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EFFECTS OF DIETARY THREONINE ON WHITE PECKIN DUCKS ON GROWTH PERFORMANCE AND PHYSIOLOGICAL STATUS

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SUMMARY

Two hundred and fourteen unsexed 1-day old white peckin duck chicks with initial live weight of 54.70±0.04 g, were randomly divided into four experimental groups with three replicate in each, with 20 ducks (4x3x20). They used to study the effects of different supplementation levels of threonine (THR) (0.5, 1 and 1.5% /kg diet) on peckin duck performance, some blood metabolites. White peckin duck were raised for 6 weeks in an open house system and were offered both feed and clean drinking water *ad-libitum*. During the experimental period, body weight (BW), weight gain (BWG), feed intake (FI) and feed conversion ratio (FCR) were recorded weekly. At the end of the feeding trial, five ducks from each treatment were randomly selected weighed, fasted for 12 hrs prior to slaughter by slitting the jugular vein. Significant differences (*P≤0.05*) were observed among all treatments during the experimental period, for the pervious parameters. At the end of the experimental period, peckin ducks fed diet supplemented with 1 and 1.5% of Thr /Kg diet had significantly the highest body weight, followed by those received 0.5% of Thr /Kg diet by (9.5, 9.15 and 6.1%), respectively compared with the control group. The same direction was found for body weight gain, Feed conversion ratio was improved by using different levels of Thr. Group fed diet supplemented with 1.5% of Thr in diet had significantly (P≤0.05) the best FCR followed by those received 0.5% of Thr in diet then those treated with 1% of Thr in diet compared with ducks in control groups. Hematological parameters of white peckin ducks affected by threonine_are listed in table (3). The results indicated that, no significant differences among all treatments for globulin (g/dl), Cholesterol (mg/dl), HDL (mg/dl), ALT (U/L), AST (U/L) when compared with control one while white peckin ducks which fed diets containing with Thr had a significant effect for total protein and albumin. The microscopic examination for the liver and kidney of the control group and ducks which fed different levels of Thr revealed normal histological structure of the hepatoctic acini.

Keywords: *Therionine, white peckin ducks, growth performance, physiological status and section of liver.*

INTRODUCTION

Pekin ducks is a various poultry species bring up for meat production. It is blessed with the unraveled characteristics of fast growth production, short generation interval that makes it suitable for diversified poultry agriculture. Pekin ducks are completely high resistant to disease and impart less worry for vaccination. Large feed input due to great volume and weight. When compared to poultry, pekin duck farming for meat production can be started with a lot less capital outlay and roughly the same profit margin.

Threonine (Thr) is a nitrogen-containing amino acid with a molecular mass of 119.12 g mol-1 (Kidd 1996 and Ayasan, 2004). For birds fed low-protein corn-soybean meal diets, Thr is the third limiting amino acid (Kidd *et al.,* 1999). To properly align the dietary amino acid balance with the preferred nutritional needs of poultry, Thr is added to broiler diets. Due to the process of balancing, chickens can use feed with lower protein levels more effectively. There haven't been many studies to assess Thr's effectiveness on pekin duck performance and growth. There has been several research done to see if dietary added Thr can improve the productivity of chickens and rabbits. Supplementing with Thr increases feed consumption and body weight (Estalkhzir *et al.,* 2013; Khan *et al.,* 2006). In poultry, intestinal mucin and plasma g-globulin are primarily composed of Thr (Kim *et al.,* 2007). The addition of

Thr to the culture medium reduced apoptosis, accelerated cell proliferation, and encouraged the generation of antibodies in lymphocytes through protein synthesis and cellular communication processes (Duval *et al.,* 1991). Immune system modifications are susceptible to dietary Thr consumption (Li *et al.,* 1999). Thr is a vital vitamin that controls the integrity of the mucosa and has significant advantages in managing the intestinal health of chickens (Bortoluzzi *et al.,* 2018).

The study reported here is designed to investigate the effect of dietary supplementation of different levels of threonine in diet on growth performance, some blood parameters and histology studies in liver of white pekin ducks.

