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EFFECT OF DIETARY SUPPLEMENTATION WITH DIFFERENT LEVELS OF L-CARNITINE ON PRODUCTIVE AND ECONOMIC PERFORMANCE OF BROILER CHICKENS

MS THESIS

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THESIS ACCEPTANCE AND APPROVAL

This thesis entitled Effect Of Dietary Supplementation With Different Levels Of L-Carnitine On Productive And Economic Performance Of Broiler Chickens presented by Mohammed M.Rasheed Hameed WARMAZYAR under supervision of Asst. Prof. Dr. Muhamat Ali Kara and second-Supervisor:Asst. Prof. Dr. Shahla M. S. Kirkuki in the Department of animal science has been accepted as a M.Sc. thesis according to Guidelines of Graduate Higher Education on ..../......./.......... With unanimity / majority of votes members of jury.

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THESIS NOTIFICATION

I hereby declare that this paper is my unique authorial work, which I have worked out by my own. Every information bases, references and liter-ature used or excerpted through explanation of this work are correctly cited and listed in complete reference to the owing cause.

Mohammed M.Rasheed Hameed WARMAZYAR

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Mohammed M.Rasheed Hameed WARMAZYAR
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LIST OF ABBREVIATIONS

Abbreviations	**Statement**
EBEF	**:** European Production Broiler Index
EBI	**:** European Broiler Index
FCR	**:** Feed Conversion Ratio
BW	**:** Body Weight
T	**:** Treatment
P	**:** Period
WG	**:** Weight Gain
CP	**:** Crude Protein
ME	**:** Metabolism Energy
NRC	**:** Nutrition Requirement Commercial
Lys	**:** Lysine
Me	**:** Methionine

ABSTRACT

MS THESIS

EFFECT OF DİETARY SUPPLEMENTATİON WİTH DİFFERENT LEVELS OF L-CARNİTİNE ON PRODUCTİVE AND ECONOMİC PERFORMANCE OF BROİLER CHİCKENS

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The experiment was conducted during the period from March 8th 2017 to April 26th 2017 at the Poultry Farm of Animal Sciences Department, College of Agriculture Sciences, University of Sulaimani to investigate the effects of dietary supplementation with different levels of L-carnitine on economic productive and performance of broiler chickens. By using 260 one-day old of Ross 308 broiler chicks, divided into 5 treatments and 4 replicates based on completely randomized design for 49 days. Feed and water were providedas *ad libitum*.Chicks were divided into five treatments 52 birds for each treatment. Each treatment contained four replicates of 13 birds.Dietary L-carnitine was added to the diet from the first day to the end of experimental which lasted 49 days at levels of 0% (Control), 0.01% (T1), 0.02% (T2), 0.04% (T3) and 0.08% (T5).The body weight had significantly ($p<0.05$) affected by L-Carnitine supplementation at period 6 and 7, feed intake at 6th, 7th and 8th period, L-Carnitine had a significantly ($p<0.05$) effect on weight gain at 6th and 8th period, it had significantly effect on feed conversion ratio at 5th and 6th period. While L-carnitine had not significant effect on the overall body weight, weight gain, feed intake and feed conversion ratio at the final of the experiment. However, l-carnitine had not significant effect on dressing percentage with and without giblets while it had a significantly ($p<0.05$) effect on abdominal fat at T5 compare to other treatments. In addition, there were no significant effects of treatments on economic index (European Production Efficiency Factor and European Broiler Index).

Keywords: broiler chicks, L-Carnitine, diet, productive, performance

1. INTRDUCTION

Poultry meat is nutritionally desirable because its high quality protein and low fat content(Laudadio et al.2012).Since poultry meat is an important source of high quality protein, minerals and vitamins to balance the human diet, poultry industry continues to play a positive role in the whole world as the major supplier for animal protein. Due to an increasing consumer demand for the lean tissuethe production of broiler meat that contains body fat is among one of the problems for the poultry meat industry(Daskiran 1991). Broiler chickens have been selected for increased weight gain. This strategy increases the rate of growth and feed conversion but had undesirable influence in the form of increased of abdominal fat, at the same time, increased carcass fatness can cause reduces the profits of poultry producers (Monika et al. 2012). To obtain an increased performance with broiler chicks, it is necessary to look at the development of their diets that will meet the requirements of the bird more precisely in order to obtain optimum growth. The influence of nutrition and genetic on fat deposition is higher compared to the environmental factors (Lin et al. 1980). Thus, the livestock researchers and producers tended to examinenew feed additives that had benefit to the poultry performance and production This presents a large opportunity for the use of a recent physiological feed additiveL-carnitine.

L-carnitine was needed to transport long-chain fatty acids into mitochondria, these amino acids taking part in B-oxidation that leads to production of energy (Carter et al. 1995, Brooks 1998).L-carnitine had two major functions. The best known is to facilitate the transport of long-chain fatty acids across the inner mitochondria membrane. L-carnitine also helpe the removal of short and medium-chain fatty acids from the mitochondria that made as a result of normal and abnormal metabolism (Matalliotakis et al. 2000; Buyse et al. 2001; Xu et al. 2003). Alterations in carnitine concentration or metabolism may significantly affect energy production in mitochondria (Arslan *et al*., 2003). In addition, L-carnitine has secondary functions, including the containment, buffering and removal of potentially toxic acyl groups from cells, equilibratingthe 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; Corduk et al., 2007).Some trials have invested that supplemental L-carnitine improved body weight gains and decrease the deposıtıon fat content of chickens (Rabie *et al*. 1997; Rabie and Szilagyi, 1998; Xu et al., 2003). According to these results, the aim of this study is to examine the performance, carcass parameters, abdominal fat and economic production of the addition of L-carnitine at different levels to the broiler rations.

2. LITERATURE REVIEW

2.1. L- Carnitine

Carnitine is a water-soluble quaternary amine (β-hydroxy γ-rimethylaminobutyrate), which found in two stereoisomeric forms, D- and L-carnitine (Bremer, 1983). Between these two farms only L-Carnitine physiological active (MeDowell, 1989). L-Carnitine is a zwitterionic form (Borum, 1983). These compound is synthesized from lysine and methionine in the kidney and liver (Rebouche and Paulson, 1986; Feller and Rudman, 1988).

2.2. L-Carnitine and Its Functional Effects in Poultry Nutrition

L-carnitine is used as supplementation in poultry diets to improve feed efficiency and to increase yield (Baumgartener1993). L-carnitine have a major metabolic role is transport long-chain fatty acid in to mitochondria for β-oxidation (Coulter, 1995). L-carnitine reduces the availability of lipids for peroxidation through transportation of fatty acids into the mitochondria to produce ATP energy (Nouboukpo et al., 2010). Burtle and Liu (1994) found that L-carnitine addictive to diets alters fat metabolism and decrease body fat. Improvement of chicken performance can be realized with one day-old chicks of high quality, which may be determined posteriori by their survivability and growth potential (Christensen, 2001). Several factors in newly hatched chick can influence post-hatch growth, and these include chick holding and nutritional conditions during juvenile stage (Uni and Ferket, 2004). According to Romanoff (1960), yolk sac is an important source of energy in developing embryo. This author reported that almost 20% of the body weight of newly hatched chicks is yolk, which provides immediate post-hatch energy. Indeed, Anthony et al. (1989) and Noy and Sklan (1998) reported that during the first days of life, yolk sac content is used for maintenance. Energy of chick during the first days of life is provided by oxidation of fatty acids of yolk sac content (Puvadolpirod et al., 1997). During the first five days after hatching, chicks acquire yolk derived lipids via lipoproteins. It is also assumed that yolk sac is involved in initiation of the growth process for chicks (Bigot et al., 2001) and carries immunoglobulins which are transferred from hen to chick. With regard to its importance during early stage of chick life, quick utilization of yolk sac content can improve chick juvenile performance parameters such as growth rate, feed efficiency and mortality. Fast utilization of yolk sac content can be increases by administration of substances that can be involved in fatty acid metabolism. L-carnitine is well known for its metabolic activity of fatty acid (Rebouche, 1992; Heo et al., 2001) and in addition to its anti-oxydant activity. L-carnitine increases long chain fatty acids' metabolism through mitochondrial membrane. It can be produced by the animal organism from lysine and methionine. Arslan (2006) reported that endogenous production together with feed supplementation of L-carnitine should be sufficient to cover the needs of adult birds. However, in young chick biosynthesis of L-carnitine is less well developed and therefore, L-cartinine supplementation of chicks during the starter stage may lead to faster utilization of yolk sac content. This fast utilization of yolk may result in improvement of performance parameters and immunity functions. L-carnitine has indispensable functions in intermediary metabolism and be received by endogenous synthesis and from exogenous sources. It plays an obligate role in fatty acid metabolism by directing fatty acids into the mitochondrial oxidative pathway through the action of specialised acyltransferases. In poultry production, L-carnitine has a multi-functional purpose, which includes: growth promotion, strengthening the immune system, antioxidant effects and improving semen quality. The concentration of L-carnitine in animals varies widely across species, tissue type, and nutritional status of the animal. It has been suggested that the L-carnitine requirement may be increased under certain circumstances such as via higher performance, various stress conditions and where the feed is deficient in animal protein sources.

