EFFECT OF MELATONIN AND VITAMIN E AS ANTIOXIDANTS ON BODY WEIGHT, CARCASS TRAITS OF AWASSI LAMBS FED A HIGH-ENERGY AND NORMAL DIET

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ABSTRACT

This experiment was carried out to evaluate the effects of vitamin E (Alpha tocopherol acetate) supplementation and melatonin implants on growth performance, and meat quality traits of Awassi male lambs fed by a high and normal energy concentrated diet in Iraq. Lambs were divided equally to two main groups to be fed either high or normal energy diet ,and each of them divided in to five treatment, the first as a control (T1,T6),two level of melatonin (18, 36mg/lamb) were applied to (T2,T3,T7,T8) and two level of vitamin E (200,400mg/lamb/day) to (T4,T5,T9,T10).All animals were slaughtered at the end of the fattening period. Lambs received 400 g/day vitamin E with high energy diet surpassed significantly other treatment in final weight gain, vitamin E 400 mg/lamb/day and melatonin 18-36 mg/lamb at day 14 of storage increased retail color stability. enhanced meat color parameters. Melatonin implantation 18 mg/lamb, 36 mg /lamb significantly at day 7 of storage reduced MDA value, but at day 14 of storage vitamin E 200 and 400 mg/day/lamb reduced significantly MDA value of the Muscle Longissimus dorsi (LD) during storage.

Keywords: melatonin implants, alpha-tocopherol acetate, growth performance,

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تأثير الميلاتونين وفيتامين E كمضادات اكسدة في وزن الجسم وصفات الذبيحة للحملان المغداة على نوعين من العلائق احدهما ذات طاقة اعتيادية والأخرى مرتفعة الطاقة

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المستخلص

أجريت هذه الدراسة لمعرفة تأثير الميلاتونين و فيتامين E في معدل وزن الجسم وصفات الذبيحة للحملان المغداة على نوعين من العلائق احدهما ذات طاقة اعتيادية والأخرى مرتفعة الطاقة خلال الأجواء الحارة في العراق ، وزعت الحملان عشوائياً إلى مجموعتين رئيسيتين متساويتين اذ غذيت الحملان اما على العليقه عاليه الطاقه او اعتياديه الطاقه، وضمت كل مجموعة 5 معاملات، حيث كانت هناك معاملتي سيطرة شملت المعاملة (T1,T6) تم تطبيق مستويين من الميلاتونين (18 ، 36 مجم) إلى (T2، T3، T7، T8) ومستويين من فيتامين E (200، 400 ملغم /حمل) إلى (T4، T5، T9، T10). وبعد انتهاء مدة فترة التسمين تم ذبح جميع الحملان.أظهرت نتائج الدراسة حدوث تفوقا معنوياً (P<0.05) لمعاملة فيتامين E 400 ملغم / كغم علف ذات طاقة عالية مع معاملة السيطرة ومعاملات التجربة الأخرى في وزن الجسم النهائي , ادت فيتامين E 400 ملغم / كغم علف وغرز الحملان بالميلاتونين بتركيز 18-36 ملغم يوميا الى ثباتية لون اللحم في اليوم سابع من مده التخزين .غرز الحملان بالميلاتونين بتركيز 18-36 ملغم يوميا خفضت مستوى MDA في اليوم سابع من مده التخزين ،لكن في اليوم الرابع عشر من مدة التخزين اظهرت كل من الحملان المغذات بفيتامين E 400_200 ملغ يوميا انخفاضا معنويا في خفض مستوى MDAلعضلة العينيه LD من مده التخزين.

