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GROWTH PERFORMANCE AND CARCASS TRAITS OF GROWING RABBITS AS AFFECTED BY L-CARNITINE

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ABSTRACT

This experimental was carried out in the rabbit Farm belonged to the Animal Production Department, Faculty of Agriculture, Ain Shams University on 50 male New Zealand White (NZW) growing rabbit , of four weeks-age, in order to determine the effect of L-carnitine on growth performance and carcass characteristics. Rabbits were randomly distributed into two comparable groups of 25 rabbits and housed in individual cages provided with continues feeder and automatic waterer facilities during the experimental period, which lasted for 8 weeks. The basal diet (commercial pellets) was fed to the control group (I) without L-carnitine supplementation, while the group (II) was supplemented with 40 mg L-carnitine/kg body weight. Performance was assessed by measuring body weight gain (BWG). At 12 weeks of age ten animals from each group were slaughtered for carcass evaluation.

Results showed that rabbits in group (II) were significantly ($p < 0.005$) heavier in body weight than those not received L-carnitine. Average daily gains at the end of experimental periods were 21.1 ± 1.34 and 27.1 ± 1.2 gm for groups I and II respectively. L-carnitine Supplementation improved ($P< 0.01$) the dressing percentage by 4.5 %; middle part by 4 % as compared with the control group. However, the hind part increased insignificantly by 0.8 %. The percentage of bone less meat increased ($P<0.01$) in front leg and middle part in L-carnitine treated rabbit. Meat protein increased ($P<0.05$) in L-carnitine supplemented rabbit; however ether extract decreased ($P<0.01$) by L-carnitine supplementation. The muscle Ca, Cu, Na and

P increased insignificantly in L-carnitine supplemented group. However, muscle Fe, Se and Zn decreased insignificantly

Key Words : L-carnitine – Rabbits - Growth performance - Carcass characteristics.

INTRODUCTION

L-carnitine is formed from tri methyl lysine. Tri methyl lysine is derived from lysine liberated during intracellular hydrolysis, then lysine is methylated by S- adenosyl methionine (Brody, 1994). In addition, several co-factors are involved such as ascorbate, niacin, vitamin B6, and iron. L-carnitine has 2 major functions: facilitating transport of long chain fatty acid across the mitochondrial membrane and facilitating the removal from mitochondria of short and medium chain fatty acids that accumulate as a result of normal and abnormal metabolism (Rabie *et al* 1997,1998, Metalliotakis *et al* 2000, Buyse et al 2001 and Xu *et al* 2003). Thus, dietary L-carnitine supplementation promotes the ß oxidation of these fatty acids to generate adenosine tri phosphate (ATP) and improved energy use (Rabie *et al* 1997 and Neuman *et al* 2002). Consequently, L-carnitine supplementation to diets reduces long chain fatty acid availability for etherification to triacyl glycerols and storage in the adipose tissue (Xu *et al* 2003 and Barker and Sell 1994). In addition, L-carnitine has secondary function such as buffering and removing potentially toxic acyl groups from cells. (Allen 1998) .Previous research (Owen *et al* 1993), demonstrated that the addition of L- carnitine decreases lipid in growing- finishing pigs. L- carnitine has also accretion been shown to affect several key enzymes involved in protein and lipid metabolism (Rebouche *et al* 1990; Owen *et al* 1997). Indeed, L- carnitine supplementation in growing pigs reduced body fat deposition and increased protein accretion (Owen *et al* 1996; Heo *et al* 2000 and Owen *et al* 2001a). These effects are due to an increased rate of ß-oxidation and increased reutilization of waste nitrogen for protein synthesis by dietary L- carnitine (Owen *et al* 2001b).

MATERIAL AND METHODS

This experiment was carried out in the rabbit Research Unit, Animal Production Department farm, Faculty of Agriculture, Ain shams University.

Animals, Treatment and Management:

A total of 50 growing New Zealand White rabbits of four weeks of age were randomly distributed into two comparable groups of 25 rabbitS in each. Animals were housed in individual cages provided with continues feeders and automatic waterers during the experimental period, which lasted for 8 weeks .The basal diet was a commercial feed pellets .Chemical analysis showed that the basal diet contained 7.93% moisture, 17.6% crude protein, 2.5% ether extract, 11.8% crude fiber , 51.37% nitrogen free extract (NFE) and 8.8% ash. Animals were weighed individually at weekly intervals..

