Zagazig J. Agric. Res., Vol. 42 No. (4) 2015

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

THE EFFECT OF AMBIENT TEMPERATURE, ENERGY LEVEL AND L-CARNITINE SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKS

Esam M. El Mez*, M.M. Elhindawy, A.A. Askar and S.M. Sonbol

Poult. Dept., Fac. Agric., Zagazig Univ., Egypt

ABSTRACT

This work was carried out to study the effect of different ambient temperature, dietary mitabolisable energy levels and L-Carnitine supplementation on the performance of broiler chicks [live body weight (LBW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), efficiency of protein utilization (EPU) and efficiency of energy utilization (EEU)] and carcass traits during rearing period from one up to 42 days of age. A total number of 1080 one day old unsexed Arbor Acres broiler chicks used in 3 × 3 × 2 factorial design experiment. Chicks were randomly allocated into 18 equal groups (60 chicks each) in 3 equal replicates each of 20 chicks. Groups (1 – 6), (7 – 12) and (13 – 18) were brooded in 30, 33 and 36°C respectively. Chicks brooded under every ambient temperature (AT) fed from 1 up to 21 days of age (starter period) three starter rations isonitrogenous (23% crude protein), differ in metabolisble energy level (ME) 2950, 3050 and 3150 kcal ME/kg supplemented or not with 50 mg/kg L-Carnitine (L-Car). In the finisher period (22 – 42 days) all chicks were fed finisher ration contained 20% crude protein and 3150 kcal ME/kg with or without L-Car supplementation. At the end of the experimental period (42 days of age) a slaughter test was performed on 54 birds (3 birds for each group). Results obtained indicated significantly ($P \leq 0.05$) improvement in LBW at 21 and 42 days of age and BWG, FI, FCR, EPU and EEU during all the experimental periods studied (1 - 21, 22 – 42 and 1 – 42 days of age) except FCR, EPU and EEU during 1 – 21 days of age where the effect was insignificant for chicks exposed to 30°C comparatively with those exposed to 33°C and 36°C. significant ($P \leq 0.05$) improvement observed in LBW, BWG and FI during all the experimental periods, FCR, EPU and EEU during 1 -21 days of age in the groups fed diet containing 2950 kcal ME/kg diet compared with 3050 and 3150 kcal ME diet. Addition 50 mg/kg diet L-Carnitine significantly ($P \leq 0.01$) improved LBW at 42 days of age and FCR, EPU and EEU during 1 – 21 and 22 – 42 days of age, while FI and abdominal fat significantly ($P \leq 0.5$) decreased comparatively with unsupplemented groups. The performance and carcass traits of broiler chicks were significantly ($P \leq 0.5$) affected by interaction among AT, ME level and L-Car supplementation. It could be concluded that broiler chicks could start brooding with 30°C and fed starter diet containing 2950 kcal ME supplemented with 50 mg/kg L-Carnitine followed by finisher diet containing 3150 kcal ME supplemented with 50 mg/kg L-Carnitine.

Key words: Broiler, L-Carnitine, ambient temperature, energy level.

INTRODUCTION

The thermal environment is a controlling factor in energy metabolism and exchange and it is generally assumed that rearing temperature should be approximately 32°C on the first day and be gradually decreased to approximately 20°C at the 6th week of age (Leenstra and Cahaner, 1991; Zhou and Yamamoto, 1998). Cahaner *et al.* (1995) reported that nutritional requirements are affected by variations in ambient temperature.

***Corresponding author: Tel.** : +201002606853
E-mail address: esamelmez@yahoo.com

Too low or too high ambient temperature is highly undesirable during rearing of broiler chickens. Elevated temperature reduces the feed intake and body weight of broilers. Results further suggest that early age thermal conditioning might durably stimulate muscle growth by increasing the satellite cell myogenic process in young chicks (Halevy *et al.*, 2001).

Dietary energy has always been an expensive component in poultry rations and consumption of energy increases rapidly around the world (Pardue, 2010), The dietary energy level is one of the major factors, which play an important role in regulating feed intake and feed efficiency in broilers (Lopez and Leeson, 2008). Energy is essential component of poultry diet that must be supplied in adequate amount to meet up the bird's requirements for maintenance, optimum growth, egg production and reproduction (Bawa, 2010). It is also known that although broilers generally adjust feed intake to achieve a minimum energy intake from diets containing different energy levels, these adjustments are not always precise (NRC, 1994).

L-Carnitine (β-hydroxyl-γ-N-trimethylamino butyrate) is a water-soluble quaternary amine that occurs naturally in microorganisms, plants and animals (Bremer, 1983). L-Carnitine is well recognized for playing an important role in the mitochondrial oxidation of long chain fatty acids to produce energy *via* β oxidation and oxidative phosphorylation (Borum, 1983), by decreasing their availability for estrification to triglyceride and storage in the adipose tissue.

L-Carnitine also facilitates the removal of short- and medium-chain fatty acids from the mitochondria that accumulate as a result of normal and abnormal metabolism (Buyse *et al.*, 2001 ; Xu *et al.*, 2003). Thus, dietary L-Carnitine supplementation promotes the β-oxidation of these fatty acids in order to generate adenosine triphosphate (ATP) and improve energy utilisation (Neuman *et al.*, 2002). In addition, L-Carnitine has secondary functions, including the containment, buffering and removal of potentially toxic acyl groups from cells, equilibrating the ratio of free CoA and acetyl-CoA between the mitochondria and cytoplasm, participating in biological processes such as regulation of gluconeogenesis, stimulating fatty acid and the metabolism of ketones, branched-chain amino acids, triglycerides and cholesterol (Novotny, 1998).

