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EFFECTS OF DIETARY CHOLINE CHLORIDE LEVEL ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND BLOODS CHOLESTEROL AND TRIGLYCERIDE CONTENTS OF BROILERS

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SUMMARY

The present work was carried out to study the effect of choline chloride supplementation of the broiler diets on growth performance, carcass quality, and bloods cholesterol and triglyceride in broiler with using three levels of choline chloride. First group fed on basal diet(without choline chloride) act as control, Second group fed on basal diet plus 650mg choline chloride/kg diet **(0 - 3) weeks** and500mg choline chloride **(3 - 6) weeks**, Third group fed on basal diet plus 1300mg choline chloride/kg diet**(0 - 3) weeks** and1000mg choline chloride **(3 - 6) weeks** and fourth group fed on basal diet plus 1950mg choline chloride/kg diet**(0 - 3) weeks**) and1500mg choline chloride **(3 - 6) weeks**.The results revealed that final live body weight, body weight gain, relative growth rate and feed conversion ratio were improved significantly by using choline chloride. The statical analysis of the obtained data showed that no significant difference between all groups in dressing percentage ,leg or breast muscle. However there were significant decrease in abdominal fat and liver weight in treated groups when compared with control group.The present data revealed that serum total cholesterol and LDL reduced significantly in all groups when compared with control and HDL increased significantly but triglyceride reduced numerically in all groups when compared with control.

Keywords: choline chloride, cholesterol, broiler performance, lipoprotein, carcass quality

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INTRODACTION

Choline plays an essential rol in fat metabolism in the liver. it prevents abnormal accumulation of fat (fatty livers) by promoting its transport as lecithin or by increasing the utilization of fatty acids in the liver itself. Choline is added to feed in the form of choline chloride as an essential

component of feed mixture. Choline, betaine and methionine are the most important sources of methyl groups for methyl group transfer. Methyl groups are an essential part of animal diet because they cannot be synthesized by the organism. Moreover, choline is a source of phospholipids and a precursor for acetylcholine. It also has a role in lipid metabolism, which prevents fatty liver. Choline chloride as a dietary supplement improves production and has a considerable influence on the health of broiler chickens.(**Janicki and Buzala .,2011)** Supplementation of choline chloride should also be considered, since it contributes to the preservation and endogenous synthesis of methionine **(Sandoval et al ., 2004)**. liver fat content was significantly reduced in birds given diet containing 760 mg supplemental choline/kg diet **(Rao**.**2001**) . Choline deficiency is a significant contributor to the development of total parenteral nutrition -associated liver disease **(Buchman et al .,2001**).

Addition of choline chloride into the diet of chickens with the feed mixture or as a component of mixed plant protein sources, increased weight gain, percentage survival and feed utilization efficiency.(**Baranova .,1991).**The potential expected effect of the added choline was believed to be masked by limiting factors such as the essential amino acid content of the basal diets, particularly arginine and tryptophan.**(Mohamed ,1998**).choline chloride supplementation can improve the production performance of broilers **(Shen Hong and Huo QiGuang .,1999**). (**Jadhav et al., 2000)** concluded that choline chloride supplementation at 250 g/tonnes feed improved the performance of broilers significantly.**(Fouladi et al .,2008**) showed that choline chloride supplementation at all levels did not significantly affect chilled carcass weight and breast, thigh, gizzard and proventriculus weight. Choline chloride supplementation at 1000 and 500 mg/kg significantly decreased liver, spleen and heart weight and abdominal fat deposition ($p<0.0001$) compared to the basal diet. (**Gangane et al .,2010a,b)** showed that A significant ($P<0.05$) increase in body weight gain and improvement in feed conversion ratio was observed in herbal and synthetic supplement groups as compared to control. An overall improvement in carcass quality parameters was also

evident in treated groups .inclusion of either synthetic choline or herbal source of choline exerted a hypocholesterolemic effect and also decreased the level of triglycerides as compared to untreated control thus minimizing the incidence of fatty liver.

Fouladi et al., (2011) result showed choline chloride supplement in levels of 1000 and 500 mg/kg (T3 and T2, respectively) significantly decrease the livers weight and abdominal fat deposition ($p<0.0001$) in relationship to basal diet, as the 3 treatment include of 1000 mg/kg has a highest effects.**(Das et al .,2011**) found that A significant increase ($P<0.05$) in body weight gain, improved feed conversion ratio, performance index score and economic benefit were observed in synthetic choline than herbal fed groups and control.