MATERIALS AND METHODS

Experimental design:

Two hundred and fourteen unsexed 1-day old white peckin duck chicks with initial live weight of 45.70±0.58 g, were randomly distributed into four experimental groups with three replicate in each, with 20 ducks (4x3x20). They used to study the effects of different supplementation levels of threonine (THR) (0.5, 1 and 1.5% /kg diet) on peckin duck performance, some blood metabolites. The first group (T1) fed the basal diet without any supplementation and served as control. Groups T2, T3 and T4 and were fed basal diet supplemented with (0.5, 1 and 1.5%) of threonine per kg diet, respectively. White peckin duck were raised for 6 weeks in an open house system and were offered both feed and clean drinking water *ad-libitum*. Table provided the formulation and approximate composition of the experimental diets (1). Body weight (BW), weight growth (BWG), feed intake (FI), and feed conversion ratio (FCR) were tracked weekly during the trial period. Chemical analyses of experimental diet were performed using standard methods (AOAC, 2000).

Table (1): The composition and calculated analysis of experimental starter and grower diets.

Ingredient	Starter diets	Grower diets
Yellow corn	56	67.8
Soya bean meal (44%)	30.16	26.78
Gluten	6.84	----
Wheat	2.98	1.18
Oil	1	0.8
Dicalcim	0.8	1.8
Limestone	1.8	0.8
Primex	0.4	0.4
Salts	0.3	0.3
Dl-methionine	0.14	0.14
Total	100	100
Proximate composition (dry matter)		
Crude protein (%)	22.81	18.06
Crude fiber (%)	3.56	3.42
Ether extract (%)	3.73	3.38
Calcium (%)	1.03	1.04
Available Phosphoru(%)	0.45	0.45
Methionine (%)	0.5	0.5
Lysine (%)	1.10	1.2
Metabolize Energy(Kcal/Kg)	3210.75	2907

**premix: carbonate calcium 250mg, mg sulfate 125 mg, Zi oxide 75mg, Fe sulfate60 mg, Cu sulfate 25mg, Pot 80mg.vitamin premix: vit A 13,000I.U, D3 5,000,00 I.U, E 80,00mg, K3 2000mg, B2 500mg, B6 1500mg, Biotin 50mg pantothenic 10,000mg, Niacin 30,000mg.*

At the end of the feeding trial, five ducks from each treatment were randomly selected weighed, fasted for 12 hrs prior to slaughter by slitting the jugular vein. Ten ml of blood were obtained from each birds in a sterile centrifuge tube containing heparin (20 IU/ml) for determine some blood constituents. Plasma was obtained immediately by centrifugation of heparinized blood for 10 min. at 3000 rpm and frozen rapidly in ependorf tubes until the time of analysis. All plasma parameters were determined using commercial kits (Transasia Bio-Medicals, India). Plasma total protein and albumin were determined using colorimetric method according to Gornall *et al.* (1949) and Doumas *et al.* (1971) and globulin was then calculated by subtracting albumin value from corresponding total protein value for the same sample. Triglycerides concentration was determined according to recommended method of Richmond (1973). Aspartic amino transfers (AST) and alanine amino transfers (ALT) were detected according to Reitman and Frankel (1957). Determination of cholesterol, HDL, and LDL were performed according to Watson (1960), Herrmann *et al.* (1983), and Okada and Ishida (2001), respectively. Small pieces of liver was removed immediately after decapitation and fixed in 10% formal in solution and then dehydrate as usual in ascending grades of ethyl alcohol, cleared in xylol embedded in paraffin wax sectioned at five microns. Sections were stained with haematoxylin and eosin according methods was described by (Carleton, 1980) and then subjected for the light microscopically examination at magnification power. Data were analyzed according to SAS program (SAS, 2004).The application of the least of significance test for the differences among the different treatment means were done according to Duncan (1955). The following model was used:- $Y_{ij} = \mu + T_i + e_{ijk}$.