Providing the body with sufficient supplies of L-Carnitine can induce more efficient utilization of dietary energy and protein (Harmeyer, 2002). Also, it is well known that L-Carnitine plays an important role in reducing fat deposition. L-Carnitine supplementation increased weight gain, reduced carcass fat and improved feed conversion in broiler chickens (Rabie *et al.*, 1997a; Rabie *et al.*, 1997b). In addition, Rabie *et al.* (1997a) reported that supplementing 50 mg L-Carnitine/ kg diet to broiler chickens increased ($P<0.05$) breast muscle and leg meat yields and content of fat in breast muscle.

Therefore, the present study was carried out to evaluate the response of broiler chicks to varying ambient temperature (30, 33 and 36°C) with three levels of metabolisble energy (2950, 3050 and 3150 kcal ME/kg diet) without or with L– Carnitine supplementation to the diet from 1 to 42 days of age.

MATERIALS AND METHODS

The present study was carried out in the researcher's own Poultry Farm, San El-Hagar Area, Sharkia Governorate, located in the North Eastern part of the Nile Delta (30 N), Egypt, during March and April 2010.

A total number of 1080 one day old unsexed broiler chicks nearly similarly initial weight (37.5 ± 0.08 g). A 3 x 3 x 2 factorial design experiment was performed including three ambient temperatures (30, 33 and 36°C), three levels of dietary energy (2950, 3050 and 3150 ME kcal/ kg diet) and two levels of L-Carnitine supplementation (0 and 50mg/ kg diet). Chicks were allocated randomly into 18 equal groups (60 chicks each) every group divided to 3 replicates each of 20 chicks. The treatment groups 1 – 6, 7 - 12 and 13 - 18 were brooded in 30, 33 and 36°C respectively. The brooding temperatures in each room was then gradually reduced one degree every three days to reach 23, 26 and 29°C, respectively at the end of the starter period (21 days of age) and tell the end of the experimental period (finisher period).

The chicks brooded the same ambient temperatures fed from hatching up to 21 days of age (starter period) with three commercial starter basal rations containing 23% crude protein, differ in metabolisble energy levels 2950, 3050 and 3150 kcal ME/kg and sufficient in other nutrients as recommended by strain manual guide, followed by finisher ration which contained 20 % crude protein and 3150 kcal ME/kg From 22 up to 42 days of age (finisher period). Within each dietary energy level, each diet was supplemented or not with 50 mg L-Carnitine / kg diet (Table 1).

Chicks in each treatment group received the same managerial, environmental and hygienic conditions. Lighting was continuous during all experimental period, experimental rations were offered *ad-libitum* and fresh water was available all the time.

Individual live body weight (LBW) was recorded at one, 21and 42 days of age, feed intake (FI) was recorded and assumed at 21 and 42 days of age, body weight gain (BWG) was calculated as the deference between every tow intervals, feed conversion ratio (FCR) was calculated as g feed/g gain, efficiency of protein utilization (EPU) was calculated as g protein/g gain and efficiency of energy utilization (EEU) was calculated as kcal metabolisable energy/g gain.

At the end of the experimental period (42 days of age) a slaughter test was performed on 54 birds (3 birds for each group) which body weight was near the average of its treatment. Prior to slaughter the birds were fasted for 8 hours. Just prior to slaughter the birds were individually weighed, and after complete bleeding, were plucked their feathers and eviscerated. The weight of abdominal fat (AF; the adipose tissues surrounding the gizzard and bursa of fabricius and those adjacent to the cloaca) was determined. The individual weights of eviscerated carcass (EC) and giblets (GIB; *i.e.* heart, liver without gall bladder and skinned empty gizzard) were estimated. Dressing was calculated as EC plus GIB. All measurements on carcass traits were expressed as percent of per slaughter weight.

Data obtained were statistically analyzed 3 x 3 x 2 factorial design basis according to Snedecor and Cochran (1982) using statistical analysis program SAS (2003). Least square and maximum likelihood significant differences among means were identified by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth Performance

Data displayed in Tables 1 and 2 showed the effect of ambient temperature (AT), metabolisable energy level (ME), L-Carnitine (L-Car) and their interactions on live body weight (LBW), body weight gain (BWG), feed intake (FI) and feed conversion (FC).

Live Body Weight

Results obtained indicates that LBW at 21 days of age significantly ($P \leq 0.01$) increased for broiler exposed to 30 and 33°C more than those exposed to 36°C, while at the end of finisher period and finally LBW was significantly ($P \leq 0.01$) increased for broiler exposed to 30°C comparatively with those exposed to 33 or 36°C. Results agreed with those obtained by Sahin *et al.* (2005) and Onderic *et al.* (2005).

LBW at 21 and 42 days of age significantly ($P \leq 0.01$) increased in chicks fed diets contained 2950 kcal ME/kg diet when compared with other treatment groups (3050 and 3150 kcal ME/kg diet). Results agreed with those obtained by Aboul-Ela *et al.* (2004) who showed that consistent higher body weight in quail chicks received 2800 and2900 compared to 3000 kcal/Kg diet.

Chicks fed diets supplemented with 50 mg/ kg diet L-Carnitine showed significant ($P \leq 0.01$) increas in the average LBW at 42 days of age. These results might be due to the adequacy of L-Carnitine in the diets to maintain body weight. These results are in agreement with (Adabi *et al.*, 2006; Abou-Zeid *et al.*, 2007) who found that growth performance can be improved by dietary L-Carnitine supplementation in broiler chickens.