2.3. Effect L-Carnitine on Body Weight

In a later study that showed the supplementation of L-carnitine to the diet caused of high body weight and leading to increase valuable meat parts in broilers such as breast and drumsticks (Farrokhyan *et al. 2014*). The feeding of diets with a standard energy level (12.13 MJ ME/kg) and supplementary of L-carnitine significantly increased body weight in quail (Sarica *et al.* 2007).Michalczuk *et al.* (2012) revealed that Aminocarnifarm (43.68% of L-carnitine) supplemented (62.5 g per 100 l) via drinking water for broiler chickens (male and female) had significantly increases average body weight from 1 to 7, 21 to 28, and 36 to 42 days of age. Parsaeimehr *et al.* (2010) showed that diet with supplementation of L-carnitine and 5% animal fat improve body weight. Oladele et al.(2011) reported that supplementation at 60 ppm of L-carnitine either in water or in feed had positive affect to increase the body weight. Rabie and Szilagyi (1998) and Buyse *et al*. (2001) noticed that supplementary of L-carnitine had a positive effect on the body weight of chickens on the end of fattening period. Hrnčár *et al.* (2015) found supplementary 30% of L-carnitine in base diet had a positive impact on body weight. Birds fed 40 ppm Lcarnitine were increased body weight independent of crude protein, methionine, and lysine level *(Kidd et al.2009).*

Nouboukpo et al. (2010), who noticed the influence of L-carnitine in drinking water on the growth ability of broiler, showed at 7 days of rearing that chickens from the group experimental had significantly higher body weight compared to the control groups when receiving 30 and 60 mg of L-carnitine in 1L of drinking water. Some authors who studied the influence supplementary of L-carnitine on broiler performance showed that it had no impact on body weight (Leibetseder 1995; Lien and Horng, 2001; Xu *et al*. 2003; Cevik and Ceylan 2005). Barker & Sell (1994) noticed feed addictive of L-carnitine at 0, 50 or 100 mg/kg fed low- or high-fat diets did not effect on the body weight of broiler chickens. Rabie *et al.* (1997a; b) pointed out that L-carnitine feed addictive to diets at the end of the experimental period had no significant impact on body weight of broilers. Likewise, Celik *et al.* (2003) showed fed diets supplemented with L-carnitine had no significant differences in the body weights of broilers.

2.4. Effect L-Carnitine on Weight Gain

Number of studies have demonstrated that supplemental L-carnitine improved body weight gains of broilers (Lettner *et al*. 1992, Rabie *et al*. 1997]. Gropp *et al*. (1994) showed that L-carnitine supplementation on diet could improve live weight gain in poultry. Yalçin *et al*. (2008) noticed that supplementation 200 ppm L-carnitine of Japanese quail diet from one till 4 weeks, significantly increased body weight gains. the supplementation of L-carnitine at either 50,100, or 150 g/kg could cause increased weight gain (Rabie *et al.1997a.* and Rabie and Szilaggi 1998) Rabie *et al.* (1997) have noticed that L-carnitine supplementation (50, 100 and 150 mg / kg) in broiler chickens fed with isoenergetic diets, containing variable crude protein contents (18, 20 and 22 %) Significantly increased weight gain. L-carnitine supplementation at level of 500 mg / kg ducks diet positively affected weight gain during the first 4 weeks of age (Mona, E. M. 2015). Celik *et al*. (2003) indicated that L-carnitine or L-carnitine ± niacin supplementation on diet during the early stages of growing have significantly effects on body weight gain. Abdel-Fattah *et al*. (2014) noticed that supplementation of L-carnitine (200-400 mg/kg) in Japanese quail diet positively increased body weight gains. Sayed *et al.* (2001) reported that supplementation of L-carnitine (50 mg / kg) to diet containing 2 and 4 % of sunflower oil positively improved weight gain. L-carnitine supplementation (300 mg/kg) broiler chicken's diets had significantly increased body weight gain **(**Parsaeimehr *et al*. 2014).Taklimi *et al*. (2015)reported that supplementation 600 up to 800 mg/kg L-carnitine in diet for broiler chickens had significant improve weight gain. Buyse *et al.* (2001) and Xu *et al.* (2003) showed that L-carnitine supplementation of diet did not affect body weight gain. Sarica *et al*. (2005) reported that supplementation of L-carnitine (25-100 mg/kg) to male broilers diet had no significant effect on body weight gain. Barker and Sell (1994) also reported that Carnitine feed addictive of diet at 0, 50, or 100 mg/kg diet had not significantly affected on body weight gain. Leibetseder (1995) pointed out that body weight gain of broiler chickens was not affected by dietary carnitine (L or DL form) at 200 mg/kg. Xu et al. (2003) showed feed supplemented with 0, 25, 50, 75, or 100 mg/kg L-carnitine had no differences in body weight gain on male broilers. Leibetseder (1995) investigated the effectiveness of carnitine and its precursors (lysine and methionine) for reducing the formation of abdominal fat in broilers fed with diets supplemented with 0 or 50g fat/kg. He found that body weight gain, of broilers were not influenced by dietary carnitine (L or DL form) at a dosage of 200 mg/kg diet. Arslan *et al.* (2003) addition of L-carnitine to drinking water (100 mg/l in geese and 200 mg/l in ducks) did not significantly improve body weight gain.

2.5. Effect L-Carnitine on Feed Intake and Feed Conversion Ratio

Golrokh et al (2016) indicated that supplementation of l-carnitine for broiler diet at level (150,300) mg/kg had a significant effect on feed conversion ratio at level 300 mg/kg compare to control at final period. Abdel-Fattah et al (2014) who use l-carnitine supplementary at level (100, 200,400) ppm to Japanese quail diets at 2-6week result showed significant improve in feed conversion ratio particularly with high level (400 ppm).

Cyril Hrnčár et al (2015) revealed L-carnitine supplemented to drinking water (1 ml per 1.2 l) during three periods: from 1 to 5, 19 to 23, and 37 to 41 days of age had a significant effect to improve feed consumption from broiler.