RESULTS AND DISCUSSION

Effect of dietary threionine on growth performance:

Effects of dietary threionine on body weight gain, body weight, feed conversion ratio and feed intake are summarized in table (2). Significant differences ($P \leq 0.05$) were observed among all treatments during the experimental period, for the pervious parameters. At the end of the experimental period, peckin ducks fed diet supplemented with 1 and 1.5% of Thr /Kg diet had significantly the highest body weight, followed by those received 0.5% of Thr /Kg diet by (9.5, 9.15 and 6.1%), respectively compared with the control group.

Table (2): Effect of different levels of threonine on the body weight, body weight gain, feed intake and feed conversion ratio.

Items	Dietary treatment				Sig.
	T1 control	T2 (0.5%Thr)	T3 (1%Thr)	T4 (1.5%Thr)	
Initial body weight (IBW) (one-day of age) (g)	45.58 ±2.67	44.89 ±3.02	46.12 ±4.18	44.55 ±3.45	NS
Final body weight (FBW) (42 days of age) (g)	2489.00 ±35.33^{b}	2641.25 ±28.25^{ab}	2726.29 ±29.17^{a}	2716.88 ±22.24^{a}	*
Body weight gain (BWG) (0-42 days)(g)	2443.42 ±30.33^{b}	2596.36 ±24.25^{ab}	2530.17 ±26.14^{ab}	2672.33 ±21.22^{a}	*
Total feed intake (TFI) (0-42 days) (g)	8977.25 ±50.59	8916.66 ±110.80	8822.16 ±76.88	8751.55 ±115.8	NS
Feed conversion ratio (FCR) (0-42 days) (g /g gain)	3.67 ±0.02^{a}	3.43 ±0.03^{b}	3.48 ±0.04^{b}	3.27 ±0.03^{c}	*
Survival rate (%)	100.00 ±0.00	100.00 ±0.00	100.00 ±0.00	100.00 ±0.00	NS

*^{a,b,c,} means within the same row with different superscripts are significantly different. Sig.= Significance, * ($P \leq 0.05$). N.S= No significant.*

The same direction was found for body weight gain, ducks received dietary 1.5% of Thr in diet archived significantly ($P \leq 0.05$) the highest of body weight gain followed by those received 0.5% of Thr in diet then those treated with 1% of Thr in diet by (9.36, 6.25 and 3.55%) respectively compared with the control groups. At the end of experimental period broilers received 0.5, 1 and 1.5% of Thr in diet t had no significant effect on feed intake compared with broilers in control groups. Feed conversion ratio was improved by using different levels of Thr. Group fed diet supplemented with 1.5% of Thr in diet had significantly ($P \leq 0.05$) the best FCR followed by those received 0.5% of Thr in diet then those treated with 1% of Thr in diet compared with ducks in control groups. Kidd *et al*. (2001) found that rising fed

Thr from 6.0 to 7.0 g/kg diet increased significant body weight. However, Dozier *et al*. (2001), and Kaur *et al*. (2006) Thr addition of the diet for Japanese quail had not affect body weight gain. Baylan *et al*. (2006) showed the Japanese quail (1-42) day-old fed diet contained Thr level above 1.02% had not a significant effect on body weight gain When broilers are subjected to microbial challenges, there may be a greater need for Thr. This would increase the maintenance requirements for intestinal activities, where Thr is highly required. Furthermore, it is probable that the use of petersime-battery cages led to a decrease in the energy needed for maintenance and growth because of the decreased activity of the birds, which in turn affected the body's overall metabolism. (Corzo *et al.,* 2003). Gong *et al.* (2005) studied the growth performance of broilers given low-protein diets with varying threonine-to-lysine ratios added. The Thr/Lys in treatments 1-5 was 0.65, 0.70, 0.75, 0.80 and 0.85, respectively. They found that nitrogen excretion from broiler production was reduced by increasing the ratio of Thr/Lys in treatments 1-5. These results may be due to improved feed conversion ratio and carcass traits. And increasing the liver activity increased normally of total protein and globulin in the plasma and improvements of red blood cell account and packed cell volume according to Corzo *et al*. (2003), Akagi *et al*. (2004) and Kidd *et al*. (2004). This result agrees with Corzo *et al.* (2007), Adeola *et al*. (2009), Maroufyan *et al*. (2010) and Rama *et al*. (2011). Maroufyan *et al*. (2010) reported that threonine at the highest levels significantly decreased feed intake. Corzo *et al.,* (2007) stated that feed intake decreased linearly with increasing dietary Thr on new soft wood shavings. Feed conversion ratio behavior of Japanese quail, may be due to the increased of threonine levels in intestinal crude mucin excretion and an increase in the number of intestinal goblet cells per millimetre of villus length Due to its role in the structure of mucin, Thr may be of special interest in terms of intestinal growth and development. (Adeola *et al.,* 2009 and Burrin and Stoll, 2002). This result agreed with Alemi *et al*. (2009), Dozier *et al.* (2010) and Rama *et al*. (2011). Rama *et al*. (2011) found that feed conversion ratio was significantly higher in broilers fed the control diet compared to those fed the low crude protein diet supplementation with Thr 0.64 % at 14 d of age. Increasing dietary threonine levels from 0.64 to 0.76% had no effect on feed conversion ratio. Corzo *et al*. (2007) found that increasing levels of dietary Thr from 0.51% to 0.86% had significant effected on feed conversion ratio.

