1500	1650	1800	1950

Results and Discussion

The mean effects of different level of choline upon the growth traits of quails are shown in tables 3,4 and 5. The results in the table (3) Showed adding 400 and 600mg choline/kg as choline chloride into the basal diet (control diet) had led to significant ($p \leq 0.05$) increase the body weight at 54 days and weight gain during 10-54 days and the percentage of increasing for body weight were (8.96, 10.97, and 8.11%) for T2, T3 and T4 respectively by comparing with T1, while the significant($p \leq 0.05$) enhancement percentage in the body weight gain were (11.87, 14.42 and 11.93%)for T2, T3, and T4 comparing with T1. In this experiment, feed intake was decreased with increasing the levels of the choline in the ration. The birds of control treatments had consumed higher amount feed by comparing with the birds of T2, T3 and T4 as shown in table 3. Feed conversion ratio were significantly ($p \leq 0.05$) influenced with the additional choline levels the experiment. The best average of feed conversion ratio of feed, protein, energy, methionine and lysine was for the quails of fourth treatment (T4). The results of the our experiment on line with finding of the studies which noted enhancement the growth traits of the birds by increasing the choline levels inclusion in the rations of the poultry (Snobo, 1990; Shrivastav *et al*., 2004; Hassan *et al*., 2005; Waldroup *et al*., 2005). The Choline is necessary for poultry nutrition because its function as methyl donor (Workel, 2005; Garrow, 2007 and Zhang *et al*., 2013). According to Sun *et al.* (2008), the methionine is a competent amino acid S-adenosyl methionine (SAM).Therefore methyl groups drive form choline chloride can decrease the usage of methionine and methionine can be more efficiently used for protein synthesis (Khairani *et al*., 2011). In quails, Del-vesco *et al*. (2014)found that a methionine deficient diet caused a significant decline in the activity of glutathione (GSH) compared with a diet formulated to meet the requirements for methionine.

Table 2 : Effects of different additional levels of choline upon the body weight(g), body weight gain (g) and percentage of mortality%.

Dietary treatment	Body weight(g) at 54 days age	Body weight gain(g) during experiment period	Mortality (%)
(control diet)T1	195.92 ± 2.77b	146.53 ± 3.42c	7.14
T2	197.02 ± 2.30b	148.70 ± 1.88bc	3.52
T3	206.19 ± 2.01a	159.34 ± 3.46a	7.14
T4	207.76 ± 1.36a	156.76 ± 1.56a	7.14

T1: control, T2: basal diet +200mg choline /kg, T3: basal diet +400mg choline /kg and T4: basal diet +600mg choline /kg.
Mean: values in the same Colum with different letters are significantly different ($p \leq 0.05$).

Table 3 : Effect of different additional levels of choline upon intake of the feed, protein,energy,methionine and lysine.

Dietary treatment	*Intake of :*				
	Feed(g)	Protein(g)	Energy (kcal)	Methionine(g)	Lysine(g)
(control diet)T1	602.59±22.9	144.68±5.5	1747.51±65.4	3.01±0.19	7.83±0.35
T2	574.94±18.3	138.04±4.4	1667.32±52.2	2.87±0.15	7.47±0.28
T3	588.54±25.3	141.30±6.1	1706.76±72.3	2.94±0.21	7.65±0.38
T4	594.54±21.9	142.74±5.2	1724.16±62.5	2.97±0.19	7.73±0.33

T1: control, T2: basal diet +200mg choline /kg, T3: basal diet +400mg choline /kg and T4: basal diet +600mg choline /kg.
Mean: values in the same Colum with different letters are significantly different ($p \leq 0.05$).

Table 4 : Effect of different additional levels of choline upon the efficiency conversion ratio of feed, protein, energy, methionine and lysine.