Interactions occurred in 18 to 25 and 25 to 32 d feed conversion revealed that the lowest level of CP provided good conversion only if dietary L-Carnitine was supplemented (Rabie et al., 1997a) Michalczuk et al (2012) found that Aminocarnifarm (43.68% of L-carnitine) supplemented (62.5 g per 100 l) via drinking water for broiler chickens (male and female) improved feed conversion during the whole rearing period, from 1 to 7, 21 to 28, and 36 to 42 days of age. Rabie and Szilaggi (1997a, 1998) found that supplementation of L-carnitine at either 50, 100, or 150 ppm significantly at (1- 6 weeks) age improved feed conversion ratio of broiler chickens. Geng et al. (2004, 2007) reported the effects of L-carnitine (added daily to feed from 1 to 42 days of age) and coenzyme Q10 on productivity of males, found that the supplements improved feed conversion ratio (FCR). In the experiment from 2004, the authors indicated FCR to reduce non-significantly, and in the experiment from 2007, FCR decreased significantly in the group of male supplemented with 100 mg of L-carnitine per 1 kg of feed compared to the other groups. Kidd et al. (2009) who also found there was not significantly effect on feed conversion ratio with supplementation of 50 mg/kg l-carnitine with deferent level of energy to broiler diet from 15 to 35 d also there was no significant effect from 30 to 42 days with deferent level of l-carnitine (10, 20, 30, 40) mg/kg. Xu et al. (2003) indecated that supplementation of L-carnitine to dietary commercial male broilers at 0, 25, 50, 75, or 100 ppm had no significant effect on feed conversion. No significant interaction of carnitine was noted for feed conversion ratio of birds fed six different l-carnitine levels at (40, 80, 120, 1 and 200 ppm) throughout the starter(1-19days) grower(1-35days), and finisher (1-49 days) periods (Daskiran 1991). Kheiri et al (2011) observed supplementation of l-carnitine at (0, 60 and 120 mg/kg) to broiler diet at the growth periods (3 to 6 weeks of age) had not significant impact to improve feed conversion ratio and feed consumption. Deng et al. (2006) found that supplementation of L-carnitine at levels of 0, 100 or 1000 ppm of egg Leghorn type chickens after hatching for 4 weeks cause no difference in feed intake or feed utilization efficiency. Wang et al. (2003) founded supplementation of l-carnitine at level 30, 50, 100 mg/kg from (0-3 weeks, 4-7 weeks and 0-7 weeks) had not significantly effect on feed conversion ratio of broiler chickens.

2.6. Effect L-Carnitine on Carcass and Abdominal Fat

L-carnitine supplementation in diets reduces the amount of long-chain fatty acids availability for esterification to triacylglycerols and storage in the adipose tissue (Barker and Sell, 1994; Xu et al. 2003).Dietary addition of 25 (Xu et al., 2003) or 50 (Rabie et al., 1997 a,b; Rabie and Szilagyi, 1998) ppm L-Carnitine have been reported to decrease abdominal fat pads in comparison to broilers receiving no supplemental dietary L-carnitine. However, Cartwright (1986), Baker and Sell (1994), Lien and Horng (2001), and Leibetseder (1995) demonstrated that the dietary addition of 50 and 100, 160 and 200 ppm L-carnitine did not affect abdominal fat broilers. Golrokh et al (2016) showed that l-carnitine supplementation for broiler diet at level (150,300) mg/kg both level had a significant effect on reduced abdominal fat, l-carnitine at level 300 mg/kg had a significant influence on carcass and empty carcass at final period.

Wang et al., 2003 who reported supplementation (30, 50, 100) mg/kg of l-carnitine for broiler fed have shown (100 mg/kg) L-carnitine had better regulative effects on fat and cholesterol metabolism than lower adding levels. Burtle and Liu, (1994) indicated that L-carnitine supplementation to diets increases fat metabolism and decreases abdominal fat. Kidd et al. (2009) reported that supplementation 50 mg/kg l-carnitine from 20-35 days to broiler diet had not significantly effect on carcass and abdominal fat moreover feed addictive 50 mg/kg l-carnitine with different level energy had a significantly effect on broiler carcass while supplementation of l-carnitine at different level (10, 20, 30, 40) from 30–42 days had not a significantly effect on carcass and abdominal fat. Hrnčár et al (2015) indicated L-carnitine supplemented to drinking water (1 ml per 1.2 l) to broiler chicken both sex (male and female) had not significant effect to improve carcass and reduce abdominal fat at final period. Kheiri et al (2011) observed supplementation of l-carnitine at (0, 60 and 120 mg/kg) to broiler diet at the growth periods (3 to 6 weeks of age) had not significant effect on carcass while there was significantly effect to reduce abdominal fat at level (120 mg/kg). Bozkurt, (2008) indicated that adding animal or vegetable fat at the 5% level in broiler breeder hens and males diet had no significant effect on performance at 22, 34, 46 and 58 week of age. Daskiran (1991) found that l-carnitine supplementation of broiler fed at six different level (40, 80, 120, 1 and 200 ppm) at(1-19days) grower(1-35days), and finisher (1-49 days) periods was not significant effect on carcass and reduce abdominal fat. Celik and Ozturkcan (2003), Celik et al. (2003) and Kidd et al.(2009) who observed that supplementation of L-carnitine had no effect on carcass yield.

2.7. European Production Efficiency Factor and European Broiler Index in Broiler

Measurement of the efficiency of broiler chicken production is an important issue for developing countries.
Index (EBI) or European Production Efficiency Factor (EPEF) can be used to compare broiler results from different flocks and different regions, the European Broiler.
This factor stand arises technical results, taking into account feed conversion, mortality and daily gain.

The European Broiler Index compares technical results, but it doesn't automatically mean that the results can also be compared economically.

If for instance a very low density is used during the grow-out period, the daily gain and with it the EBI will most likely go up, but the profit per square meter will go down, and the last one is economically of more interest.

If a low density, cheap feed is used, the daily growth and feed conversion might be negatively influenced, and with it the EBI, but the net profit per kg of meat might go up.

3. MATERIALS AND METHODS

This study was conducted at the Bakrajo Poultry Breeding Field, Animal Sciences Department, College of Agricultural Sciences, University of Sulaimani during the period from March 8th 2017 to April 25th 2017 to study the effect of dietary supplementation with different level of l-carnitine on the performance and carcass parameters of Ross 308 broiler chickens (Figure. 3.1, 3.2).

Two hundred and sixty, one-day old Ross 308 broiler chicks were obtained from Lawa Hatchery in Arbil Province and were randomly distributed in to five treatment groups (52 chicks for each group) with four replicates (Table 3.1). Chicks were raised on floor cages (110×120×60 cm); and lighting was continuous (24 hours / day) starter period, (21 hours / day) grower and (24 hours / day) finisher. Temperature and humidity of the rooms were measured by electronic thermometers and the electronic thermometers were placed at different locations of the room above (50-60 cm) from the floor of the rooms (Figure 3.3).

Table 3.1. The Experimental Treatments

Treatment	Feeding system
T1 (control)	Feed with 0 mg / kg L-Carnitine
T2	Feed with 100 mg / kg L-Carnitine
T3	Feed with 200 mg / kg L-Carnitine
T4	Feed with 400 mg / kg L-Carnitine
T5	Feed with 800 mg / kg L-Carnitine

