

EFFECT OF ASCORBIC ACID SUPPLEMENTATION ON GROWTH PERFORMANCE, CARCASS TRAITS, SOME PHYSIOLOGICAL PARAMETERS AND SOME BLOOD CONSTITUENTS OF GROWING LAMBS UNDER THE SUMMER EGYPTIAN CONDITIONS

U.M. Abd El-Monem*, B. Abel-Ghany* and A.A. Abd El-Hamid **

* Department of Animal Production, Faculty of Agriculture, Zagazig University, Zagazig, Egypt.

** Animal Production research Institute, Ministry of Agriculture, Dokki, Cairo, Egypt.

ABSTRACT

This study was carried out on twenty weaned commercial male lambs of 4 months old and weighing on average 17.04 ± 2.33 Kg live body weight at 150 days old. The lambs were allotted at random into four similar groups (5 males each). The first group was served as control while, the second, third and fourth were fed the control diet supplemented with ascorbic acid at the rates of 500, 750, and 1000 mg per kg diets, respectively.

The results showed that, the final live bodyweight and daily body gain were significantly ($p < 0.01$) increased. The daily feed intake and feed conversion were significantly ($p < 0.05$) improved. On the other hand, daily water intake, rectal temperature and respiration rate were not affected. The final growth margin, hot carcass weight, abdominal fat weight, liver weight, kidney weight, head weight, tail weight, heart weight, lung weight and eye muscle weight were improved when growing lambs treated with ascorbic acid at all the rates of 500, 750, and 1000 mg per kg diets.

Serum total proteins, albumin, globulin, urea-N, AST, ALT and creatinine were not significantly affected, while, the T3 and T4 levels were significantly ($P < 0.05$) increased with increasing ascorbic acid doses comparing with the control group under the summer heat stress.

Key words: lambs, ascorbic acid, heat stress, growth, carcass, blood components

INTRODUCTION

In tropical and sub-tropical countries, climatic heat is the major constraint affect animal productivity. Production and reproduction are impaired as a result of the drastic changes in biological function caused by heat stress (*Kamal et al., 1989 and Marai et al., 2006*). Live body weight and gain were decreased by exposure to heat stress (*Marai et al., 2006*). Depression in feed intake of lambs is one of the most important reaction to heat exposure (*Abdel – Moneim and Abdel-Hamid 2007*). The increase in water consumption is another reaction to heat exposure (*Marai et al., 1999 and 2000*). Ascorbic acid, which is present in most animal cells, has numerous biochemical functions. The metabolic one is essential for growth and counteracting infections caused by pathogenic bacteria and viruses. *Verde and Piquer (1986)* noted that in animals exposed to stress (loud noise and high environmental temperature), the plasma ascorbic acid concentration was significantly reduced . In other species,

supplementation with ascorbic acid had shown of beneficial effects on stress. This means that the metabolic need for ascorbic acid is increased at certain conditions. Therefore, the growth –promoting effect of ascorbic acid may be associated with the alleviation of retardation in the thyroid function, (Coates, 1984).

In Egypt, several studies reported the influence of ascorbic acid supplementation in animals. *Abdel – Hamid (1994)* studied the effect of ascorbic acid on the physiological responses of rabbits at 40 days of age as affected by seasons of the year. *Abdel - Hamid and El- Adawy (1999)* studied the effect of ascorbic acid supplementation at rate of 300 or 600 mg/kg diet, on growth performance and carcass traits and found significant increase ($P<0.05$) in daily gain, growth performance index, economical efficiency and feed conversion ratio compared with the control. The aim of present work was to study the effects of supplementing lambs diet with 500, 750 and 1000 mg ascorbic acid per kg feed, on growth performance, carcass traits and some blood components, under the heat stress of summer in Egypt.

MATERIALS AND METHODS

This work was conducted in the Department of Animal Production, Faculty of Agriculture, Zagazig University. The experimental work was carried out at privet farm in Zagazig city Sharkia governorate.

Twenty weaned male lambs with equal average live body weights of 17.04 ± 2.33 kg were used in the present study. The lambs were allotted randomly to four similar experimental groups (5 lambs each).