Interaction results cleared significant ($P \leq 0.05$) increases in LBW due to interaction between AT and ME and interaction between AT and L-Car during starter and finisher periods, while interaction between ME and L-Car was significant ($P \leq 0.05$)

Table 1. Composition and calculated analysis of the experimental diet fed during the starter and finisher periods

Ingredient	Starter (1 – 21 days)			Finisher
	Diet 1	Diet 2	Diet 3	(22-42 days)
Yellow corn	56.00	52.95	49.93	59.75
Soybean meal (44%)	31.98	33.20	34.55	28.50
Corn gluten (60%)	5.80	5.40	4.80	3.43
Soya oil	1.42	3.66	5.95	4.40
Di-calcium phosphate	2.36	2.33	2.34	2.10
Limestone	1.00	1.02	1.00	0.80
Lysine	0.37	0.36	0.34	0.15
Dl-Methionine	0.27	0.28	0.29	0.17
Vit + Min. premix*	0.30	0.30	0.30	0.30
Choline chloride	0.20	0.20	0.20	0.10
Salt (Na Cl)	0.30	0.30	0.30	0.30
Calculated analysis **				
Crude protein (%)	23.02	23.05	23.02	20.02
ME, Kcal/Kg.	2951	3052	3151	3150
Lysine, (%)	1.43	1.42	1.43	1.09
Methionine + cystine (%)	1.08	1.07	1.07	0.86
Calcium (%)	1.05	1.05	1.05	0.90
Ava. phosphorus (%)	0.50	0.50	0.50	0.45

* Vitamin and mineral premix: each 3 Kg of vitamin and mineral premix (Special component from commercial source AGRIVET Co.) contains: Vit. A. 12000000 IU, Vit. D_3 2000000 IU, Vit. K_3 2000 mg, Vit. E10,000 mg, Vit. B_1 100 mg, Vit. B_2 5000 mg, Vit. B_6 1500 mg, Vit. B_{12} 10 mg, Biotin 50 mg, Choline chloride 250000 mg, Pantothenic acid 10000 mg, Nicotenic acid 3000 mg, Folic acid 1000 mg, Manganese 60000 mg, Iron 30000 mg, Selenium 100 mg, Copper 10000 mg, Iodine 1000 mg, Cobalt 100 mg, Carrier(Ca Co_3) add to 3kg.

** Calculated according to NRC 1994

Table 2. Effect of ambient temperature, energy level, L-Carnitine supplementation and their interaction on live body weight and body weight gain of broiler chicks during the experimental period

Items	Live body weight(g)			Body weight gain(g)		
	1 day	21 days	42 days	1 – 21 days	22 – 42 days	1 – 42 days
Effect of ambient temperature (°C)						
30	37.61±0.13	437.85±14.31 [a]	1705.64±64.58 [a]	400.24±14.27[a]	1267.79±54.71[a]	1668.03±64.55 [a]
33	37.47±0.12	437.74±11.12 [a]	1569.47±47.71[c]	400.27±11.14[a]	1131.73±40.23[c]	1532.00±45.87 [b]
36	37.49±0.06	417.62±14.51 [b]	1629.76±51.97 [b]	380.13±14.51[b]	1212.13±41.75[b]	1592.26±51.96 [c]
Sig.	NS	**	**	**	**	**
Effect of energy levels (ME Kcal/ kg diet) (E)						
2950	37.57±0.13	504.16±14.31 [a]	1850.87±64.58 [a]	466.59±14.27 [a]	1346.71±54.71 [a]	1813.29±64.55 [a]
3050	37.48±0.12	394.82±11.12 [b]	1552.56±47.71 [b]	357.34±11.14 [b]	1157.73±40.23 [b]	1515.07±45.87 [b]
3150	37.52±0.06	394.23±14.51 [b]	1501.44±51.97 [c]	356.71±14.51 [b]	1107.21±41.75 [c]	1463.92±51.96 [c]
Sig.	NS	**	**	**	**	**
Effect of L-Carnitine levels (mg/ kg diet) L-Car.						
0	37.59±0.08	427.47±10.50	1484.59±35.43 [b]	390.00±10.49	1057.12±26.98 [b]	1447.12±35.41 [b]
50	37.46±0.10	434.47±11.43	1785.32±34.03 [a]	397.09±11.43	1350.65±25.00 [a]	1747.74±34.02 [a]
Sig.	NS	NS	**	NS	**	**
Interactions						
°C x E	NS	**	**	NS	*	*
°C x L-Car.	NS	NS	**	NS	NS	NS
E x L-Car.	NS	**	**	NS	NS	NS
°CxExL-Car.	NS	**	**	NS	NS	NS

Means having different letters within the same column are significantly different.

NS= Not significant. *=P≤0.05 **=P≤0.01

during finisher period. However, LBW of broiler chicks was significantly (P≤0.05) greater in broiler chicks fed diets contained 2950 kcal ME/kg supplemented with 50 mg L-Car / kg diet and brooded in 30°C compared with other treatments at 21 and 42 days of age.

Body Weight Gain

Body weight gain during all experimental periods (1–21, 22–42 and 1–42 days of age) was significantly (P≤0.01) decreased for broiler chicks exposed to 36°C more than those exposed to 30 or 33°C. These results are in agreement with those obtained by Sahin *et al.* (2005) and Onderic *et al.* (2005).