Slaughter and Carcass Traits:

At the end of the experiment period (at 12 weeks of age) ten animals from each experimental groups were slaughtered according to the Islamic Slaughtering using the procedure described by Abou-Ashour and Ahmed (1983). Rabbits were weighed just before slaughter as well as after complete bleeding. The head, giblets (heart, liver and kidneys) and hot carcasses were weighed. The dressing percentage was calculated. For meat composition traits, all carcasses were divided longitudinal two similar halves. The right half was physically separated into lean, bone. Lean of each carcass was separated and prepared for chemical analysis. Lean samples from different carcass parts as a percentage of the carcass in the animal are mixed for chemical analysis. Dry matter, Crude protein, ether extract and ash in meat were determined according to the A.O.A.C.(1990) .Muscle Calcium (Ca), Phosphorus (P), Zinc (Zn), Iron (Fe), Cupper (Cu) and Selenium (Se) were determined using Inductive Coupled Plasma (ICP) technique. Perkin Elmer- Optima 2000 DV as described in A.O.A.C (2000)

Statistical Analysis:

Data of the present investigation were analyzed using procedure of SAS program, version 6.12

RESULTS AND DISCUSSION

Growth Performance Traits.

Data in table (1) and figure(1) represent the rabbit performance as affected by L-carnitine supplementation. Differences between the body weights of the experimental groups were significant ($P< 0.01$). Rabbits in supplemented group were heavier than the control. The final body weights were 1624 and 1928 gm for control and treatment groups, respectively. Average daily gains followed thè same trend of the final body weights being higher for rabbits fed L-carnitine than control group. Average daily gains were 21.1 and 27.1gm during the experimental period for control and treated groups. Similar resultswere recorded by Rincker *et al* (2003) that added 50 to 100 ppm of L-carnitine to the diet improved growth performance of weanling pigs. Brad *et al.,* (2003) reported that feeding pigs L-carnitine or Paylean in the late finisher improves average daily gain and feed efficiency.

This improvement of growth performance and daily gain may be due to the effect of L-carnitine on hepatocytes, which enhances ß-oxidation by increasing the activity of carnitine palmitoyl transferase I and stimulating the reutilization of amino acids from waste protein for protein synthesis (Owen *et al* 2001b), In addition Birkenfeld *et al* (2006) reported that L-carnitine increased plasma concentration of insulin-like growth factor(IGF-I), which stimulate proliferation and differentiation of skeletal muscle cells and are regulators of muscle growth and development (Waylan *et al.* 2005)

Carcass characteristics:

Data concerning the carcass characteristics of the growing rabbits (NZW) supplemented with L-carnitine and control group are shown in table (2). Body weight at slaughter was heavier in rabbit supplemented with L-carnitine than control group .That was mainly due to the differences in body weight gain (Table 1 and Fig. 1). Carcass weight followed the same trend being heavier for rabbit received L-carnitine than control group. The inclusion of L-carnitine supplementation for rabbits led to increase in dressing percentage being $65.9\pm 2.96\%$ and 61.4 ± 2.80 % for L-carnitine and control groups, respectively. L-carnitine enhancement ($P<0.01$) the percentage of bone less meat in the front leg and middle part by 23.18 and 46%, respectively. The increasing bone less meat in the L-carnitine treated group may be due

to L-carnitine helps the body to absorb chromium picolinate to help build lean muscle mass (Keizo,2006) . The percentage of rabbit Head, Liver, Kidney, Lung and Heart did not differ significantly between L-carnitine and control groups.

Table (1): Effect of supplemental L-carnitine on growth performance of growing rabbits

Item	Control	+ L-carnitine	Diff.	%	Significant
Initial body weight (g) (4^{th} weeks of age)	444 ± 19.1	410 ± 8.4	-34	-7.66	NS
Final body weight (g) (12^{th} weeks of age)	1624 ±32	1928 ±43	304	18.72	**
Total body gain (g) (4^{th} to 12^{th} week of age)	1180±21	1518 ±323	338	28.65	**
Daily body gain (g) (4^{th} to 12^{th} week of age)	21.1±1.34	27.1± 1.2	6	28.44	**