All groups fed *ad libitum* on a concentrate mixture basal diet contained 16 % crude protein. The diet composition is shown in Table (1). The first group (control group) fed on a basal diet only while, the second, third and fourth ones supplemented with 500, 750 or 1000 mg ascorbic acid per kg diet for-5 months, respectively. Daily feed consumption was recorded. Fresh water was available to all animals and the free water consumption was estimated daily.

Animals were weighed at two successive days at the beginning of the experiment then at 15 days intervals up to the end of experiment. Lams were housed in semi- open sheds allover the experimental period. Physiological parameters measurements were rectal temperature, wool, middle and surface, temperature and respiration rate at 8.00, 12.00 and 16.00 hrs for one day every week.

Rectal temperature was measured by inserting YSI Electronic Thermometer Model 46. The wool surface temperature was measured by using the upper part of the hind-quarter at the right side of the animal. Respiration rate (RR) was counted by the consistent flank movements per one minute. All measurements were taken within a range of time that did not exceed 2-3 minutes for each animal. At the end of experimental period, blood samples were collected from ear vein of lambs in all groups for biochemical analysis. Five lambs in each group were slaughtered for studying carcass traits. Before slaughter, the lambs were fasted 12 hours. After slaughtering,

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carcasses were chilled, dissected into wholesale cuts (legs, loin, rack, shoulder, neck and brisket), and their weights were recorded. Slaughter weights of hot carcass, four feet, head, digestive tract (full and empty), lungs and trachea, testes, heart, liver, kidneys and internal fat (heart, kidneys and abdominal fat) were recorded either absolute or relative to carcass weight. The dressing percentage was calculated as (hot carcass weight plus liver, heart and kidneys) relatively to (slaughter body weight). The data were analyzed statistically according to *Snedecor and Cochran (1982)* as following: $x_{ij} = \mu + T_i + e_{ij}$ where, μ = general mean, T_i = fixed effect of the treatments (1, ..., 4) and e_{ij} = random error. The differences between experimental groups were separated by Duncan's multiple range test (*Duncan, 1955*)

RESULTS AND DISCUSSION

The statistical analysis indicated non significant difference in the initial live body weight of lambs in all experimental groups. The final live body weight and daily body gain were significantly ($P < 0.01$) increased by increasing ascorbic acid doses from 500, 750, to 1000 mg per kg diets. Daily feed intake and feed conversion were significantly ($P < 0.05$) improved, while water intake was not affected by supplementation with ascorbic acid to lambs (Tables 2). The same trend was observed by *Abdel – Hamid and El – Adawy (1999)* who found that addition of 600mg ascorbic acid tended to increase significantly ($P < 0.01$) final body weight and daily weight gain by 3.04 and 9.41 %, respectively, than the control group. Also, other authors obtained the same results such as *Abdel-Monem (2000)* in rabbits, *Shahin and Kucuk (2001)* in Japanese quails, *Sahina et al., (2003)* and *Maziar Mohiti Asli et al., (2007)* found the same trend in laying hens.

The increase in growth rate and final body weight accompanied ascorbic acid supplemented could result in increased immune response of heat stressed animals (*Pion et al., 2004 and Maziar Mohiti Asli et al., 2007*).

Rectum temperature, wool temperature and respiration rate were affected insignificantly by using ascorbic acid at levels 500, 750 and 1000 mg/kg diet (Table 2). Similar results were obtained by *Shetaawi (1998)* and *Abdel-Monem (2000)*. The margin rate (%) was increased with 49.69, 85.26 and 134.78 % for 500, 750 and 1000 mg ascorbic acid addition per kg diets, respectively, (Figure 1) than the control group. The best margin obtained for growing lambs fed diet supplemented with 1000 mg ascorbic acid per kg diet (Table 2). Similar results were obtained by *Abdel – Hamid and El – Adawy (1999)* and *Abdel-Monem (2000)*, who found that feeding growing animals on diets containing ascorbic acid increased the return from gain.