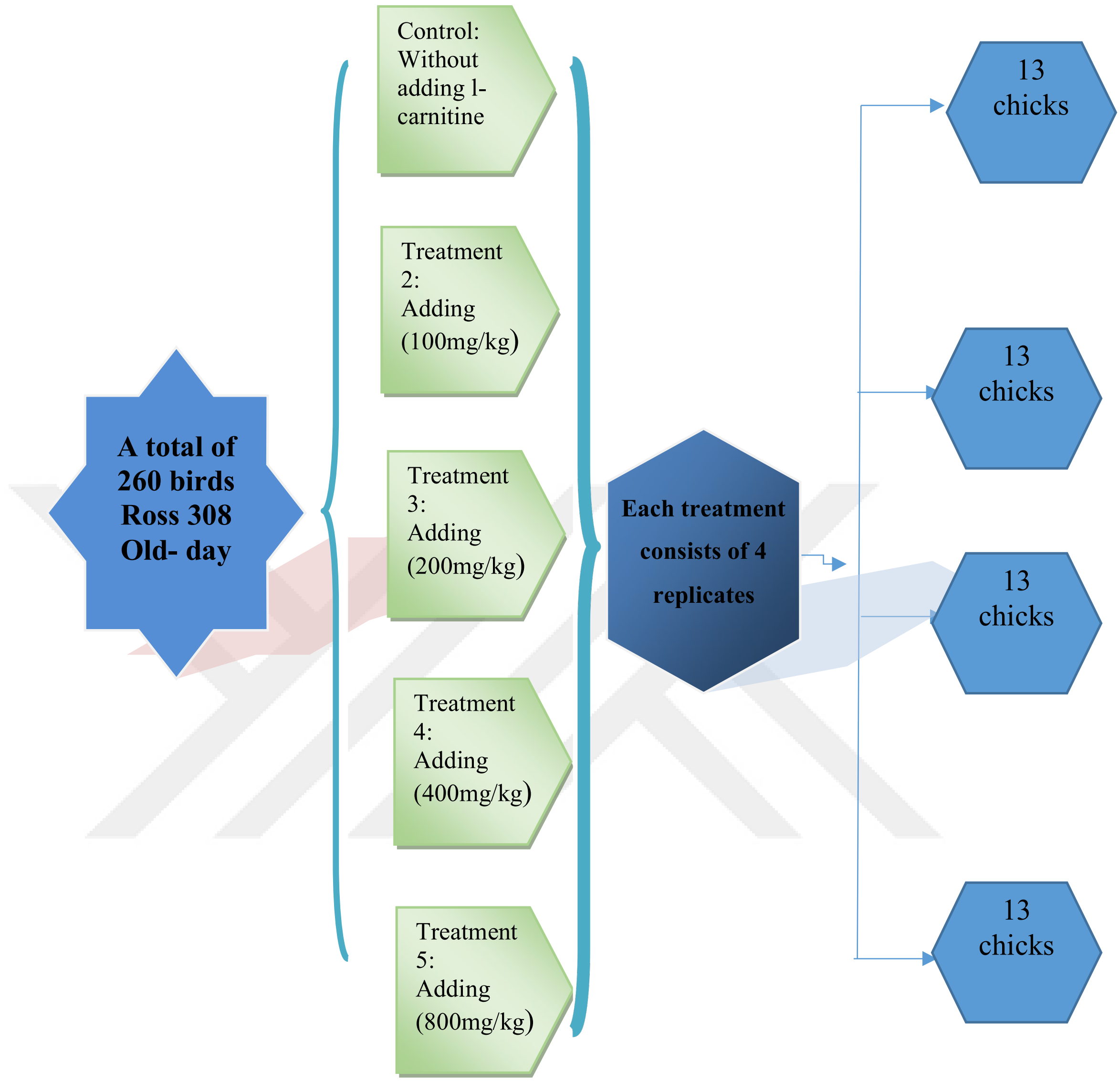

Figure 3.1. Experimental Design

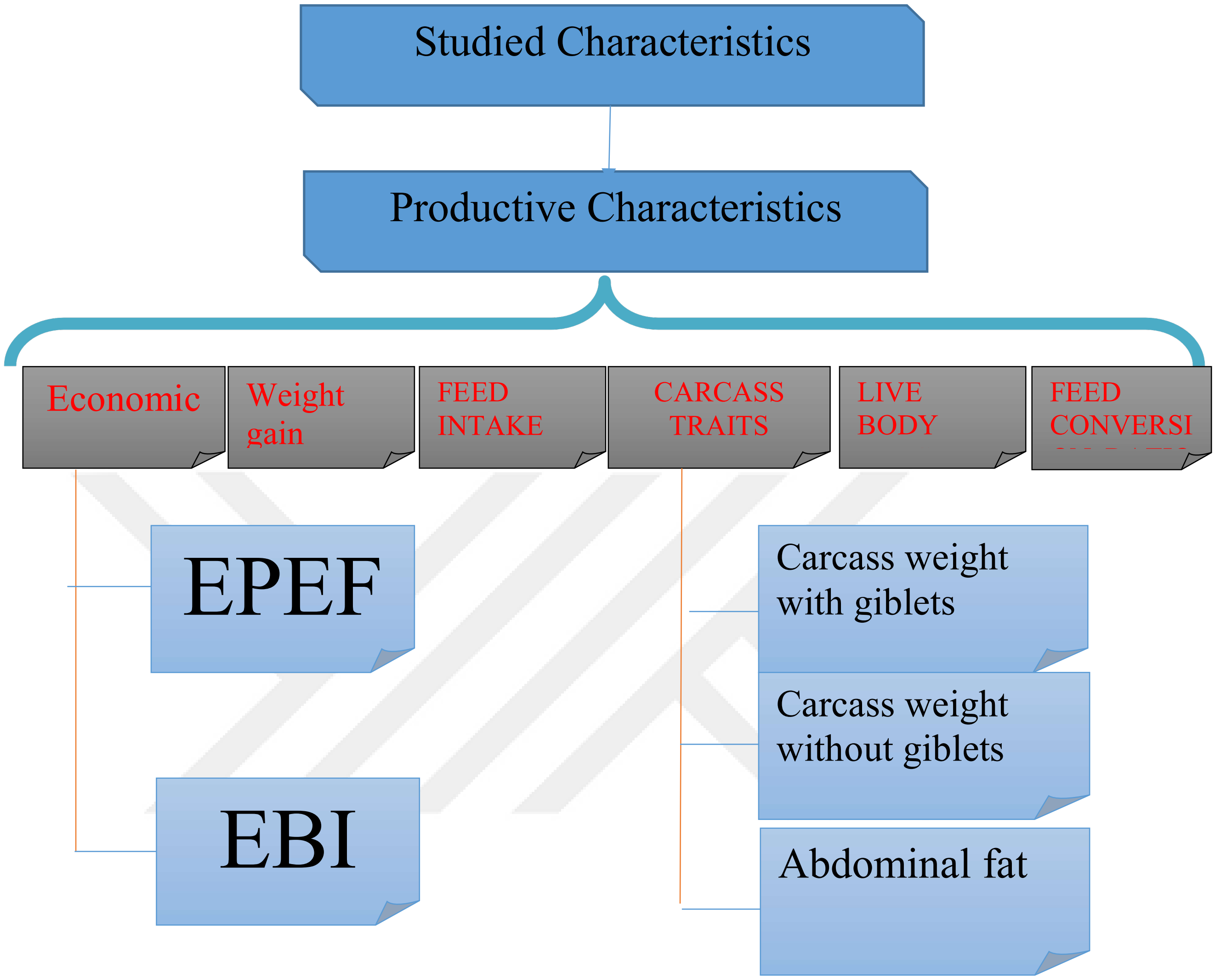

Figure 3.2. The Studied Characteristics

3.3. Feeding Program

Feed and water were providing *ad libitum* during the experimental period. The diets were determined according to NRC (1994). The nutrition substances were as follows: Starter feed: (CP = 22.8% and ME = 3,079 kcal/ kg) from (1- 11) day of age; Growth feed: (CP = 21.0% and ME = 3,139Kcal/ kg) from (11-28) day of age; Finisher feed: (CP =19.1% and ME = 3,212 kcal/ kg) from (29-49) day.

Ingredients composition of Commercial feed were Soybean meal, Wheat, Yellow Corn, Sunflower seed Oil, Limestone, Vitamin, minerals, Salt (NaCl), Calcium phosphate (Table 3.2).