The results indicated significantly low ($P<0.05$) blood serum lipid profile i.e. cholesterol and triglycerides level in the birds fed with diet containing synthetic choline chloride than herbal choline and control group. Supplementation of both synthetic and herbal choline chloride resulted in overall improvement of broiler performance, economy and biochemical parameters when compared with control.(.**Fouladi et al .,2012)**found that choline chloride supplement could increase significantly high density lipoprotein cholesterol (HDL) content in blood, and no significantly affected on blood low density lipoprotein cholesterol (LDL) content. Choline chloride supplement was decrease LDL content in blood numerically. This work was to carried out to evaluate the effects of dietary choline chloride level on growth performance, carcass characteristics, bloods cholesterol and triglyceride

MATERIALS AND METHODS

Experimental Birds

Total of 120 one day old Cub Chicks were obtained from the General Egypt Poultry Organization to be used in this experiment. They were divided into 4 equal groups: each group subdivided into 3 replicates. Each replicate housed in a separate compartment. Each compartment was bedded by fresh clean wood shave forming a deep litter of 4 cm

depth and changed every week and provided with continuous lightening program, suitable feeder and water and adjusted to the recommended temperature and humidity. Prophylactic antibiotics and vaccination program against the most common infectious bacterial and viral diseases were carried out.

Experimental diets and feeding design

The present feeding trial was lasted 6 weeks. the diets for different experimental groups were formulated as two phase program (starter and grower) according to NRC (1994) for broiler (table 1), and the applied experimental feeding design according to the level and choline chloride level

Table (1) : Experimental feeding program

Physical composition	Basal diet **(0 -3) weeks**	Basal diet **(3 - 6) weeks**
Yellow corn	69	72
Corn glutine 62%	16.84	14
Fhsh meal72%	8.7	6
Wheat bran	1.5	3.48095
Dicalcium phosphate	2.3	1.5
Lime stone	.7	2
Lysine	.262	.31905
Common salt	0.4	0.4
Premix	0.3	0.3
Chemical composition %		
ME Kcal/kg*	3246.99	3186.93
Crude protein	23.142	20.066
Calcium	1	.9
Available phosphorus	0.45	0.35
Lysine	1.1	1
Methionine + cystine	0.9	.72

The diets were formulated according to **N.R.C. (1994)**.

** The used premix (*Multivita Co.*) composed of vitamin A 12000000 IU, vitamin D_3 2200000 IU, vitamin E 10000 mg, vitamin K_3 2000 mg, vitamin B_1 1000 mg, vitamin B_2 5000 mg, vitamin B_6 1500 mg, vitamin B_{12} 10 mg, Niacin 30000 mg, Biotin 50 mg, Folic acid 1000 mg, Pantothenic acid 10000 mg, Iron 30000 mg, Manganese 60000 mg, Copper 4000 mg, Zinc 50000 mg, Iodine 1000 mg, Cobalt 100 mg, Selenium 100 mg, calcium carbonate ($CaCO_3$) carrier to 3000g .

Table(2):The applied experimental design during the experimental period

Group	Diet
First	Basal diet
Second	Basal diet plus 650mg choline chloride/kg diet (0 - 3) weeks and500mg choline chloride (3 - 6) weeks
Third	Basal diet plus 1300mg choline chloride/kg diet(0 - 3) weeks and1000mg choline chloride (3 - 6) weeks
Fourth	Basal diet plus 1950mg choline chloride/kg diet(0 - 3) weeks) and1500mg choline chloride (3 - 6) weeks

Experimental Parameters

Growth performance measurements: Body weight **(Vohra and Roudybush, 1971)**. Relative growth rate **(Brody,1968)**. Feed conversion ratio **(Lambert et al., 1936)***a*nd body weight gain was calculated by the difference between two successive weeks or periods weights.

Dressing percentage, Total edible carcass %: Abdominal fat, skin plus subcutaneous fat, breast muscle, leg muscle, organ weight and their relative weights to body weight were recorded.

Serum cholesterol **(Schettler et al., 1975)**, Serum triglycerides **(Fossatip, 1982)**. Serum HDL (high density lipoprotein) and serum LDL (Low density lipoprotein), **(Young, 1995)**

Statistical analysis

The analysis of variance for the obtained data was performed by student T.test using statistical analysis system: **(SAS, 1987)** to assess significant differences.