Hot carcass, abdominal fat weight, liver weight, kidney weight, tail weight, head weight, heart weight, lung weight and the eye muscle weight were increased by using ascorbic acid (Table 3 and Figures 2, 3, 4 and 5). Similar results were obtained by *Abdel-Monem (2000)*, *Shahin and Kucuk (2001)* and *Pion et al., (2004)* who found

that feeding growing swine on diets containing ascorbic acid increased the carcass and non carcass weights.

Table (4) showed that daily oral administration of ascorbic acid elicited non significant increase in the serum AST, ALT, albumin, globulin and total protein levels at doses 500 ,750 and 1000 mg, while serum urea and creatinin were not affected with the three doses used. Also, T3 and T4 were significantly ($p < 0.05$) increased by increasing ascorbic acid doses . These results agree with those obtained by *Sahina et al., (2003* , who showed that serum T3 and T4 were increased with ascorbic acid supplementation, while *Mehemet et al., (2005)* found no effect for ascorbic acid on blood parameters. The effect of ascorbic acid may be through reducing the effects of stress, increasing the immunological traits and its growth –promotion (*Coates, 1984*).

Practically, it seemed that supplementation with ascorbic acid to lamb at rate 1000 mg/ kg diet is necessary to improve lambs production under the summer condition of Egypt.

Table (1):-Feed ingredients of the experimental concentrate mixture and the calculated chemical composition (%) and feeding value (%) on DM basis

Items	%
Feed ingredients (as fed basis) :	
Yellow Corn	30
Wheat bran	29
Anticorticatted cotton seed meal	25
Soya bean meal	6
Rice bran	4
Molasses	3
Limestone	2
Salt	1
Total	100
Calculated chemical composition % :	
Dry Matter	90.38
Crude Protein	16.51
Ether Extract	3.31
Crude fiber	10.86
NFE	61.89
Ash	7.43
Calculated feeding Value :	
TDN	65.82
SV	44.62
DCP	11.94

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Table (2) :- Effect of ascorbic acid supplementation on growth performance, feed intake, feed conversion, rectal temperature, respiration rate and profit analysis of growing commercial lambs, under summer Egyptian conditions ($\bar{x} \pm SE$).

Items	control	Ascorbic acid 500 mg / kg diet	Ascorbic acid 750 mg / kg diet	Ascorbic acid 1000 mg/ kg diet	
Body weight (kg):					
Initial weight (1)	16.3±2.0	17.1±2.7	16.8±2.2	17.8±2.4	NS
At 90 days of experiment	26.0±2.2b	29.2±2.1 ^a	30.6±1.9a	31.9±2.7a	*
At 150 days of	30.8±2.2 c	34.6±2.7 b	36.8±2.9b	40.6±3.1a	**
Daily gain (g/day)					
From 1 to 2	107.0±9.0c	133.7±10.4b	153.0±13.1a	156.9±14.3a	**
From 2 to 3	81.0±9.6c	90.2±11.6b	102.5±11.9b	145.0±12.2a	**
From 1 to 3	96.6±8.1c	116.3±12.0b	132.8±14.2b	152.1±14.0a	**
Some physiological parameters					
Rectal Temperature (C°)	39.6±0.4	39.2±0.2	39.4±0.2	39.3±0.4	N.S.
Wool Temperature(C°)	36.4±0.4	36.5±0.3	36.0±0.3	36.1±0.2	N.S.
Respiration rate	77.1±3.0	81.1±3.2	80.9±3.6	79.4±4.3	N.S.
Feed Intake (g)					
Feed Intake (g)	805.9 ^c	815.1 ^b ± 76.4	848.9 ^b ±71.9	913.6 ^a ±79.7	*
Feed conversion (g DM /					
Feed conversion (g DM /	8.3 ^a ±0.1	7.0 ^b ±0.2	6.4 ^b ±0.1	6.0 ^c ±0.2	*
Water intake (L)					
Water intake (L)	2510.5±20.9	2531.9±27.4	2495.1±29.4	2502.7±22.8	N.S.
Profit analysis					
Feed cost (LE)	120.9	122.3	127.3	137.0	
Ascorbic acid cost (LE)	-	12.23	19.1	27.41	
Total cost (LE)	120.9	134.5	146.4	164.4	
Return (LE)	144.9	170.4	190.9	220.8	
Margin (LE) (LE)	24.0	35.9	44.5	56.4	