Dietary treatment	Efficiency conversion ratio of :				
	Feed	Protein	Energy	Methionine	Lysine
(control diet)T1	4.10±0.09a	0.98±0.02a	11.71±0.26a	0.035±0.0008	0.063±0.0014
T2	3.86±0.10ab	0.92±0.03ab	11.02±0.30b	0.033±0.0009	0.059±0.0016
T3	3.69±0.11b	0.88±0.03b	10.52±0.31b	0.031±0.0009	0.056±0.0017
T4	3.79±0.14b	0.91±0.04ab	10.81±0.42ab	0.032±0.0012	0.058±0.0025

T1: control, T2: basal diet +200mg choline /kg, T3: basal diet +400mg choline /kg and T4: basal diet +600mg choline /kg.
Mean: values in the same Colum with different letters are significantly different ($p \leq 0.05$).

Table 5 : Effect of different additional levels of choline upon the Dressing percentage and the visceral organs weight (as percentage of live body weight).

Dietary treatment	Dressing %	Heart%	Liver%	Gizzard%
(control diet)T1	69.42±0.39b	0.88±0.13a	2.07±0.09a	2.08±0.23a
T2	69.56±0.34b	0.91±0.08a	2.11±0.16 a	2.11±0.12a
T3	71.52±0.26a	0.86±0.09a	2.20±0.14a	2.23±0.11a
T4	71.55±0.34a	0.89±0.01a	2.25±0.27 a	2.17±0.19a

T1: control, T2: basal diet +200mg choline /kg, T3: basal diet +400mg choline /kg and T4: basal diet +600mg choline /kg.
Mean: values in the same Column with different letters are significantly different ($p \leq 0.05$).

Table 6 : Effect of different additional levels of choline upon the Feed consumption, egg production, egg weight, egg mass and feed conversion ratio.

Dietary treatment	Egg production (%)	Egg weight(g)	Egg mass (g/bird)	Feed consumption (g/bird/d)	Feed conversion ratio
(control diet)T1	83.57±1.02b	12.30±0.10a	10.28±0.14b		1.98±0.09a
T2	83.91±1.41b	12.54±0.16a	10.52±0.25ab	20.37±0.77a	1.97±0.06a
T3	88.02±0.54a	12.37±0.19a	10.89±0.19ab	20.82±0.72a	1.93±0.06a
T4	88.37±0.92a	12.60±0.08a	11.13±0.16a	21.06±0.54a	1.86±0.05a

T1: control, T2: basal diet +150mg choline /kg, T3: basal diet +300mg choline /kg and T4: basal diet +450mg choline /kg.
Mean: values in the same Colum with different letters are significantly different ($p \leq 0.05$).

The relationship between methionine and choline is the role of choline as a methyl group donor necessary for the formation of methionine from homo cysteine via betaine (Worki, 2005; Garrow, 2007 and Zhang *et al*., 2013). Increased methionine in the diet can maximize egg production for the layer birds (Bunchasak, 2009 and Khairani *et al*., 2016). Choline is also functions as an essential nutrient required by laying quail in influencing the egg production ,because it is a major component in the eggs production performance are presented in Table (7). Dietary supplementation with 300 and 450 mg choline/kg feed contributed to significant ($p \leq 0.05$) increase (5.32% and 5.74%) in average of egg production for T3 and T4 as compared to the T1 (control diet). The egg mass laid by T4 hens had significantly ($p \leq 0.05$) higher as compared to T1 hens high, egg production is usually positively correlated with increasing egg mass, because egg mass is the result of egg production multiplied by egg weight (Sh *et al*., 2013). No significant differences ($p \leq 0.05$) were observed among the hens of the egg weight, feed consumption and feed conversion ratio. The formation of the phospholipid lecithin, a component of the egg yolk. Egg yolk phospholipid is very rich in phosphatidyl choline (Huopalahti *et al*., 2007).

Conclusions

Supplementation the growth diets of unsexed quails with 400 and 600 mg of choline /kg of basal diet which contained 2000mg choline significantly improved body weight ,while efficiency conversion ratio of feed, energy, protein, methionine and lysine were significantly improved by supplementation the basal diet with 400 mg choline/kg basal diet. Egg production and egg mass of quails were significantly increased by supplementation of the basal diet which contained 1500mg choline diet with 300 and 450 mg choline /kg of basal diet.

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