* P<0.05
** P<0.01
NS = Non significant

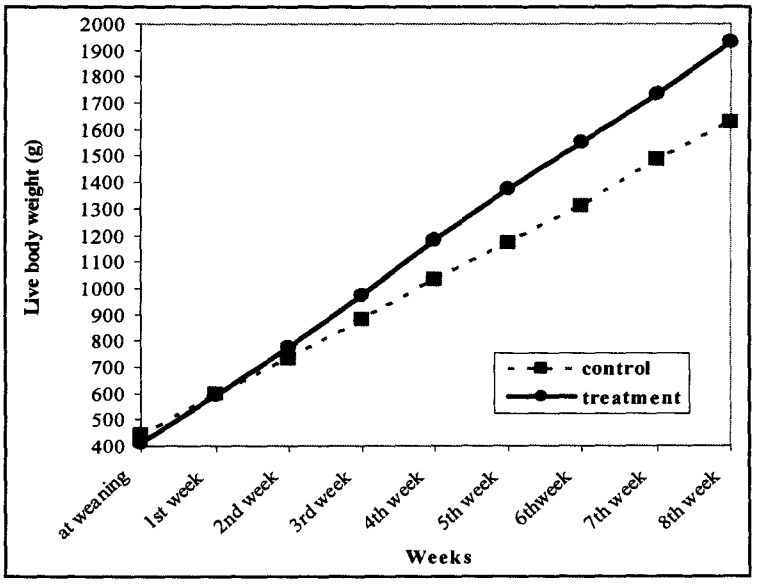

Figure (1): Effect of L-carnitine supplemented on body weight post weaning of growing rabbit

Table (2): Effect of supplemental l-carnitine on carcass characteristics of growing rabbits

Item	Control	+L-carnitine	Diff.	%	Significant
Carcass traits:					
Slaughters body weight (g)	1624 ± 32.1	1928±43.2	304	18.7	**
Hot carcass (g)	997.13±27.2	1270.5±25.6	272.8	27.3	**
Dressing %	61.4±2.8	65.9±2.96	4.5	7.32	*
Front legs+ chest %	18.23±0.8	17.75±0.62	0.48	2.63	NS
Bone less meat %	4.83± 0.25	5.95±0.32	1.12	23.18	**
Front legs %	6.76±0.35	7.6± 0.32	0.84	12.42	NS
Bone %	1.925±0.098	1.65±0.32	0.27	14.2	*
Middle part %	11.10±0.22	15.1±0.32	4	36	**
Bone less meat %	8.42±0.158	12.3±0.252 a	3.88	46	**
Bone %	2.68± 0.062	2.8±0.068	0.12	4.47	NS
Hind part %	15.6±0.72	16.4±0.43	0.8	5.12	NS
Bone less meat %	11.96±0.572	13.08±0.337	1.04	8.69	NS
Bone %	3.63±0.144	3.32±0.093	0.31	8.5	NS
Head%	11.01± 0.32	11.0±0.27	0.01	0.09	NS
Liver %	3.23± 0.13	3.67± 0.153	0.44	13.6	NS
Kidney %	0.71 ± 0.031	0.79± 0.038	0.08	11.2	NS
Lung %	0.26± 0.018	0.266 ±0.024	0.006	2.3	NS
Heart %	0.79 ± 0.032	0. 82 ±0.052	0.03	3.7	NS

* $P<0.05$
** $P<0.01$
NS = Non significant

The chemical analysis showed that L-carnitine had significant ($P<0.05$) effect on CP and EE % in rabbit meat (Figure 2). That may be due to the effect of L-carnitine on increasing rate of ß-oxidation and increased reutilization of waste nitrogen for protein synthesis (Owen *et al* 2001b), and/ or L-carnitine affect on several key enzymes involved in protein and lipid metabolism (Rebouche *et al* 1990; Owen *et al* 1997). Moreover Ramanau *et al* (2004) viewed that dietary L- carnitine causes a shift from body fat to body protein. The muscle ash and moisture had not been affected by L- carnitine supplementation.

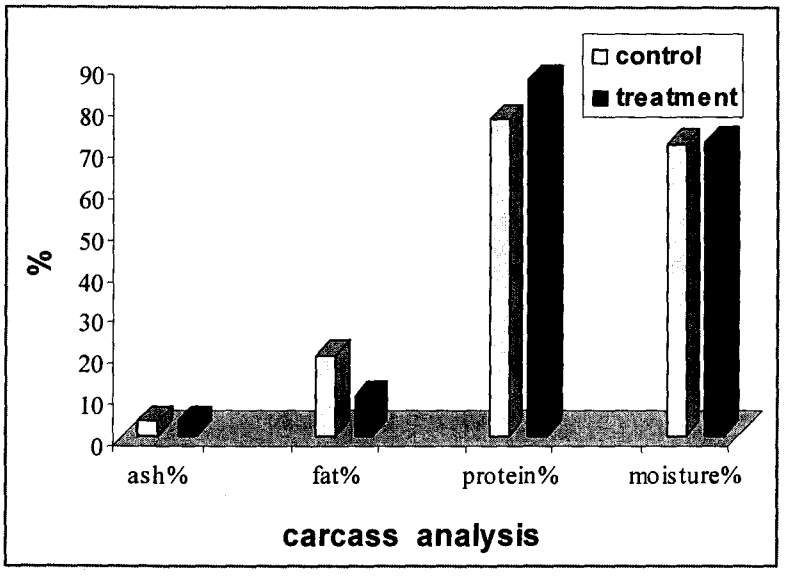

Figure (2): Effect of supplemental L-carnitine on chemical composition of carcass