ME energy level of 2950 kcal ME/kg diet showed significant (P≤0.01) increase in BWG of broiler chicks during starter, finisher and the whole experimental period compared to 3050 and 3150 kcal ME/kg diet. These results agreed with the findings of Pieniz *et al.* (1990) who revealed that the levels of 2900 and 2800 kcal ME/kg *vs* 3000, 3100 or 3200 Kcal ME/Kg resulted in the best values of BWG of Arbor Acre broiler chicks from 1 to 28 and 29 to 49 days old.

Significant (P ≤ 0.01) increase in BWG of broiler chicks due to L-Car supplementation during starter and finisher periods comparing with unsupplemented groups which agreed with that reported by (Rabie *et al.*, 1997b).

No significant differences were found in BWG of broiler chicks due to the interaction among treatments except between AT and ME level during 22 – 42 and 1 – 42 days of age which showed significantly (P≤0.05) BWG increase.

Feed Intake

Feed intake was significantly (P≤0.01) decreased for broiler exposed to 36°C more than those exposed to 30 or 33°C during all the experimental periods (Table 3). These results are in agreement with those obtained by Olanrewaju *et al.* (2010) who reported that broilers subjected to high ambient temperature had significantly (P<=0.05) lower feed intake.

Energy levels studied showed significantly (P≤0.01) consistent decreased FI of broiler chicks received 3150 and 3050 Kcal ME/Kg diet compared to 2950 Kcal ME/Kg diet during all experimental periods. It is clear that feed intake were decreased with increasing energy from 2950 to 3150 kcal/kg diet. The results agreed with the finding of Ghaffari *et al.* (2007) who demonstrated that in grower period chicks received high energy diets(3175 Kcal) had significantly lower feed intake.

Results showed significant (P≤0.01) decrease in average FI of broiler chicks due to the addition of 50mg/kg L-Car, when compared with unsupplemented groups during 1 -21 and 1-42 days of age. Results disagree with Lien and Horng (2001) and Xu *et al.* (2003) who observed no effect of supplemental dietary L-Carnitine on feed intake of broiler chicks.

Feed intake of broiler chicks was significantly (P≤0.01) affected by interaction between AT and ME level and between ME level and L-Car supplementation during 1–21 and 1–42 days of age. However, it was significantly (P ≤ 0.05) affected by interaction between AT and L-Car addition during starter period. FI of broiler chicks was significantly (P≤0.05) greater in broiler chicks reared under the temperature of 30°C and received 2950 kcal ME/kg with 0 mg L-Carnitine/kg diet as compared with other treatments at periods from 1 - 21 and 1-42 days of age.

Feed Conversion

Feed conversion was significantly (P≤0.01) improved for broiler exposed to 30 and 36°C more than those exposed to 33°C from 22 - 42 and 1 - 42 days of age (Table 3).

Dietary ME level of 2950 Kcal ME/Kg improved significantly (P≤0.01) FCR of broiler chicks as compared to 3150 and 3050 Kcal ME/Kg during the starter period. These results are in good agreement with those reported by Pieniz *et al.* (1990).

Broiler chicks fed diets supplemented with L-Car showed significantly (P≤0.05) better FCR compared with those fed unsupplemented diets during finisher and 1-42 periods. These results are in agreement with those obtained by Hossininezhad *et al.* (2011) who reported that FCR was significantly decreased in total period by dietary L-Carnitine supplementation.

Table 3. Effect of ambient temperature, energy level, L-Carnitine supplementation and their interaction feed intake and feed conversion ratio of broiler chicks during the experimental period

Items	Feed intake			Feed conversion		
	1 – 21 days	22 – 42 days	1 – 42 days	1 – 21 days	22 – 42 days	1 – 42 days
Effect of ambient temperature (°C)						
30	718.80±11.29 [a]	2446.72±67.68 [a]	3165.52±78.61 [a]	1.80±0.04	1.93±0.09 [b]	1.90±0.07 [b]
33	721.27±8.86 [a]	2435.11±57.59 [a]	3156.38±65.32 [a]	1.80±0.03	2.15±0.09 [a]	2.06±0.06 [a]
36	686.47±14.68 [b]	2385.54±58.13 [b]	3072.00±71.29 [b]	1.81±0.04	1.97±0.06 [b]	1.93±0.05 [b]
Sig.	**	*	**	NS	**	**
Effect of energy levels (ME Kcal/ kg diet) (E)						
2950	770.75±11.29 [a]	2762.95±67.68 [a]	3533.70±78.61 [a]	1.65±0.04 [b]	2.05±0.09	1.95±0.07
3050	687.88±8.86 [b]	2263.00±57.59 [b]	2950.88±65.32 [b]	1.93±0.03 [a]	195±0.09	1.95±0.06
3150	667.91±14.68 [c]	2241.42±58.13 [b]	2909.33±71.29 [b]	1.87±0.04 [a]	2.02±0.06	1.99±0.05
Sig.	**	**	**	**	NS	NS
Effect of L-Carnitine levels (mg/ kg diet) L-Car.						
0	711.24±11.49	2467.89±49.14 [a]	3179.12±59.64 [a]	1.78±0.03	2.33±0.04 [a]	2.20±0.03 [a]
50	706.45±8.40	2377.02±48.95 [b]	3083.48±56.32 [b]	1.82±0.04	1.76±0.02 [b]	1.76±0.02 [b]
Sig.	NS	**	**	NS	**	**
Interactions						
°C x E	**	NS	**	NS	NS	NS
°C x L-Car.	*	NS	NS	NS	*	NS
E x L-Car.	**	NS	**	NS	NS	NS
°CxExL-Car.	**	NS	**	**	NS	NS

Means having different letters within the same column are significantly different.
NS= Not significant. *=P≤0.05 **=P≤0.01

There were no significant differences in FCR due to interaction between AT and ME level or between ME and L-Car supplementation during all experimental periods studied while, FCR was significantly (P≤0.05) improve due to interaction between AT and L-Car supplementation during finisher period. However, broiler chicks fed diets containing 2950 kcal ME and supplemented with 50 mg L-Car/kg diet under 30 and/or 36°C significantly (P≤0.05) improved in FC ratio during starter period.