الكلمات المفتاحية:غرز الميلاتونين. الفاتوكوفيرول اسيتيت. اداء الانتاجى

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INTRODUCTION

Awassi sheep breed is an important genetic resource that plays a significant role in sheep industry in more than 30 countries (21, 23, 29). In many places, it became the breed of choice, especially for dairy, because of its high performance in milk and lamb production and ability to produce under varied production environments Galal. (10). Meat from sheep is an important source of daily food consumption accounting for approximately 26% of the total red meat production in Turkey. Even though red meat, especially lamb meat, is considered as a major ingredient in Kurdish region-Iraq (5), but the information on customer demand has not been quantified in the region yet. Energy is the major dietary element that is responsible for the different utilization of nutrients and thereby the productivity and gain weight of an animal Kasapidou. (13). Many studies have reported that high dietary energy levels increase the average daily gain (ADG) of lambs (19).One of the basic principles of animal nutrition is to produce high quality meat. Hence, the diet in animal nutrition is very important,and different diet combinations have been applied to livestock. Vitamin E is the main lipid-soluble biological antioxidant and the alpha-tocopherol is its most important biologically active form (12).The dietary supplementation with vitamin E increases the amount of alpha-tocopherol deposited on muscle and fat, which neutralizes free radicals before lipid oxidation occurs in unsaturated fatty acids of cell membranes (16, 31). Maiorano (20) i**n**dicated that vitamin E, especially when administered during 35-70 d of age, influences lamb skeleton development, and improves productive performances. Melatonin is an endogenous hormone derived from tryptophan that is mainly released from the pineal gland in the dark. Melatonin is secreted primarily by the pineal gland in response to darkness. (28). Melatonin has beneficial effects including stimulation of antioxidant enzymes, inhibition of lipid peroxidation, and so it contributes to protection from oxidative damages It was later found to be also present or synthesized in extra pineal sites such as retina, harderian gland, lymphocytes, gastrointestinal tract, bone marrow cells, platelets and skin (33, 37, 3).The synthesis of melatonin shows a clear circadian rhythm with low levels during the daytime and its secretory peak at night (3, 32).The objective of this study was to compare normal and high energy diet implanted with two levels of melentonin (18-36 mg/) and supplemented two level of vitamin E (200 mg/kg and 400 mg/kg) to feed on performance, feed consumption, FCR carcass properties of lambs, MDA level in meat and meat physical properties (Minolta values of Meat).

MATERIALS AND METHODS

The experiment was conducted in 2021 in private farm of animal production at Bahrka farm, Erbil government – Iraq. Fifty Awassi lambs at 4 to 5 months of age (with determined weighs 29±1kg) were selected for the current study. One week prior to the trail, all lambs were weighted at weekly interval. Lambs were divided equally to two main groups to be fed either high or normal energy diet ,and each of them divided in to five treatment, the first as a control (T1,T6),two level of melatonin (18, 36mg) were applied to (T2,T3,T7,T8) and two level of vitamin E,(Table 1)

Table1.Experiment diet ingredient and chemical composition

Ingredients	Control diet %	High energy diet %
Corn	23.5	31
Wheat bran	7.29	13.78
Barley	50	33
Soybean meal 48%	14	15.67
Salt	0.96	0.30
Limestone	4	2
Vegetable oil	-	4
Vitamin Mineral Premix	0.25	0.25
Total	100	100
Chemical composition		
Dry mater %	94.23	95.13
Ash %	6.4	5.7
Crude protein %	16	15.3
Crude fat %	1.796	2.296
ME (K Cal/kg)	2650	3156

(200,400mg to (T4, T5, T9, T10).All animals were slaughtered at the end of the fattening period. Feeding period was designed as 2 diet energy level (Normal Energy (T1) and High Energy Level (T6) concentrated lamb fattening feed. Lambs were housed in shaded pens and water were provided as ad libitum. Concentrate feed was formulated to meet the requirement for gain of 200-250 g/day for lambs, according to the NRC (24). Alfalfa hay and concentrate diet ratio was around 20:80 provided 2 times/day. Experiment lasted 60 days.

Body weight and feed consumption

All lambs were weighed at weekly interval Refusal feed was collected daily throughout the experimental period to calculate daily consumption. Final weights of all lambs were recorded at the end of the fattening period after 18 hours fasting prior to slaughter. Feed consumption of the groups was recorded periodically.

Slaughtering and carcass measurement

All animals were slaughtered at the end of the fattening period. The animals were slaughtered in an experimental abattoir severing the throat and major blood vessels in the neck. Immediately after slaughter, the head was removed at the atlanto – occipital joint and fore and hind feet at the carpal and tarsal joints, respectively. Then the carcass was partially skinned on the floor and then hanged in the racks by hind legs and skinning was completed. The digestive tract was removed and weighed, then emptied of their content, washed, drained and weighed to facilitate the calculation of empty body weight. After complete evisceration and dressing, carcasses were chilled for 24 hours at 4 °C in refrigerated then cold carcasses were recorded. Longissimus dorsi (LD) muscles were dissected from the left and right side of each carcass. The tails were removed at its articulation and the cannon bones were dissected from the carcasses. Dressing percentage was calculated as a ratio of 24 h fasting weight prior to slaughter and cold carcass weight.

HoteDressing%=Hot carcass weight/Slaughter weight*100

Cold Dressing %=Hot carcass weight/Empty body weight *100

Meat samples from the Longissimus dorsi (LD), (150 g) were collected 24 h postmortem and kept at 4^0C in trays and wrapped with oxygen-permeable PVC film, Level of MDA of Longissimus dorsi (LD) muscle measured at day 1, 7 storage in refrigerator (4^0C) and day14 after storage in Freezer -20°C. Malondialdehyde was estimated by Thiobarbituric acid (TBA) assay method on spectrophotometer.