Effect of dietary threonine on blood parameters:

Hematological parameters of white peckin ducks affected by threonine are listed in table (3). The results indicated that, no significant differences among all treatments for globulin (g/dl), Cholesterol (mg/dl), HDL (mg/dl), ALT (U/L), AST (U/L) when compared with control one while white peckin ducks which fed diets containing with Thr had a significant effect for total protein and albumin. At the end of the experimental period, peckin ducks fed diet supplemented with 1 and 1.5% of Thr in diet had significantly the highest total protein, followed by those received 0.5% of Thr in diet by (8.84, 6.67 and 1.76%), respectively compared with the control group. The best value of albumin noticed in ducks which fed with 0.5% of Thr in diets compared with the control group. Ducks fed diet supplemented with 1 and 1.5% of Thr in diet had significantly decreased in triglyceride by (26.76 and 33.2%) respectively compared with control. No significant observed in cholesterol on plasma for ducks in experimental groups while cholesterol levels were decreased with different levels of Thr.

Table (3): Effect of different levels of threonine on blood biochemical parameters.

Items	**Dietary treatment**				**Sig**
	T1 control	**T2 (0.5%Thr)**	**T3 (1%Thr)**	**T4 (1.5%Thr)**	
Total protein (g/dl)	3.39±0.18 [b]	3.45±0.09[ab]	3.62±0.19[a]	3.69±0.18 [a]	*
Albumin (g/dl)	1.47±0.09[b]	1.68±0.05[a]	1.62±0.05[ab]	1.57 ± 0.03[ab]	*
Globulin (g/dl)	1.96±0.12	1.88±0.08	2.08±0.13	2.35±0.10	N.S
Triglycerides (mg/dl)	76.77±10.45 [a]	66.55±3.18 [ab]	56.22±2.77 [b]	51.22±2.20 [b]	*
Cholesterol (mg/dl)	168.88±11.10	167.00±10.77	166.11±5.85	169.66±12.11	N.S
HDL (mg/dl)	65.55±4.88	66.00±5.72	64.66±2.83	65.11±3.59	N.S
LDL (mg/dl)	59.66±8.34 [b]	99.22±8.43 [a]	85.56±3.53 [a]	86.77±6.32 [a]	*
ALT (U/L)	22.66±2.15	20.88±1.49	20.33±2.69	23.77±3.80	N.S
AST (U/L)	332.00±49.28	354.66±39.27	329.88±22.18	359.00±18.39	N.S