RESULTS AND DISCUSSION

Growth Performance

Live body weight, body weight gain, and relative growth rate and feed conversion ratio data are summarized in *Table (3):*

Table (3): Summary of Influence of choline chloride level supplementation on growth performance during experimental period

Parameters	Group			
	First	**Second**	**Third**	**Fourth**
Cumulative initial body weight	48.54±0.24	47.84±0.31	47.03±0.31	47.72±0.38
Cumulative final body weight	2134.31±40.77	2144.96±44.30	*** 2315.71±27.60	*** 2273.93±37.51
Cumulative total body gain	2085.53±40.77	2096.88±44.16	*** 2268.58±27.32	*** 2226.08±37.27
Relative growth rate (RGR)	191.10±10.04	191.27± 10.04	192.03±10.01	191.77±10.03
Cumulative avarage F.C.R.	2.16±0.16	2.16±0.16	*** 1.94±0.14	*** 1.90±0.14

Means ±standard .Error

,*,**,*** significant at (P < 0.05, <0.01, and<0.001). respectively

The obtained data indicated positive effect of dietary supplementation of choline chloride on growth performance represented by the final live body weight, body weight gain, Relative growth rate and Feed conversion ratio. All parameters were increased significantly in groups fed on diets supplemented with choline chloride 1300mg and 1950mg choline chloride/kg diet respectively when compared with control or the group fed on diet supplemented with choline chloride 650mg choline chloride/kg diet we noticed that the best results were obtained in the group fed on diet supplemented with choline chloride 1300mg choline chloride/kg diet

The previous result agree with those obtained by **Baranova (1991)**who reported that Addition of choline chloride into the diet of chickens with the feed mixture or as a component of mixed plant protein sources, increased weight gain, percentage survival and feed utilization efficiency.This results supported by those obtained by **(Shen Hong and Huo QiGuang 1999)** and **Gangane et al., (2010**) who found that A significant (P<0.05) increase in body weight gain and improvement in FCR was observed in herbal and synthetic supplement groups as

compared to control. Also our results in harmony with those obtained by. **Das et al (2011**) and **Janicki and Buzala (2011)** who concluded that Choline chloride as a dietary supplement improves production and has a considerable influence on the health of broiler

Carcass Characteristics

Table (4): Influence of choline chloride level supplementation on Carcass traits percentage at the end of experimental period (Relative weight)

Group / Item	Group			
	First	**Second**	**Third**	**Fourth**
Dressing %	71.58±0.82	73.51±5.95	74.33±1.62	74.57±3.51
Head %	2.94±0.12	3.01±0.04	2.99±0.07	3.10±0.12
Liver %	2.31±0.05	2.07±0.05	*** 1.89±0.05	*** 1.99±0.03
Heart %	0.46±0.01	0.46±0.01	0.42±0.02	0.42±0.01
Gizzard %	1.81±0.07	1.83±0.05	1.78±0.01	1.85±0.05
Breast Muscle %	17.29±0.67	17.12±0.03	17.42±0.18	17.78±0.15
Leg Muscle %	16.75±0.35	16.82±0.22	16.73±0.33	16.87±0.01
Abdominal Fat %	1.36±0.15	*** 0.65±0.11	*** 0.60±0.07	*** 0.69±0.12

Means ±standard .Error

,*,**, *** significant at (P < 0.05, <0.01, and<0.001). respectively

The statistical analysis of the obtained data showed that no significant difference between all groups in dressing percentage, leg or breast muscle.

However there were significant decrease in abdominal fat and liver weight in treated groups when compared with control group. The previous findings are in agreement with those obtained by **Fouladi et al (2008**) who found that choline chloride supplementation at all levels did not significantly affect chilled carcass weight and breast, thigh, gizzard and proventriculus weight. Choline chloride supplementation at 1000 and 500 mg/kg significantly decreased liver and abdominal fat deposition. These results confirmed also by **Fouladi et al(2011)** the Result showed choline chloride supplement in all levels not significantly effects on the chilled carcass weight, breasts, thighs weight and gizzards, spleen, hearts and proventriculus weight not affected whit all of treatments. But result showed choline chloride supplement in levels of 1000 and 500 mg/kg significantly decrease the livers weight and abdominal fat deposition. The previous findings in harmony with those obtained by **Rao**, **(2001)** who reported that liver fat content was significantly reduced in birds given diet containing 760 mg supplemental choline/kg diet.