Efficiency of Protein and Energy Utilization

Table 4 cleared that efficiency of protein utilization (EPU) and efficiency of energy utilization (EEU) were significantly (P≤0.01) better under AT of 30 and 36°C compared with 33°C during finisher period and during the whole experimental period.

Dietary ME of 2950 kcal/kg significantly (P≤0.01) improved EPU and EEU of broiler chicks compared to other energy levels during starter period. The results are in agreement with Rabie *et al.* (2010), who reported that decreasing dietary ME level in both starter and grower periods from 3100 to 2700 kcal/kg positively affected EEU.

L-Car supplementation in broiler chick's diets resulted significantly (P≤0.01) better EPU and EEU during finisher period and the whole experimental period. Soltan *et al.* (2010), cleared that protein efficiency ratio was not significantly affected by diet containing 300 mg L-Carnitine.

Insignificant differences in EPU and EEU during all experimental periods due to interaction between AT and ME levels, between AT and L-Car addition and between ME levels and L-Car addition except EPU due to interaction between AT and L-Car addition during 22–42 days of age and due to interaction between ME levels and L-Car addition during the whole experimental period which the differences were (P≤0.05) significant. Interaction results cleared that diets with 2950 kcal/kg and supplemented with 50 mg/ kg L-Car under 30 and 36°C resulted the best significantly (P≤0.01) value of EPU and EEU during starter period.

Table 4. Effect of ambient temperature, energy level, L-Carnitine supplementation and their interaction on efficiency of protein and energy utilization during the experimental period

Items	Efficiency of protein utilization			Efficient of energy utilization		
	1 – 21 days	22 – 42 days	1 – 42 days	1 – 21 days	22 – 42 days	1 – 42 days
Effect of ambient temperature (°C)						
30	0.42±0.010	0.40±0.017 [b]	0.40±0.016 [b]	5.37±0.124	6.24±0.271 [b]	6.00±0.213 [b]
33	0.42±0.007	0.44±0.018 [a]	0.43±0.013 [a]	5.36±0.096	6.92±0.279 [a]	6.47±0.192 [a]
36	0.42±0.010	0.40±0.012 [b]	0.40±0.009 [b]	5.40±0.130	6.28±0.190 [b]	6.05±0.141 [b]
Sig.	NS	**	**	NS	**	**
Effect of energy levels (ME Kcal/ kg diet) (E)						
2950	0.38±0.010 [b]	0.42±0.017	0.41±0.014	4.88±0.124 [b]	6.56±0.271	6.11±0.213
3050	0.44±0.007 [a]	0.40±0.018	0.41±0.013	5.69±0.096 [a]	6.31±0.279	6.13±0.192
3150	0.43±0.010 [a]	0.42±0.012	0.42±0.009	5.55±0.130 [a]	6.57±0.190	6.28±0.141
Sig.	**	NS	NS	**	NS	NS
Effect of L-Carnitine levels (mg/ kg diet) L-Car.						
0	0.42±0.006	0.47±0.008 [a]	0.46±0.006 [a]	5.43±0.080	7.41±0.130 [a]	6.86±0.092 [a]
50	0.41±0.008	0.35±0.005 [b]	0.37±0.004 [b]	5.32±0.107	5.55±0.078 [b]	5.49±0.057 [b]
Sig.	NS	**	**	NS	**	**
Interactions						
°C x E	NS	NS	NS	NS	NS	NS
°CxL-Car.	NS	NS	NS	NS	*	NS
ExL-Car.	NS	NS	NS	NS	NS	*
°CxExL-Car.	**	NS	NS	**	NS	NS

Means having different letters within the same column are significantly different.
NS= Not significant. *=P≤0.05 **=P≤0.01

Carcass Traits

Table 5 indicate that all ambient temperatures had no significant effect on carcass, gizzard, giblets, and abdominal fat as percentage of pre-slaughter weight, while liver, heart, and dressing were significantly higher for broiler exposed to 36°C more than those exposed to 30 or 33°C.

Percentage of carcass and dressing relatively to pre-slaughter weight of broiler chicks received 2950 Kcal ME/Kg diet significantly (P≤0.01) increased as compared to 3050 and 3150 Kcal ME/Kg diet while, gizzard, liver and giblets significantly (P≤0.05) decreased. Similar results were reported by Pieniz *et al.* (1990).

Carcass, gizzard, and dressing were, significantly (P≤0.05) increased due to L-Car addition in the diet. However liver, heart and giblets were insignificantly improved, while abdominal fat percentage was significantly (P≤0.01) decreased compared with unsupplemented one. These results are in agreement with those reported by Xu *et al.* (2003) and Ghods *et al.* (2010) who demonstrated that the abdominal fat percentage of body weight was significantly reduced by adding L-Carnitine to diets.