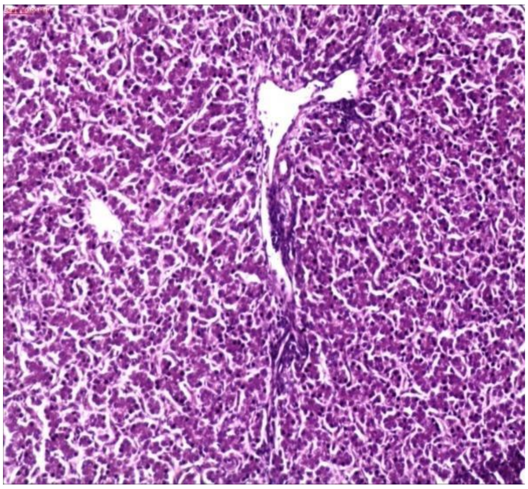
*[a, b]Means within same row with different superscripts significantly different. Sig.= Significance, * (P≤0.05). NS= Non-Significant.*

Ghanaian and Rasouli (2012) reported that elevation the dietary threonine levels from 0.592 to

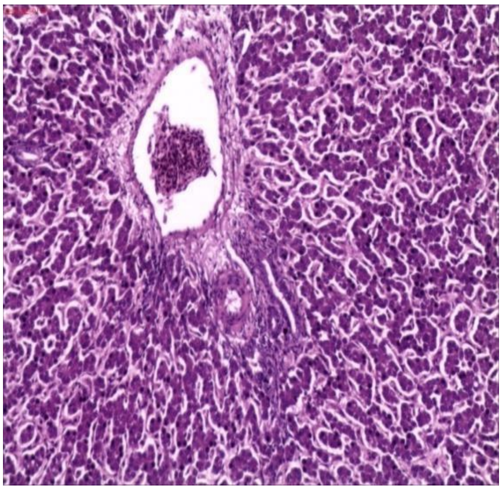
0.814% increased serum total protein from 3.9 g/dl to 5.29 g /dl, respectively. Gamma globulin's concentration was linearly ($P<0.05$) increased by Thr supplementation up to 110% of NRC (1994) recommendations. Azzam *et al*. (2011) found that The response was greatest at 0.2 and 0.3% supplementary L-threonine, and the serum total protein content increased quadratically in response. Serum free threonine had the same direction. In comparison to the control group, the addition of L-threonine at 0.3% of the meal led to linearly rising levels of Ig and total IgG Kidd *et al*. (2004) they found that plasma free Thr's sigmoidal response as influenced by dietary Thr. When Thr was increased to 0.80% of the diet for birds fed Thr graduations, plasma free Thr increased (P 0.05).Corzo *et al*. (2003) reported that increasing dietary threonine levels from 0.55% to 0.80% increased plasma free threonine of broiler females at 42 days of age.

Histology studies:

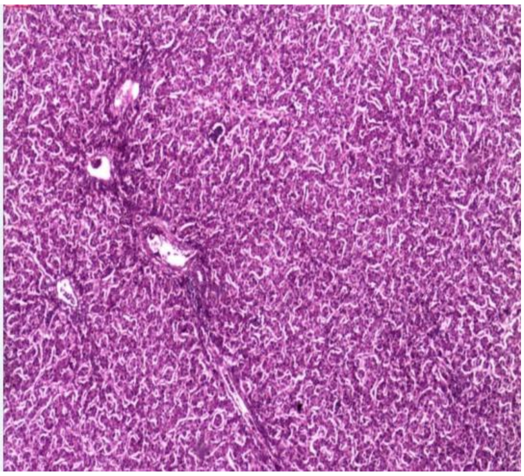
The microscopic examination for the liver and kidney of the control group and ducks which fed different levels of Thr revealed normal histological structure of the hepatoctic acini (Fig.1).



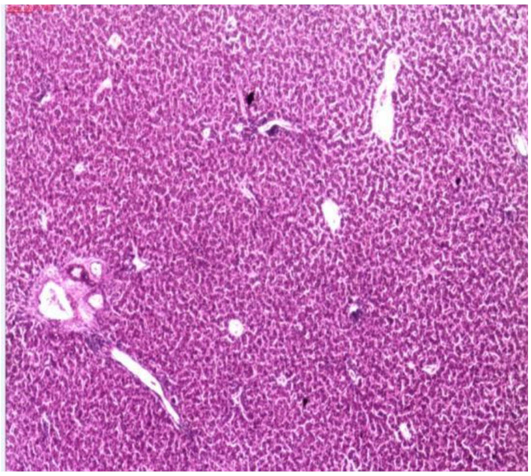
Liver in control groups



Liver in ducks fed diet containing 0.5% of Thr in diet.