Table 3.2. Ingredient of the composition of Commercial feed used in the experiment

Ingredients %	Period		
	Starter	Grower	Finisher
Yellow Corn	32	32	35
Soya bean meal	34	28	22.5
Protein conc.*	5	5	5
Wheat	24.3	30.2	32.5
Sunflower oil	3.5	3.5	3.7
Limestone**	1	1.2	1.2
salt	0.2	0.1	0.1
Total	100	100	100
	Calculated composition***		
Protein	22.8	21	19.1
ME Kcal / Kg	3079	3139	3212
Calcium	0.76	0.82	0.81
fiber	3.7	3.5	3.3
Lys.	1.34	1.19	1.04
Me.	0.89	0.83	0.77
fat	5.6	5.6	6.0

* Protein concentrate used in the diets was produced in Holland (WAFI) which contains: 40 % crude protein, 2100 Kcal ME / Kg, 5% crude fat, 2% crude fiber, 6.5% calcium, 2.50% phosphorus, %3.85 lysine, 3.70 % methionine, and 4% cystine.
** Limestone:
*** The calculated composition of the diets was determined according to NRC (1994).

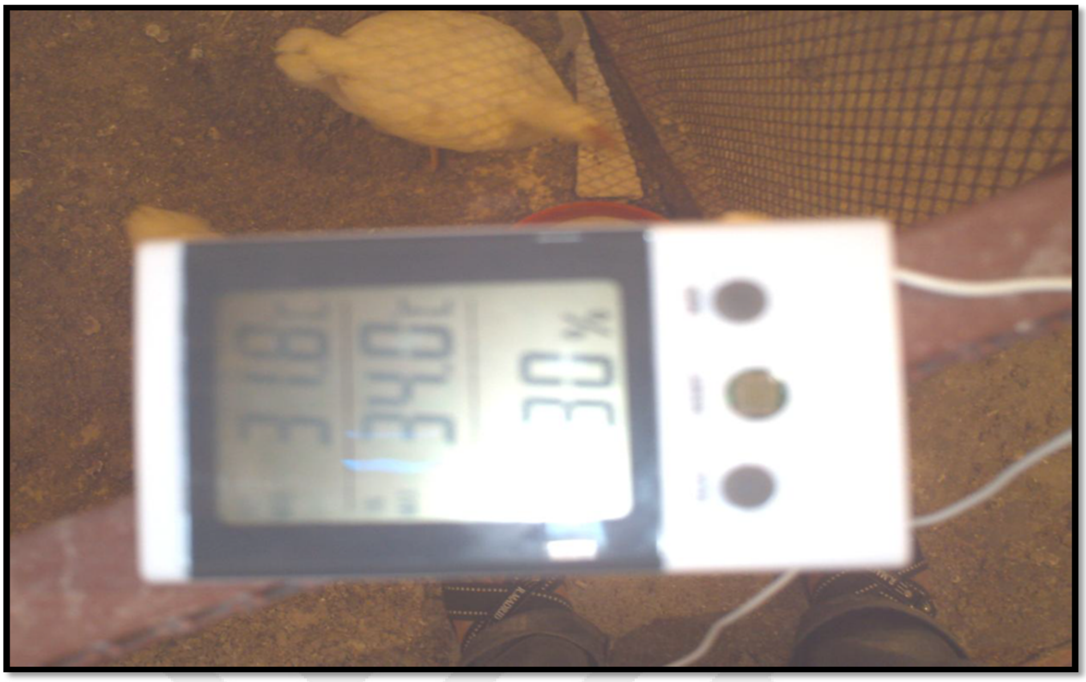

Figure 3.3. Electronic thermometers used for measuring temperature and humidity inside the rearing room.

3.4. Health Care:

The birds were raised throughout the experiment period with the health precaution program, and they were being taken care of as follows:

1- Providing Vitamin C (1 gm /liter of water) when the broilers have been brought to the field for twelve hours to reduce the stress of transportation from the hatchery to the field.

2- Providing Vitamin E (1 gm /liter of water) and vitamin B complex (2 gm /liter of water) while the birds showed vitamin deficiency.

3- The following precaution program has been applied:

a- Newcastle vaccine (1st dose) through drinking water at the age of 10 days.

b- Newcastle vaccine (2nd dose) through drinking water at the age of 21 days.

c- Gumboro vaccine (1st dose) through drinking water at the age of 27 days.

d- Newcastle vaccine (3rd dose) through drinking water at the age of 40 days.

4- Vitamins C (0.5 gm / liter drinking water) has been given after each vaccination process. The vaccines were obtained from Intervet Company.

3.5. Production Traits

3.5.1. Live Body Weight

Birds were weight every week at day 1, 7, 14, 21, 28, 35,42, 49 of broilers age by the following:

Body Weight = weight of the birds (g) / number of birds

3.5.2. Weight Gain

The average daily body weight gain was calculated by subtracting the average initial live weight of a certain period (which was usually weekly) from the average final live weight of the same period for each chick.

3.5.3. Feed Intake

Feed intake in each replicate was measuredandrecorded at the end of each week by subtracting feed residual from total amount of feed supplied by the following formula:
Feed Intake Weekly = The feed intake (g/week)/ (number of birds)

3.5.4. Feed Conversion Ratio

Feed Conversion Ratio is the amount of feed intake estimated to unit weight for each weight gain estimated in the same unit and calculated by the following formula:
Feed Conversion Ratio = Average of feed intake by one bird in week (kg)/(Average of weight gain by one bird in the same week (kg).

3.5.5. Mortality

Mortality is a number of died birds to total number of birds of each treatment and calculated weekly by the following formula:
Mortality = ((number of died birds)/(total number of birds)) *100

3.6. Carcass Traits

At the end of the experiment, 8 birds from each treatment (2 birds male and female from each replicate) were randomly chosen for slaughter and evaluation carcass traits, dressing percentages educated with or without giblets were determined and abdominal fat as follows:

Dressing percentage with giblets = (Carcass weight with giblets / Live body weight) *100

Dressing percentage without giblets =(Carcass weight without giblets / Live body weight)*100

Abdominal fat percentage = (abdominal fat /live body weight) * 100

3.7. Economic Efficiency

Economic Efficiency of the experiment was calculated according to the following equations:

Viability(%) =(number of live bird at final / number of live bird at first) * 100

European Production Efficiency Factor = (viability (%) *body weight (kg)/age (day)*feed conversion ratio)*100

European Broiler Index = (viability (%)* average daily gain (g/check/day) / feed conversion ratio) * 10

Figure 3.4. Distribution of chickens into the replicates.

3.8. Statistical Analysis

General Linear Model (GLM) within the statistical program XLSTAT (2004, version-7.5) was use to analyze the two factors namely the treatments and periods affecting productive traits within the factorial Complete Randomized Design (CRD).

The significant differences between means of traits included in this study were determined using Duncan's multiple range test under the probability ($p< 0.05$) (Duncan, 1955).

The total variance was partitioned into main effects and their interaction according to the following model:

$Yij = \mu + Ti + Pj + TP\ ij + eij$

Where:

Yij= Observation of the performance traits.

μ = Overall mean.

Ti = Effect of treatments (T1 0%, T2 0.01%, T3 0.02%, T4 0.04%, T5 0.08%)

Tj = Effect of periods (day 1, 7, 14, 21, 28, 35 and 42 of age).

TDij = Interaction between treatments and periods.

eij= Random error, assumed to be equal to zero and variance is $б^2e$ (N~ 0, б2e)

4. RESULTS AND DISCUSSION

4.1. The Effect of Treatments and Sex on Live Body Weight, Carcass, Clear Carcass and Abdominal Fat at Day 49 of Age of Broiler Chickens.