Results obtained revealed that percentage of carcass traits studied relatively to pre-slaughter weight were significantly (P≤0.05 and 0.01) affected by interaction between AT and ME levels at the end of the experimental period, while abdominal fat was insignificantly affected by their interaction. However, significantly (P≤0.05 and 0.01) decreased Abdominal fat percentage due to interaction between AT and L-Car, while other carcass characteristics did not affected. Results obtained revealed that percentage of some carcass traits were significantly (P≤0.05) affected by interaction between ME levels and L-Car supplementation, while gizzard, liver and heart were insignificantly affected. However (carcass, Liver, giblets, dressing and abdominal fat weight) were significantly affected by interaction among AT, ME levels and L-Car supplementation, while, gizzard and heart were insignificantly affected.

Table 5. Effect of ambient temperature, energy level, L-Carnitine supplementation and their interaction on some carcass traits of broiler chicks at 42 days of age

Items	(%) of Pre- slaughter weight							
	Pre-Slaughter	Carcass	Gizzard	Liver	Heart	Giblets	Dressing	Abdominal fat
Effect of ambient temperature (°C)								
30	1877.22±52.05	68.02±0.53	1.81±0.06	2.00±0.07[b]	0.42±0.01[ab]	4.22±0.13	72.24±0.45[b]	2.04±0.14
33	1764.44±45.98	67.84±0.61	1.76±0.08	2.20±0.07[a]	0.39±0.02[b]	4.34±0.11	72.18±0.54[b]	2.19±0.11
36	1746.39±59.63	68.96±0.64	1.93±0.05	2.14±0.05[ab]	0.45±0.01[a]	4.52±0.09	73.48±0.60[a]	1.88±0.15
Sig.		NS	NS	*	*	NS	*	NS
Effect of energy levels (ME Kcal/ kg diet) (E)								
2950	1992.78±52.05	70.16±0.53[a]	1.72±0.06[b]	1.95±0.07[b]	0.41±0.01	4.08±0.13[b]	74.23±0.45[a]	2.05±0.14
3050	1737.50±45.98	67.23±0.61[b]	1.83±0.8[ab]	2.19±0.07[a]	0.41±0.02	4.43±0.11[a]	71.66±0.54[b]	2.08±0.11
3150	1657.78±59.63	67.43±0.64[b]	1.94±0.05[a]	2.21±0.05[a]	0.43±0.01	4.58±0.09[a]	72.01±0.60[b]	1.98±0.15
Sig.		**	*	**	NS	**	**	NS
Effect of L-Carnitine levels (mg/ kg diet) L-Car.								
0	1705.56±44.38	67.57±0.53[b]	1.76±0.06[b]	2.10±0.05	0.43±0.01	4.43±0.10	72.00±0.48[b]	2.38±0.09[a]
50	1886.48±36.22	68.97±0.40[a]	1.90±0.05[a]	2.13±0.05	0.41±0.01	4.29±0.08	73.26±0.38[a]	1.69±0.09[b]
Sig.		*	*	NS	NS	NS	**	**
Interactions								
°CxE		**	*	**	*	**	**	NS
°CxL-Car.		NS	NS	NS	NS	NS	NS	*
E x L-Car.		**	NS	NS	NS	*	**	**
°CxExL-Car.		**	NS	*	NS	**	**	**

Means having different letters within the same column are significantly different.
NS= Not significant. *=P≤0.05 **=P≤0.01

Conclusion

It could be concluded that broiler chicks could start brooding with 30°C and fed starter diet containing 2950 kcal ME supplemented with 50 mg/kg L-Carnitine followed by finisher diet containing 3150 kcal ME supplemented with 50 mg/kg L-Carnitine.

REFERANCES

Aboul-Ela, S.S., M.M. El-Hindawy, A.I. Attia and A.E. Ashour (2004). Protein and energy requirements of Japanese quail under Egyptian conditions 1- winter season. Zagazig J. Agric. Rese., 31 (3): 1045-1073.

Abou-Zeid, A.E., Kh. Amder, Y.A. Mariey and M.M. El-Mansy (2007). Influence of L-Carnitine supplementation at different dietary energy levels on broiler performance. Egypt. Poult. Sci., 27 (I): 121-150.

Adabi, S.G., G. Moghaddam, A. Taghizadeh, A. Nematollahi and T. Farahvash (2006). Effect of L-Carnitine and vegetable fat on broiler breeder fertility, hatchability, egg yolk and serum cholesterol and triglyceride. Int. J. Poult. Sci., 5: 970-974.

Bawa, G.S. (2010). Response of Japanese quail chicks (*Cortinus cortinus japonica*) to various dieatary energy levels in the tropical environment. Proceedings of the 35th Annual Conference of the Nigerian Society for Animal Production. Ibadan Univ., 381-383.

Borum, P.R. (1983). Carnitine. Annual Review of Nutrition, 3: 233 – 259.

Bremer, J. (1983). Carnitine metabolism and functions. Physiological Review, 63:1420-1480.

Buyse, J., G.P.J. Janssens and E. Decuypere (2001). The effects of dietary L-Carnitine supplementation on the performance, organ weights and circulating hormone and metabolite concentrations of broiler chickens reared under a normal or low temperature schedule. Br. Poult. Sci., 42: 230-241.

Cahaner, A., Y. Pinchasov, I. Nir and Z. Nitsan (1995). Effects of dietary protein under high ambient temperature on body weight, breast meat yield, and abdominal fat deposition of broiler stocks differing in growth rate and fatness. Poult. Sci., 74:968-975.