Liver in ducks fed diet containing 1% of Thr in diet.



Liver in ducks fed diet containing 1.5% of Thr in diet.

Akagi *et al*. (2004) Reactions catalysed by threonine-3- dehydrogenase (TDH), threonine dehydrates (TH), or threonine aldolase were used to study the metabolism of threonine in the liver of Japanese quail (TA). In the livers of Japanese quails and rats, the activity of these three enzymes were compared. The animals were given a conventional diet, a diet rich in threonine, or a three-day fast. In comparison to the livers of rats fed a conventional diet, the specific activity of TDH in the livers of quail fed a standard diet was 11 times higher. In comparison to the livers of quail fed the conventional diet, the TDH activities in the fasting and 5% threonine-rich diet groups of quail were 3 and 2 times greater, respectively. Rats fed a conventional diet had livers that were 14 times more tactil than those of quail fed a standard diet. After fasting, the rat liver's TH activity increased by 2.3 times compared to the control group on a regular diet. Since TA's activity in the livers of rats and quail was so low, its contribution to the metabolism of threonine in both animals appeared to be minimal. These findings imply that threonine is a glycogenic amino acid in the liver of the rat, whereas it is a ketogenic amino acid in the liver of the quail. Figure 1 illustrates the metabolism of threonine in the quail liver, where it is converted to glycine.

Purine nucleotides, glutathione, and haemoglobin are just a few of the physiologically significant compounds that glycine helps to create (Kim *et al.*, 2007). Glycine is also a strong antioxidant that can scavenge free radicals (Fang *et al.,* 2002). Glycine is therefore crucial for leucocyte proliferation and antioxidant defence.

CONCLUSION

The dietary threonine 1% addition in the diet white peckin ducks improved the growth performance and improved some Physiological blood parameters.

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تأثير التغذية علي الثريونين علي الأداء الإنتاجي والحالة الفسيولوجية للبط البكيني.

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يهدف هذا البحث دراسة تأثير الحامض الاميني الثريونين على الأداء الإنتاجي والحالة الفسيولوجية للبط البكيني حيث تم توزيع عدد مائتان وأربعون طائر عمر يوم بمتوسط وزن أربعة وخمسون جراما وتم توزيعهم بصورة عشوائية على أربع معاملات تجريبية بكل معاملة ثلاثة مجاميع وكانت كل مجموعة تحتوي علي عشرون طائر لدراسة تأثير الثريونين علي الحالة الفسيولوجية والإنتاجية للبط البكيني مع التغيرات الهستولوجية للكبد. تم إضافة الثريونين بنسبة 0.5 و1 و1.5 % في العليقة واستمرت التجربة حتى عمر ستة أسابيع وفي أثناء التجربة تم قياس معدل الزيادة الوزنية الأسبوعية وكمية العلف المستهلك ومعامل التحويل الغذائي وفي نهاية التجربة تم أخذ عدد خمس بطات بصورة عشوائية من كل معاملة بعد تصويمهم لمدة 12 ساعة لأخذ بعض قياسات الدم وعينات من الكبد لعمل قطاعات هستولوجية. وكان البط المغذي على 1.5% من الحامض الأميني الثريونين تحقيقا أعلي معدلات في الزيادة الوزنية للبط مقارنة بالكنترول وباقي المعاملات وكذلك حدوث تحسن في معامل التحويل الغذائي للبط المغذي على الثريونين وأشارت النتائج بعدم وجود فروق معنوية في قياسات الدم لكلا من الجلوبيولين والكوليسترول والكوليسترول مرتفع الكثافة ووظائف الكبد. ومقارنة بالكنترول كانت هناك فروق معنوية في كلا من الألبيومين والبروتين الكلي ولا يوجد أي تغيرات في خلايا نسيج الكبد للبط المغذي علي الحامض الأميني الثريونين.