Effect of treatments and sex at final period of experiment day (49) on live body weight, carcass (g and %) and clear carcass (g and %) was not significant (Table 4.1). While, abdominal fat (g and %) was significantly ($p<0.05$) affected by treatments. Females in T3 was significantly ($p<0.05$) had higher abdominal fat (43.75g) compared with other males and females in same or other treatments except males and females in T4. On the other hand, females in T2 and T3 were significantly ($p<0.05$) had higher abdominal fat (g and %) compared with males in same treatments. While, abdominal fat (%) of females in T3 was significantly ($p<0.05$) higher than all females and males in other treatments. In general, the results revealed to that abdominal fat (g and %) of males and females in T5 were significantly ($p<0.05$) or numerically had lower than males and females in other treatments. Those result were similar to my result, Lien and Hornga, (2001); Celik and Ozturkcan, (2003) have shown that carcass weight and carcass yield of broilers was not significantly affected by diet supplementation. Sarica, et al., (2005) reported non-significant effect of dietary L-carnitine on carcass weight in Japanese quail fed diet contained 200 mg LC/kg. Barker and Sell (1994) showed no effect of dietary L-carnitine supplementation (0, 50 and 100 mg/kg) on performance and carcass composition of broilers and young turkeys fed with low- and high fat diets. Zhang et al. (2010) and Michalczuk et al. (2012) found that non-significant increase in carcass yield by dietary supplementing L-Carnitine. Bozkurt, (2008) indicated that adding animal or vegetable fat at the 5% level in broiler breeder hens and males diet had no significant effect on performance at 22, 34, 46 and 58 week of age. Some studies have shown that supplemental L-carnitine had a significant effect to reduce the abdominal fat content of broilers (Lettner et al. 1992, Markwell et al. 1973 and Marquis N, 1965). l-carnitine supplementary to diet had a positive effect in decrease the abdominal fat of carcasses from males (Rabie et al. 1997a; Rabie et al. 1997b; Rabie and Szilagyi, 1998; Xu et al. 2003). Burtle and Liu, (1994) indicated that L-carnitine supplementation to diets increases fat metabolism and decreases abdominal fat. Parsaeimehr et al. (2014) showed that supplementing L-carnitine (300 mg/kg) significantly decrease abdominal fat percentage of broiler chickens.

Table 4.1. The effect of treatments and sex on Live Body Weight, Carcass (g and %), Clear Carcass (g and %) and Abdominal Fat (g and %) at day 49 of age of broiler chickens.

		Traits						
Treatments	Gender	Live BW	Carcass,g	Carcass,%	Clear Carcass,g	Clear Carcass,%	Abdominal Fat,g	Abdominal Fat,%
T1	Male	2412.50±51.53	2018.75±46.79	85.91 ±0.52	1633.7 ±48.19	67.67 ±0.59	32.50b ±1.44	1.35b ±0.06
(0 mg/kg)	Female	2400.00±61.23	1967.50±89.33	84.00±1.72	1275.00 ±428.61	52.35±17.46	32.50b±1.44	1.36b ±0.06
T2	Male	2487.50±89.84	2056.25±80.42	82.64 ±0.72	1695.00 ±67.11	68.13 ±0.85	22.50c ±2.50	0.90c ±0.09
(100mg/kg)	Female	2375.00±101.3	1967.50±92.59	82.89 ±0.36	1601.25 ±88.70	67.32 ±0.84	33.75b ±2.39	1.42b ±0.04
T3	Male	2462.50±96.55	2040.00±76.45	82.86 ±0.53	1686.25 ±80.24	68.41 ±0.80	30.00bc ±4.08	1.22bc ±0.17
(200mg/kg)	Female	2300.00±67.70	1873.75±64.07	81.44 ±0.79	1543.75 ±69.11	67.03 ±0.98	43.75a ±3.14	1.90a ±0.13
T4	Male	2550.00±95.74	2151.25±113.42	84.28 ±2.17	1790.00 ±107.14	70.10 ±2.45	36.25ab ±3.75	1.42b ±0.14
(400mg/kg)	Female	2462.50±134.43	1867.50±293.55	75.09 ±9.56	1725.00 ±92.28	70.07 ±0.73	37.50ab ±3.22	1.52b ±0.08
T5	Male	2525.00±110.88	2127.50±127.64	84.09 ±1.72	1780.00 ±120.98	70.29 ±2.03	22.50c ±1.44	0.89c ±0.04
(800mg/kg)	Female	2425.00±118.14	1961.25±155.33	81.66 ±7.03	1646.25 ±97.11	68.58 ±6.04	22.50c ±4.78	0.92c ±0.18

[a-j] Means followed by different letters are statistically different.

4.2. The Effect of Treatments on Weight Gain, Feed Intake and Feed Conversion Ratio From 1-49 Day-Old

Table 4.2 indicates that there was no significant effect of treatments on weight gain, feed intake and feed conversion ratio at day 49. Nevertheless, feed conversion ratio was numerically better in T4 followed by T2, which had better weight gain compared with other treatments. These results are agreement with those reported by other authors for broiler chickens Buyse et al (2001) Barker et al (1994) Cartwright (1986) Leibetseder (1995). Lien (2001) showed that growth performance of broilers, in terms of body weight and feed intake, were not affected by feeding diet supplemented with 0.05% L-carnitine from 5 to 7 week of age. Buyse et al. (2001) and Rezaei et al. (2007), found that L-carnitine supplemented to chickens had no effect on feed conversion, feed intake and weight gain. Murali et al. (2015) showed that dietary L-carnitine (900 mg/kg diet) supplementation had no effect on feed consumption in broilers during growing period (0-6 wks.). Xu et al. (2003) observed that dietary supplementation of L-carnitine to commercial male broilers at 0, 25, 50, 75, or 100 ppm had no significant effect on daily body gain or feed conversion. Corduk et al. (2007), Daskiran et al. (2009) and Sarica et al. (2007) revealed that various levels of L-carnitine did not affect ody weight gain and feed intake of quails. Deng et al. (2006) found that short-term supplementation of L-carnitine at levels of 0 (control), 100 or 1000 ppm for chickens after hatching for 4 weeks caused of no difference in growth rates, feed intake or feed utilization efficiency. Yalçin et al. (2006) revealed that L-carnitine supplementation at 100 mg/kg had no significant effect on feed intake and feed conversion ratio. Sarica et al. (2005) showed that supplementation of L-carnitine (25-100 mg/kg) had no significant effect on daily body gain from commercial male broilers. Arslan et al. (2003 and 2004) where they found that L-carnitine administration via drinking water 100 mg/l to Turkish native geese and 200 mg/l to Turkish native duck had not significant effect on growth performance in ducks and geese.

Table 4.2. The effect of treatments on Weight Gain, Feed Intake and Feed Conversion Ratio from 1-49 day-old.

Treatments	Feed Intake(g)	Weight gain(g)	FCR
T1(0)	4004.96a±49.62	2358.75a±36.99	1.70a±0.02
T2(100mg)	4016.79a±42.95	2384.50a±91.38	1.69a±0.07
T3(200mg)	4123.34a±100.87	2335.75a±52.16	1.77a±0.04
T4(400mg)	4056.74a±58.45	2459.50a±82.52	1.66a±0.07
T5(800mg)	4189.48a±112.47	2430.00a±93.72	1.74a±0.11

[a-j] Means followed by different letters are statistically different.

4.3. The Effect of Treatments on Economic Efficiency

Table 4.3 revealed that there was no significant effect of treatments on Economic Efficiency (European Production Efficiency Factor and European Broiler Index). While T4 at (EPEF and EBI) had a higher number compare to control and other treatments but there was not significantly (P<0.05) effect on the treatments.