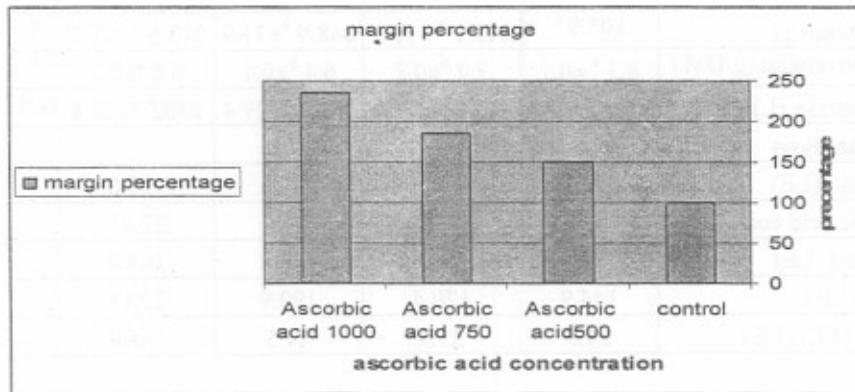
Prices : Experimental diet =1.0 L.E/kg diet , lambs live body weight = 10.0 LE /kg , Each tablet 500 mg ascorbic acid=0.20 L.E. Profit Margin per head=Return from body gain – feed cost. Other head costs were assumed constant.

N S = not significant, * (P< 0.05) and ** (P< 0.01) . Means a, b and c in the same row bearing different letters , differ significantly (P< 0.05).

Table (3) :- Effect of ascorbic acid supplementation on carcass and non carcass components of growing commercial lambs under summer Egyptian conditions .

Items	control		Ascorbic acid 500 mg/kg diet		Ascorbic acid 750 mg/kg diet		Ascorbic acid 1000 mg/kg diet	
	Wt. (kg)	%	Wt. (kg)	%	Wt. (kg)	%	Wt. (kg)	%
Slaughter weight	30.48	100	34.59	100	36.77	100	40.6	100
Hot carcass	13.80	45.3	18.49	53.45	20.01	54.4	22.7	55.9
Abdominal fat Wt.	0.29	0.95	0.39	1.13	0.35	0.95	0.40	0.98
Liver weight	0.56	1.84	0.62	1.79	0.61	1.66	0.71	1.75
Kidney weight	0.11	0.36	0.13	0.38	0.15	0.41	0.15	0.37
Tail weight	1.61	5.28	2.11	6.10	2.20	5.98	2.50	6.16
Head weight	2.64	8.66	2.91	8.41	3.01	8.19	3.15	7.76
Heart weight	0.19	0.62	0.23	0.66	0.27	0.73	0.30	0.74
Lung weight	0.45	1.48	0.49	1.42	0.52	1.41	0.59	1.45
Eye muscle Wt.	0.50	1.64	0.57	1.65	0.63	1.71	0.78	1.92

Figure 1: Effect of ascorbic acid supplementation on final profit margin percentage



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Figure 2: Effect of ascorbic acid supplementation on hot carcass weight

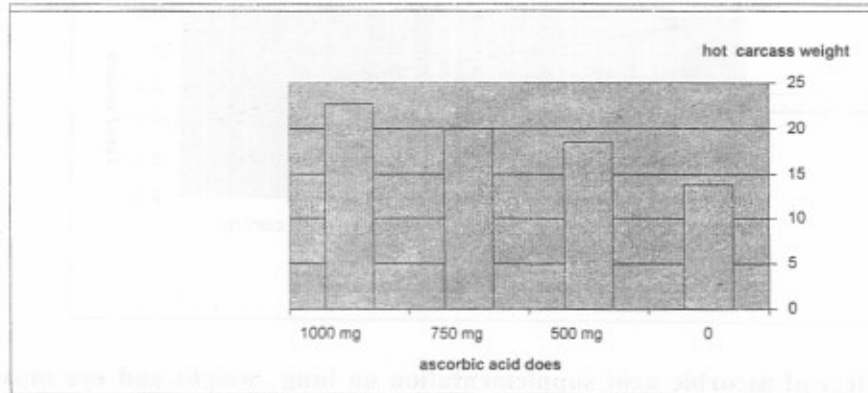


Figure 3: Effect of ascorbic acid supplementation on abdominal fat, liver weight, kidney weight and heart weight .