Data concerning the meat concentration of some minerals in growing rabbit supplemented with L-carnitine and control groups are shown in table (3). L-carnitine increased Ca, Cu, Na and P levels. Keizo (2006) found that L-carnitine helps the body to absorb calcium to improve skeletal strength and chromium picolinate to help build lean muscle mass. The Fe, Se and Zn concentration were decreased in meat. The lower concentration of pervious minerals in meat may be due to that certain minerals have to interact, either positively or negatively, with absorption of other minerals. For example, copper and zinc interfere with the absorption of the other and excessive amounts of calcium can influence phosphorus and selenium absorption (Bell, 2003).

Table (3): Effect of supplemental L-carnitine on mineral content in growing rabbit's meat

Item	Control (mg/kg meat)	+ L-carnitine (mg/kg meat)	Diff.	%	Significant
Ca	931.02±17.08	983.77±19.87	55.75	5	ns
Cu	7.295±0.582	8.29 ±0.853	0.99	13	ns
Fe	119.07±13.38	103.83±4.89	-15.24	12.79	ns
Na	3858±132.0	4171.75±155.7	313.75	8.13	ns
P	8530±465.0	8883.75±364.1	353.75	4.14	ns
Se	48.355±6.75	47.05±3.87	1.3	2.69	ns
Zn	62.337±4.54	59.95±2.45	2.38	3.83	ns

NS = Non significant

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أداء النمو وسمات الذبيحة للأرانب النامية المتأثرة بماد ة L-carnitine

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اجرى هذا البحث في مزرعة الأرانب الخاصة بقسم الإنتاج الحيواني بكلية الزراعة جامعة عين شمس.استخدم فى التجربة 50 ذكر أرنب نيوزيلأندى ابيض عند عمر أربعة أسابيع لدراسة تأثير مادة **L-carnitine** على أداء النمو وصفات الذبيحة. الأرانب قسمت عشوائيا إلى مجموعتين كل مجموعة بها 25 ذكر أرنب وتم وضع الأرانب في أقفاص فردية مزودة بمغذيات وماء اتوماتيكى إثناء فترة التجربة لمدة 8 أسابيع أخرى. مجموعة(1) غذيت على عليقة تجارية بدون إعطائها **L-carnitine** – مجموعة (11) غذيت على عليقة تجارية + **L-carnitine** (40 مليجرام / كجم وزن حي) . عند 12اسبوع من العمر ذبح 10 أرانب من كل مجموعة لتقييم صفات الذبيحة.

وكان أهم النتائج المتحصل عليها.

لوحظ ان الأرانب المعاملة بـ **L-carnitine** كانت أثقل في الوزن عند مستوى معنوية ($P<0.005$) وكان معدل النموالميومي 21.1 و27.1 جم للمجموعتين المقارنة والمعاملة على التوالي.

أوضحت النتائج إن المعاملة بـ **L-carnitine** حسنت نسبة التصافي بنسبة 4.5 % وكذلك حسنت نسبة الجزء الأوسط بنسبة 4 % بالمقارنة بالمجموعة الغير معاملة (الكنترول) بينما زاد الجزء الخلفي بزيادة غير معنوية .

لوحظ زيادة في نسبة اللحم بدون عظم في الأرجل الأمامية والجزء الأوسط عند مستوى ($P<0.01$). لوحظ زيادة معنوية عند ($P< 0.05$) في نسبة البروتين للمجموعة العاملة عن المجموعة المقارنة و كذلك يوجد نقص معنوي عند مستوى ($p< 0.01$) في نسبة الدهن في المجموعة المعاملة عن مجموعة المقارنة. لوحظ أن تأثير المعاملة بـ **L-carnitine** غير معنوية على تركيز العناصر(Ca, P, Cu, Na, Fe, Se and Zn,) في لحم الأرانب

قام بتحكيم هذا البحث ا.د حنفي إمبابي الصبحي و ا.د حمدي محمد أحمد السيد