Table 4.3. The effect of treatments on Economic Efficiency

Treatment	European Production Efficiency Factor	European Broiler Index
T1(0mg)	250.51±13.27	245.56±13.01
T2(100mg)	286.50±30.89	281.02±30.44
T3(200mg)	254.43±15.71	249.57±15.45
T4(400mg)	301.54±29.84	295.97±29.53
T5(800mg)	282.22±36.20	277.16±35.75

4.4. The Effect of Interaction Between Treatments (Different Levels of L-Carnitine) and Periods on Body Weight

Effect of interaction between treatments and periods on body weight was shown in Table (4.4). The body weight increased with the increase of periods age, whereat effect of all treatments on body weight at P8 were significantly (p<0.05) higher than the same treatments prior to periods. Moreover, effect of treatments was significant (p<0.05) at P6 and P7. At P6 significant (p<0.05)higher body was obtained by birds in T4 followed by T5 compared with T3 and T1, respectively. In addition, birds T2 was significantly (p<0.05) had higher body compared with birds in T1 at P6. While at P7 birds in T4 revealed significant higher body weight compared with all other treatments except T5. In addition, there were no significant differences between treatments at other periods, although numerically higher body weight was obtained by birds in T4 followed by T5 at all other periods except P1 and P2. Hrnčár et al. (2015) were also found significant effect of L. carnitine on body weight at day 28, 35 and 42 compared with control, Rabie and Szilagyi (1998) and Buyse et al. (2001) also reported that supplementation of L-carnitine had a significantly effect on the body weight of chickens on the end of fattening period. While, Hrnčár et al. (2015) showed that supplementation of L-Carnitine had not significantly effect on body weight at P1, P2, P3 and P4.Buyse et al. (2001) showed that non- significantly increase in average body weight of chickens receiving L-carnitine at 14, 21and 28 days of rearing. Rabie et al. (1997) reported that L-carnitine supplementary to diets had no significant impact on body weight of broilersat the end of the experimental period.

Table 4.4. Effect of interaction between treatments and period on Body Weight

Peryods (Days)	Treatments (different levels of L- Carnitine)				
	T1 (0mg)	T2 (100mg)	T3 (200mg)	T4 (400mg)	T5 (800mg)
P1 (1)	47.50^{j}±1.55	46.75^{j}±1.03	45.50^{j}±0.86	46.75^{j}±0.94	45.00^{j}±1.00
P2 (7)	104.14^{ij}±2.27	107.31^{ij}±1.03	100.96^{ij}±1.55	107.98^{ij}±3.44	107.79^{ij}±3.18
P3 (14)	205.00^{i}±5.66	216.71^{i}±5.77	199.60^{i}±7.40	221.11^{i}±8.55	221.44^{i}±3.09
P4 (21)	389.63^{h}±5.64	428.39^{h}±14.28	412.13^{h}±7.13	444.00^{h}±14.23	441.75^{h}±13.92
P5 (28)	695.31^{g}±14.74	728.12^{g}±32.32	687.50^{g}±25.25	781.25^{g}±34.04	768.75^{g}±25.25
P6 (35)	1125.00^{f}±40.50	1300.00^{de}±81.17	1215.63^{ef}±60.89	1371.88^{d}±59.37	1346.88^{d}±43.41
P7 (42)	1734.38^{c}±51.12	1859.38b^{c}±106.23	1762.50b^{c}±55.66	1890.63^{b}±55.05	1862.50^{bc}±61.66
P8 (49)	2406.20^{a}±37.32	2431.25^{a}±92.06	2381.25^{a}±52.41	2506.25^{a}±81.88	2475.00^{a}±93.54

$^{a\text{-}j}$ Means followed by different letters are statistically different.

4.5. The Effect of Interaction Between Treatments (Different Levels of L-Carnitine) and Periods on Feed Intake.

Table 4.5 demonstrated the effect of interaction between treatments and periods on feed intake were significant ($p<0.05$). Effect of treatments on feed intake at P6, P7 and P8 was significant ($p<0.05$). Whereat, observed that significant ($p<0.05$) higher feed intake were obtained by birds in T5 at P6 which also significantly ($p<0.05$) higher than other treatments in same period. Followed by birds in T3 and T5 at P7 which significantly ($p<0.05$) higher than T1. While at P8 birds in T2 significantly ($p<0.05$) had lower feed intake compared with T3 and numerically with other treatment in same period. Sayed et al. (2001) showed that supplementation of L-carnitine (50 mg/ kg) to diet containing 2 and 4% of sunflower oil increased feed intake, Rabie et al. (1997) have demonstrated that L- carnitine supplementation (50, 100 and 150 mg / kg) had significantly effect on feed intake. Bayram *et al.* (1999) noticed there was a significant improve in feed intake in quails fed diet supplemented with 500 mg LC/kg. However, Effect of treatments on feed intake at P2, P3, P4 and P5 were not significant. Rezaei et al. (2010) also found supplementary of L-Carnitine had not significant effect on feed intake in broiler. Xu et al. (2003) noticed that the supplementation of dietary L-carnitine had not significant effect on feed intake of broiler chickens and young turkeys. Barker and Sell, (1994); Leibetseder, (1995) and Buyse et al., (2001) reported that the supplementation of dietary L-carnitine did not affect feed intake. The supplementation of 100 mg/kg L-carnitine did not affect feed intake of broilers. Lien and Horng (2001) Sarica (2005) reported that l-carnitine supplementary on diet had not significant effect on feed intake from Quail. Yalçin *et al.* (2006) indicated that L-carnitine supplementation at 100 mg/kg did not effect on feed intake.

Table 4.5. Effect of interaction between treatments and period on Feed Intake

Peryods (Days)	Treatments (different levels of L- Carnitine)				
	T1 (0mg)	T2 (100mg)	T3 (200mg)	T4 (400mg)	T5 (800mg)
P2 (7)	$92.98^{i}\pm1.17$	$90.48^{i}\pm1.88$	$92.69^{i}\pm4.33$	$96.92^{i}\pm1.81$	$97.12^{i}\pm2.77$
P3 (14)	$184.62^{h}\pm2.91$	$195.14^{h}\pm4.30$	$186.54^{h}\pm3.09$	$194.90^{h}\pm2.52$	$196.34^{h}\pm4.61$
P4 (21)	$292.64^{g}\pm11.74$	$337.07^{g}\pm4.89$	$335.48^{g}\pm2.88$	$343.00^{g}\pm9.68$	$339.62^{g}\pm10.91$
P5 (28)	$613.99^{f}\pm6.87$	$657.76^{f}\pm18.63$	$647.33^{f}\pm15.69$	$671.55^{f}\pm13.75$	$645.48^{f}\pm10.76$
P6 (35)	$911.21^{cde}\pm19.75$	$902.97^{cde}\pm9.03$	$912.69^{cde}\pm12.45$	$908.26^{cde}\pm13.25$	$1020.38^{a}\pm51.95$
P7 (42)	$916.23^{cde}\pm34.34$	$959.01^{abc}\pm16.24$	$1006.29^{a}\pm41.40$	$960.70^{abc}\pm19.04$	$988.31^{ab}\pm37.86$
P8 (49)	$914.77^{cde}\pm34.07$	$874.36^{e}\pm20.04$	$942.31^{bcd}\pm36.82$	$881.41^{de}\pm20.35$	$902.24^{cde}\pm36.57$

$^{a\text{-}j}$ Means followed by different letters are statistically different.