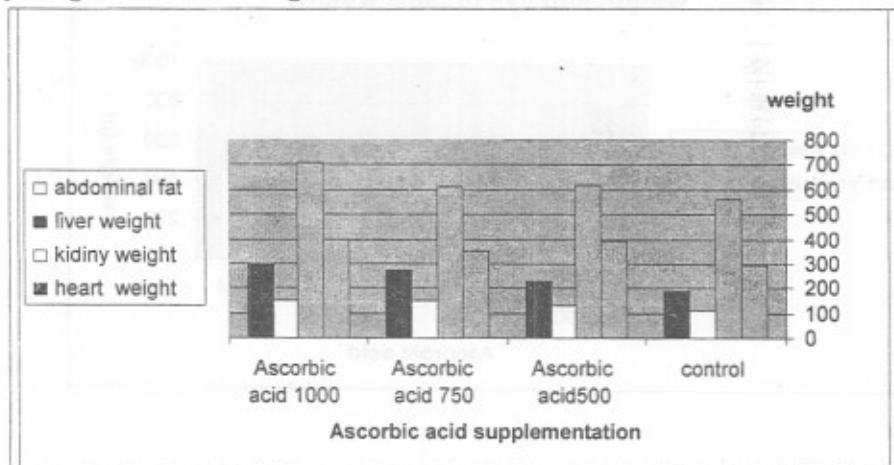


Figure 4: Effect of ascorbic acid supplementation on head weight

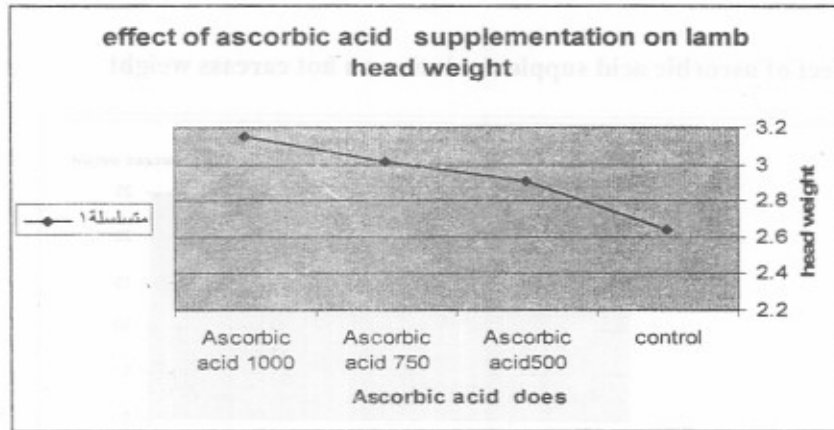
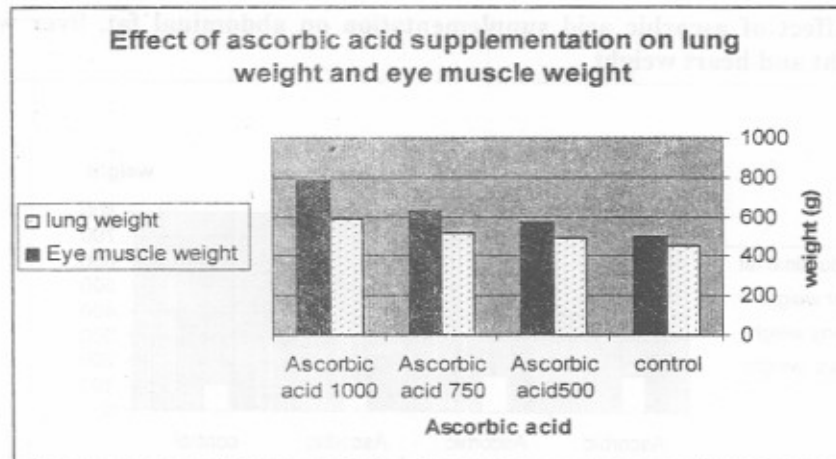


Figure 5: Effect of ascorbic acid supplementation on lung weight and eye muscle weight.