Duncan, D.B. (1955). Multiple Range and Multiple F tests. Biometrics, 11:1-42.

Ghaffari, M., M. Shivazad, M. Zaghari and R. Taherkhani (2007). Effect of energy levels of diets formulated on total or digestible amino acid basis on broiler performance and carcass trait. Asian J. Poult. Sci., 1(1):16-21.

Ghods, A.B., H. Samie and R. Jahanian (2010). Effects of supplementary dietary L-Carnitine on performance and egg quality of laying hens fed diets different in fat level. Italian J. Anim. Sci., 9:11-15.

Halevy, O., A. Krispin, Y. Leshem, J.P. Mcmurtry and S. Yahav (2001). Early-age heat exposure affects skeletal muscle satellite cell proliferation and differentiation in chicks. American J. Physiol., 281: 302-309.

Harmeyer, J. (2002). The physiological role of L-Carnitine. Lohmann-Information, 27: 15 –22.

Hossininezhad, M.M., M. Irani and A. Seidavi (2011). Dietary effects of L-Carnitine supplement on performance and blood parameters of broiler chickens. J. Food Agric. Environ., 9:475-481.

Leenstra, F.R. and A. Cahaner (1991). Genotype by environment interactions using fast growing, lean of fat broiler chickens, originating from the Netherlands and Israel, raised at normal or low temperature. Poult. Sci., 70: 2028 – 2039.

Lien, T.F. and Y.M. Horng (2001). The effect of supplementary dietary L-Carnitine on the growth performance, serum components, carcass traits and enzyme activities in relation to fatty acid and β-oxidation of broiler chickens. Br. Poult. Sci., 42: 92-95.

Lopez, G. and S. Leeson (2008). Review: energy partitioning in broiler chickens. Can. J. Anim. Sci., 88: 205-212.

Neuman, S.L., T.L. Lin and P.Y. Hester (2002). The effect of dietary carnitine on semen traits of white leghorn roosters. Poult. Sci., 81: 495 - 503.

Novotny, B.J. (1998). L-Carnitine. What difference does it make? Symp. Proc. 15th Dec., Leuven, Belgium.

NRC (National Research Council) (1994). Nutrient Requirements of Poultry. 9th revised edition, National Academy Press, Washington, DC.

Olanrewaju H.A., J.L. Purswell, S.D. Collier and S.L. Branton (2010). Effect of ambient temperature and light intensity on physiological reactions of heavy broiler chickens, Poult. Sci., 89:2668–2677.

Onderic, M., K. Sahin, N. Sahin, G. Cikim, J. Vijaya and O. Kucuk (2005). Effects of dietary combination of chromium and biotin on growth performance, carcass characteristics and oxidative stress markers in heat-distressed Japanese quail. Biological Trace Element Res., 106: 165-176.

Pardue, S.L. (2010). Food, energy and the environment. Poult. Sci., 89:797-802.

Pieniz, L., C.A. Guidoni, A.F. Girotto and J.S. Cezar (1990). Effect of the timing of feeds in relation to dietary energy level in broiler chickens. Pesquisa Agropecuaria Brasileira, 25 (10): 1383 - 1389.

Rabie, M. H., M. Szilágyi and T. Gippert. (1997a). Effects of dietary L-Carnitine supplementation and protein level on performance and degree of meatness and fatness of broilers. Acta Biol. Hung., 48:221-239.

Rabie, M.H., F.S.A. Ismail and S.Kh. Sherif (2010). Effect of dietary energy level with probiotic and enzyme addition on performance, nutrient digestibility and carcass traits of broilers. Egypt. Poult. Sci., 30 (I): 179-201.

Rabie, M.H., M. Szilágyi, T. Gippert, E. Votisky and D. Gerendai (1997b). Influence of dietary L-Carnitine on performance and carcass quality of broiler chickens. Acta Biol. Hung., 48:241-252.

Sahin, N., K. Sahin, M. Onderci, M.F. Gursu, G. Cikim, J. Vijaya and O. Kucuk (2005). Chromium picolinate, rather than biotin, alleviates performance and metabolic parameters in heat-stressed quail. Br. Poult. Sci., 46: 457-463.

SAS (2003). Version 9.1. SAS Institute Inc., Cary, N.C., USA.

Snedecor, G.W. and W.G. Cochran (1982). Statistical. Methods 6th Ed. Iowa State University Press, Ames. Iowa.

Soltan, M.A., A.F. Fath El-Bab and I.M. Samra (2010). Effect of L-Carnitine or its precursor on growth, feed utilization and body composition of Nile tilapia, (Oreochromis niloticus). Proc. 5th Inter. Conf. Vet. Res. Div., NRC, Cairo, Egypt, 161-168.

Xu, Z.R., M.Q. Wang, H.X. Mao, X.A. Zhan and C.H. Hu (2003). Effects of L-Carnitine on growth performance, carcass composition and metabolism of lipids in male broilers. Poult. Sci., 82: 408-413.

Zhou, W.T. and S. Yamamoto (1998). Heat-induced the shift of body fluid in broiler chickens. Proceedings of the 6th Asian Pacific Poultry Congress and Exhibition. Japan Poultry Science Association and Japan Branch of World's Poult. Sci. Association, Nagoya, Japan.