4.6. The Effect of İnteraction Between Treatments (Different Levels of L-Carnitine) and Periods on Weight Gain

Influence of interaction between treatments and periods on weight gain was significant ($p<0.05$) as described in (Table 4.6). Weight gain at P8 had significantly ($p<0.05$) higher weight gain compare to other periods followed by P7, P6, P5, P4, P3, and P2 of all treatments. Moreover, the higher weight gain was obtained by birds in T1 at P8 which significantly ($p<0.05$) differed with T2 at same period. While, at P7 birds in

T1 significantly ($p<0.05$) had higher weight gain compared with T5 and numerically with other treatments, although at P6 birds in T1 significantly ($p<0.05$) had lower weight gain compared with all other treatments. Number of studies have showed that supplemental L-carnitine improved body weight gains of broilers (Lettner et al. 1992, Gropp et al. 1994, Rabie et al. 1997). Parsaeimehr et al (2014) diet with L-carnitine increased significantly ($P<0.01$) the body weight gain of broiler chicks during the period from 28 to 42 days of age. Taklimi et al. (2015) reported that supplementation 600 up to 800 mg/kg L-carnitine in diet had significant increases weight gain for broiler chickens. Abdel-Fattah et al. (2014) noticed that supplementation of L-carnitine (200-400 mg/kg) in Japanese quail diet significant increased body weight gains. While, effect of treatment on weight gain at p2, p3, p4 and p5 were not significant. Parsaeimehr et al (2014) reported that experimental diets with L-Carnitine had no significant ($P>0.05$) effect on body weight gain in period from 1-21day of age. Corduk *et al*. (2007), Daskiran *et al*. (2009) and Sarica *et al*. (2007) showed that various levels of L-carnitine did not affect body weight gain over 28 day of the experimental period. Xu *et al.* (2003) indicated that dietary supplementation of L-carnitine to broilers had no significant effect on daily body weight gain. Barker and Sell (1994) were also found non-significant effect of l-carnitine on body weight gain from allexperimental period.

Table 4.6. Effect of interaction between treatments and periods on Weight Gain.

Peryods (Days)	Treatments (different levels of L- Carnitine)				
	T1 (0mg)	T2 (100mg)	T3 (200mg)	T4 (400mg)	T5 (800mg)
P2 (7)	$59.81^{k}\pm2.51$	$57.39^{k}\pm1.39$	$55.46^{k}\pm0.93$	$61.23^{k}\pm3.65$	$62.79^{k}\pm2.82$
P3 (14)	$97.69^{jk}\pm5.73$	$112.57^{jk}\pm5.28$	$98.64^{jk}\pm6.24$	$113.13^{jk}\pm6.67$	$113.65^{jk}\pm4.72$
P4 (21)	$184.63^{ij}\pm5.30$	$211.61^{hi}\pm12.04$	$212.53^{hi}\pm7.37$	$222.89^{ghi}\pm5.87$	$220.31^{ghi}\pm12.62$
P5 (28)	$305.69^{fg}\pm14.47$	$299.81^{fgh}\pm21.01$	$275.38^{fgh}\pm18.84$	$337.25^{f}\pm20.66$	$327.00^{f}\pm12.69$
P6 (35)	$429.69^{e}\pm54.44$	$571.88^{bcd}\pm50.80$	$528.13^{bcd}\pm38.31$	$590.63^{abcd}\pm27.18$	$578.125^{bcd}\pm36.57$
P7 (42)	$609.38^{abc}\pm19.34$	$559.38^{bcd}\pm27.18$	$546.88^{bcd}\pm7.86$	$518.75^{cd}\pm40.34$	$515.625^{d}\pm26.70$
P8 (49)	$671.88^{a}\pm43.11$	$571.88^{bcd}\pm51.12$	$618.75^{ab}\pm44.04$	$615.63^{ab}\pm30.77$	$612.50^{ab}\pm72.52$

$^{a\text{-}j}$ Means followed by different letters are statistically different.

4.7. The Effect of Interaction Between Treatments (Different Levels of L-Carnitine) and Periods on Feed Conversion Ratio.

The effects of interaction between treatments and periods on feed conversion ratio were summarized in Table (4.7). There were no significant differences between all treatments at all periods except at P5 and P6. Whereat, birds in T3 significantly ($p<0.05$) had lower feed conversion ratio compared with T5. While, at P6 birds in T1 T3 significantly ($p<0.05$) had lower feed conversion ratio compared with all other treatments in same period. The better significant ($p<0.05$) of feed conversion ratio was obtained at P8 of all treatments followed by below periods. Whereat, significantly ($p<0.05$) better-feed conversion ratio was obtained by birds in T1 at P8. While, lower feed intake was obtained by birds in T3 at P5. Parsaeimehr et al (2013) and Schuhmacher et al. (1993) showed that diet with L-carnitine had a significant effect on feed conversion ratio. (Barker and Sell, 1994; Xu *et al*. 2003) reported diet with levels of animal fat + 300 mg/kg L-carnitine had a significant ($P<0.05$) effect on feed conversion ratio. Bayram *et al*. (1999) showed significant decreases in feed efficiency in quails supplemented with 500 mg/kg diet L-carnitine. Parsaeimehr et al. (2014) reported that dietary L-Carnitine supplementation (200-300 mg/kg) had significant effect in improving feed conversion. While, Buyse et al. (2001) and Rezaei et al. (2007) found that L-carnitine supplemented had no effect on feed conversion to chickens. Effect of L-carnitine on feed conversion efficiency in geese at P1, P2, P3, P4, P8 were not significant (Arslan et al. 2004). Leibetseder (1995) investigated in broilers fed with diets supplemented with 0 or 50 g fat/kg. He found that feed conversion of broilers was not influenced by dietary carnitine (L or DL form) at a dosage of 200 mg/kg diet.

Table 4.7. The effect of interaction between treatments and periods on Feed Conversion Ratio.

Peryods (Days)	Treatments (different levels of L- Carnitine)				
	T1 (0mg)	T2 (100mg)	T3 (200mg)	T4 (400mg)	T5 (800mg)
P2 (7)	$1.56^{efgh}\pm 0.05$	$1.58^{efgh}\pm 0.05$	$1.67^{cdefgh}\pm 0.05$	$1.60^{defgh}\pm 0.07$	$1.55^{fgh}\pm 0.02$
P3 (14)	$1.91b^{cdef}\pm 0.11$	$1.74^{cdefgh}\pm 0.07$	$1.92^{bcdef}\pm 0.14$	$1.740^{cdefgh}\pm 0.10$	$1.73^{cdefgh}\pm 0.03$
P4 (21)	$1.59^{efgh}\pm 0.07$	$1.61^{cdefgh}\pm 0.11$	$1.58^{efgh}\pm 0.04$	$1.54^{fgh}\pm 0.01$	$1.55^{fgh}\pm 0.04$
P5 (28)	$2.02^{abc}\pm0.10$	$2.23^{ab}\pm0.18$	$2.39^{a}\pm0.17$	$2.01^{abcd}\pm0.13$	$1.99^{bcde}\pm0.10$
P6 (35)	$2.23^{ab}\pm0.28$	$1.62^{cdefgh}\pm0.14$	$1.76^{cdefgh}\pm0.14$	$1.55^{fgh}\pm0.09$	$1.79^{cdefgh}\pm0.16$
P7 (42)	$1.54^{fgh}\pm0.07$	$1.73^{cdefgh}\pm0.11$	$1.84^{bcdefg}\pm0.05$	$1.90^{bcdef}\pm0.20$	$1.93^{bcdef}\pm0.11$
P8 (49)	$1.37^{h}\pm0.05$	$1.57^{efgh}\pm0.13$	$1.54^{fgh}\pm0.08$	$1.45^{gh}\pm0.10$	$1.56^{fgh}\pm0.23$

$^{a-j}$ Means followed by different letters are statistically different.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The results of the present study showed that dietary supplementation with different levels of L-carnitine had significant effect on body weight at 6th and 7th period, there was a significant effect on weight gain at 6th and 8th period, on feed intake at 6th, 7th and 8th period and L-carnitine had significant effect on feed conversion ratio at 5th and 6th period. L-carnitine had a significant effect to reduce abdominal fat but there was not significant effect on carcass with giblet and without giblet. L-carnitine had not significant effect on body weight, feed intake, weight gain and feed conversion ratio at the final of the experimental period.Using 0.08% (T5) L-Carnitine group seemed to have a beneficial effect on most of the performance traits (live body weight, feed intake, feed conversion ratio, weight gains and abdominal fat).

5.2. Recommendations

For the better production performance, we recommend the use of 0.04%(T4) and 0.08%(T5) L-carnitine wait until 8 weeks of age to obtain the better production in broiler chicken.

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