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Table (4) :- Effect of ascorbic acid supplementation on some blood serum parameters of growing commercial lambs, under summer Egyptian conditions (x'± SE).

Items	control	Ascorbic acid 500 mg/kg diet	Ascorbic acid 750 mg/kg diet	Ascorbic acid 1000 mg/kg diet	Sig.
AST(U/L)	31.06±2.15	31.90±3.71	32.3±2.9	31.74±2.91	N.S
ALT(U/L)	22.17±1.67	22.39±2.01	22.92±2.4	23.31±1.99	N.S
Total protein (g/dl)	7.05±0.47	7.16±0.52	7.79±0.27	7.81±0.29	N.S
Albumin (g/dl)	3.91±0.19	4.08±0.21	4.26±0.26	4.01±0.17	N.S
Golbulin (g/dl)	3.14±0.12	3.08±0.14	3.53±0.19	3.80±0.15	N.S
Urea (mg/dl)	29.31±1.54	27.0±1.76	26.5±1.13	25.5±1.62	N.S
Creatinine (mg/dl)	1.72±0.07	1.64±0.04	1.49±0.09	1.32±0.06	N.S
T3 (ng/dl)	76.5±12.6 ^b	89.7±6.9 ^a	90.1±5.99 ^a	93.1±7.69 ^a	*
T4 (ug/dl)	9.3±0.74 ^b	10.8±1.0 ^a	11.1±1.3 ^a	12.7±0.86 ^a	*

N S = not significant, * (p< 0.05) and ** (p< 0.01) . a,b,c Means in the same row bearing different letters , differ significantly (p< 0.05).

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تأثير إضافة حامض الاسكوريك على أداء الحملان النامية وصفات الذبيحة وبعض الصفات الفسيولوجية وبعض مكونات الدم في الحملان النامية تحت ظروف الصيف في مصر

اسامة محمد عبدالمنعم* - بكرى عبدالغنى خليل* - ايمن عبدالحى عبدالحميد**
*قسم الانتاج الحيواني - كلية الزراعة - جامعة الزقازيق
** معهد بحوث الانتاج الحيواني - وزارة الزراعة

أجريت هذه الدراسة علي عدد ٢٠ حمل محلي نامي عمر اربع شهور وبمتوسط وزن $17,01 \pm 2,33$ كجم ووزعت الحملان عشوائيا علي اربع مجاميع تجريبية (٥ حملان في كل مجموعة) . المجموعة الأولى اعتبرت مجموعة كنترول بينما المجموعة الثانية والثالثة والرابعة قد تم تغذيتها علي عليقة الكنترول مضافا لها حامض الاسكوريك بمستويات ٥٠٠، ٧٥٠، ١٠٠٠ مجم / كجم علي التوالي .
وقد أظهرت النتائج أن وزن الجسم النهائي ومعدل الزيادة اليومية في وزن الجسم قد زادوا معنويا (علي مستوي ٠,٠١) وكذلك الغذاء المأكول وكفاءة تحويل الغذاء قد زادوا معنويا (علي مستوي ٠,٠٥) بينما وجد أن الماء اليومي المشروب ودرجة حرارة المستقيم ومعدل التنفس لم يتأثروا معنويا .
وقد وجد أن كلا من العائد النهائي ووزن الذبيحة الساخن وزن الذيل والقلب والرئة والعضلة العينية قد تحسنا بإضافة حامض الاسكوريك بمستويات ٥٠٠، ٧٥٠، ١٠٠٠ مجم / كجم علي التوالي.
بروتين الدم الكلي والالبيومين والجلوبيولين واليوريا و AST, ALT والكرياتينين لم يتأثروا معنويا بينما أن T3 , T4 قد ارتفعوا معنويا علي مستوي (٠,٠٥) دم الحملان المعاملة حامض الاسكوريك عند مقارنتها بمجموعة الكنترول تحت ظروف الصيف في مصر.