تأثير الحرارة المحيطة ومستوى الطاقة فى العليقة وإضافة L-Carnitine على أداء بدارى التسمين

عصام محمد مصيلحى المز - محمد محمد الهنداوى - على عبدالرازق عسكر - شريف محمد سنبل

قسم إنتاج الدواجن - كلية الزراعة - جامعة الزقازيق - مصر

أجريت هذه التجربة العملية لدراسة تأثير درجات الحرارة المختلفة ومستويات من الطاقة الأيضية فى الغذاء مع أو بدون إضافة L-Carnitine على معدل الأداء الإنتاجى (الوزن الحى ومعدل الزيادة فى الوزن ومعدل استهلاك الغذاء ومعامل التحويل الغذائى وكفاءة الإستفادة من البروتين والطاقة) وصفات الذبيحة لبدارى التسمين فى الفترة من ١ إلى ٤٢ يوم، أاستخدم فى هذه التجربة ١٠٨٠ كتكوت Arbor Acres عمر يوم واحد تم اختيارها عشوائياً من قطيع كبير من الكتاكيت متساويه تقريباً فى الوزن (٣٧,٥ جرام) ولا يوجد بينها فروق معنوية تم توزيعها عشوائياً على ١٨ مجموعه تحتوى كل مجموعه ٦٠ كتكوت فى ٣ مكررات متساوية، المجاميع ١ – ٦ و ٧ – ١٢ و ١٣ – ١٨ تم تحضينها فى درجات حرارة ٣٠ و ٣٣ و ٣٦°م على التوالى، الكتاكيت المحضنة فى كل درجة حرارة تحضين تم تغذيتها على ثلاثة علائق متساوية فى نسبة البروتين (٢٣%) ومختلفة فى مستويات الطاقة (٢٩٥٠ ، ٣٠٥٠ ، ٣١٥٠ كيلو كالورى/ كجم) فى مرحلة البادى (١ – ٢١ يوم) وكل عليقه أضيف أو لم يضاف لها ٥٠ مجم/كجم L-Carnitine لينتج ٦ علائق بادئه لكل ٦ مجاميع يليها فى مرحلة الناهى (٢٢ – ٤٢ يوم) عليقة تحتوى ٢٠% بروتين خام و٣١٥٠ كيلو كالورى/كجم مع أو بدون إضافة ٥٠ مجم / كجم L-Carnitine فى كل المجاميع، فى نهاية التجربة (٤٢ يوم) تم ذبح ٥٤ كتكوت (٣ من كل مجموعه) لتقييم صفات الذبيحة، وتتلخص أهم النتائج فى تحسن معنوى (٥%) فى متوسط الوزن الحى على عمر ٢١ و٤٢ يوم وتحسن معنوى (٥%) فى كل من معدل الزيادة فى الوزن و متوسط استهلاك العليقة ومعدل تحويل الغذاء وكفاءة الإستفادة من البروتين والطاقة فى جميع مراحل التجربة (١ – ٢١ و٢٢ – ٤٢ و١ – ٤١ يوم) فيما عدا معدل تحويل الغذاء وكفاءة الإستفادة من البروتين والطاقة فى فترة ١ – ٢١ يوم حيث لم تكن الفروق معنوية فى الكتاكيت المعرضة لدرجة حرارة تحضين ٣٠°م بالمقارنة بتلك المعرضة لدرجة حرارة تحضين ٣٣ و٣٦°م، تحسن معنوى (٥%) فى كل من متوسط الوزن الحى ومعدل الزيادة فى الوزن ومتوسط استهلاك العليقة فى جميع مراحل التجربة وتحسن معنوى فى كل معدل تحويل الغذاء وكفاءة الاستفادة من البروتين والطاقة فى فترة ١ – ٢١ يوم فى المجاميع المغذاة على علائق تحتوى ٢٩٥٠ كيلو كالورى طاقه ممثله/ كجم عليقه بالمقارنة ب ٣٠٥٠ و ٣١٥٠ كيلو كالورى طاقه ممثلة/ كجم عليقة، بينما أدت إضافة ٥٠ مجم/ كجم L-Carnitine إلى علائق الكتاكيت إلى تحسن معنوى (١%) فى متوسط الوزن الحى على عمر ٤٢ يوم ومعدل الزيادة فى الوزن و معدل التحويل الغذائى ومعدل الإستفادة من البروتين والطاقة فى الفترتين ١ – ٢١ يوم و٢٢ – ٤٢ يوم وإنخفض معنويا كل من متوسط استهلاك الغذاء و نسبة دهن البطن بالمقارنة بالمجاميع التى لم يضاف لعلائقها L-Carnitine ، تأثر معنوياً (٥%) كلاً من معدل الأداء الإنتاجى و صفات الذبيحة لبدارى التسمين نتيجة التداخل بين درجة حرارة التحضين ومستوى الطاقة فى العليقة وإضافة L-Carnitine، وتوصى الدراسة بأنه يمكن بدء تحضين بدارى التسمين على درجة حرارة ٣٠°م والتغذية على عليقة تحتوى ٢٩٥٠ كيلو كالورى / كجم مضاف لها ٥٠ مجم/ كجم L-Carnitine فى مرحلة البادى (١ – ٢١ يوم) يليها عليقه ناهيه (٢٢ – ٤٢ يوم) تحتوى ٣١٥٠ كيلو كالورى / كجم مضاف لها ٥٠ مجم / كجم L-Carnitine.

المحكمون :

١ - أ.د. السيد إسماعيل حسنين — أستاذ تغذية الدواجن – كلية الطب البيطري – جامعة الزقازيق.

٢ - أ.د. عادل إبراهيم عطية — أستاذ تغذية الدواجن – كلية الزراعة – جامعة الزقازيق.