Cholesterol and triglyceride

Table (5) Summary of Influence of choline chloride level supplementation on bloods cholesterol and triglyceride at the end of experimental period

Parameters	Group			
	First	**Second**	**Third**	**Fourth**
Cholesterol	122.67±3.28	*** 107.67±3.18	*** 107.33±4.33	*** 106.33±7.75
HDL	67.33±1.20	69.33±1.86	*** 71.67±1.33	* 69.33±0.88
LDL	30.67±2.19	*** 14.67±0.88	*** 12.33±2.40	*** 18.00±1.73
TRIGLYCIDE	123.33±1.67	118.33±10.14	116.67±4.41	118.33±8.33

Means ±standard .Error

, * ,**,*** significant at (P < 0.05, <0.01, and<0.001). respectively

The present data revealed that serum total cholesterol and LDL reduced significantly in all groups when compared with control and HDL increased significantly but triglyceride reduced numerically in all groups when compared with control. Our results are in agreement to those

obtained by **Gangane et al (2010)** who recorded that inclusion of either synthetic choline or herbal source of choline exerted a hypocholesterolemic effect and also decreased the level of triglycerides as compared to untreated control thus minimizing the incidence of fatty liver.

In contrast to our result **Jadhav et al(2000)** who reported that Choline chloride supplementation had no significant effect on blood cholesterol level. . The results partially disagree with those obtained by **Fouladi et al (2012)** who reported that choline chloride supplement could increase significantly high density lipoprotein cholesterol (HDL) content in blood, and no significantly affected on blood low density lipoprotein cholesterol (LDL) content. Choline chloride supplement was decrease LDL content in blood numerically.

CONCLUSION

It could be concluded that choline chloride supplementation improved growth performance of broilers significantly improved carcass quality, serum total cholesterol and LDL reduced significantly and HDL increased significantly but triglyceride reduced numerically .

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الملخـــــــص العربـــــى

تأثير إضافة كولين كلورا يد في العليقة على كفاءة النمو ومواصفات الذبيحة ومستوى الكولسترول والدهون الثلاثية في الدم في بداري التسمين

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تتجه أنظار الباحثين إلى تحسين جودة اللحوم لما في ذلك من مردود أيحابى على صحة الإنسان وذلك باستخدام بعض المركبات التي تؤدى الى تخفيض الدهون بصفة عامة والكولسترول الكلى و الكولسترول منخفض الكثافة وزيادة الكولسترول عالي الكثافة في نفس الوقت مما يحقق فوائد صحية لمستهلكي لحوم الدواجن. وهذا هو الهدف من هذا البحث أيضا بالإضافة إلى زيادة كفاءة النمو في بداري التسمين . أجريت هذه التجربة على ١٢٠ كتكوت عمر يوم(Cub Chicks)تم تقسيمهم إلى أربع مجموعات حيث غذيت المجموعة الأولى عليقه خالية من الكولين كلورا يد ثم تم إضافة كولين كلورا يد إلى العليقة بنسب (٦٥٠مجم /كجم عليقه و١٣٠٠مجم /كجم عليقه و١٩٥٠مجم /كجم عليقه)للمجموعات الثلاث الأخرى من عمر يوم الى ٢١يوم على الرتيب ثم بنسب (٥٠٠مجم /كجم عليقه و١٠٠٠مجم /كجم عليقه و١٥٠٠مجم /كجم علي عليقه) على الرتيب من عمر ٢٢يوم الى ٤٢يوم . ولقد تم تحصين الدواجن ضد الأمراض الوبائية وتم وزن الطيور وكمية العلف المستهلكة أسبوعيا لكل مجموعة وذلك لحساب متوسط الوزن ومتوسط الزيادة فى الوزن ومعدلات النمو ومعدلات التحول الغذائى.

وقد أظهرت نتائج البحث زيادة فى متوسط معدل النمو ومتوسط الزيادة فى الوزن ومعيار التحول الغذائى بإضافة كولين كلورا يد إلى العليقة وكانت الزيادة معنوية فى كل من المجموعة الثالثة والرابعة عند المقارنة بالمجموعة الضابطة. وأظهرت النتائج أن دهن البطن ووزن الكبد انخفض معنويا بإضافة كولين كلورا يد إلى العليقة و انخفضت الجلسيريدات الثلاثية بالمصل انخفاض غير معنوي بينما انخفضت نسبة الكولسترول الكلى والبروتين منخفض الكثافة معنويا .