Meat color measurement

Meat color (L*a*b*) was measured in the samples randomly taken at day 2, 7 and 14. Post-mortem at storage period. Meat colour was measured in the Longissimus thoracis (LT) muscle on the 12^{th} rib the Meat colour was determined using a Minolta CR 300 (Minolta Camera Co., LTD, Osaka, Japan) using illuminant D65. Reflectance was

determined over 400-700 nm range the lightness (L*), redness (a*) and yellowness (b*) were directly measured according to the method proposed by (CIE, 1986).

Statical analysis

The obtained data were subjected to factorial two-way analysis design, effect of two different energy level (low and high), two level of Melatonin implant (18, 36 mg) and two level of Vitamin E (200, 400 mg/kg) effect of treatments and interaction between them using general linear model (GLM) SAS.2012 program as in the following model

$Y_{ijk} = \mu + A_i + B_j + AB_{(ij)} + e_{ijk}$

Where: Y_{ijk}: experimental unit of (k) lamb for each factor Diet, different level vitamin E, melatonin implants. M: Overall mean .A_i: Effect of i^{th} (High energy diet, Normal energy diet). B_j: Effect of j^{th} (control, melatonin 18mg-36mg, vitamin E 200mg-400mg). PT_{ij}: Effect of interactions between i^{th} diet (High energy diet, Normal energy diet), and treatment j^{th} (control, melatonin 18mg-36mg, vitamin E 200mg-400mg). Y_{ijk}: Experimental error assumed to be NID with $(0,\sigma^2 e)$ Duncan multiple range tests (6) were also used to test the difference between the sub classes of each factor.

RESULTS AND DISCUSSION

Growth performance

In the present work, the effects of the Melatonin and Vitamin E (Alpha tocopherol acetate) on body weight gain, of Awassi lambs fed with a High-Energy Diet and Normal Diet was given in Table (2), initial weight and final weight, were 29.2 kg, 46.0 kg for normal energy diet and 28.9 kg, 47.1 kg for high energy diet respectively. Lambs received 400 g/day vitamin E with high energy diet surpassed other treatment in final weigh gain 48.2 significantly ($P \leq 0.05$). Also, interaction of high energy diet with 36 mg melatonin had significant effect on body weight gain than normal diet control. The present results were in agreement with the results of Liu. (16), who estabilished that supplemental vitamin E had positive effect on the performance and the quality of their meat products of feedlot ruminant Ebrahimi (8). In contrast of present study Duan. (7) Indicated that Melatonin implantation (2 mg/kg live weight) had no influence ($P > 0.05$) on daily weight gain and carcass weight of Mongolian cashmere goats. The highest value found for ADG in the present study can be attributed to the high concentrate diet and high energy diet used in confinement. Better FCR was recorded significantly ($p<0.05$) for vitamin E 400 mg/lamb/day supplemented treatment (4.81) and melatonin 36 mg/lamb fed high energy diet (5.0), compared to non-treated (6.7) group fed high energy diet, lambs fed high energy diet with vitamin E 400mg/lamb/day (T10) and lambs implanted with (T8) melatonin 36 mg/lamb/day had significantly ($p<0.05$) lowest fed intake (1500g/lamb/day) in comparison to lambs fed normal energy diet with same doses of vitamin E and melatonin). Present results agreed with Atay. (4) Who established that animals in Vitamin E group supplemented with 45 mg/lamb/day had 10.5% higher feed conversion efficiency than those in control group (4.7 vs. 5.3) during the fattening period for 70 days of Karya male lambs. Similar results have been reported by Ebrahimi. (18) on Morkaraman male lambs. Our findings were in contrast with Kaedy.(14) who found that supplementation of dietary vitamin E level (120, 250 and 500 mg of α-tocopheryl acetate/kg dry matter)of, Suffolk × Charollais wether lambs (feed intake and feed convention ratio) was not affected ($P > 0.05$). Our findings supported by Tan. (27) who reported that there was significant ($P < 0.05$) differences in the average daily gains between different experimental groups, Lambs fed on diet contained high energy level (3.50 Mcal/kg diet) recorded significant ($P<0.05$) higher average daily gain than that of medium (3.20 Mcal/kg diet) and low energy diets (2.90 Mcal/kg diet). Present results in line with other finding. (12, 31, 35, 37).

Carcass caractristics

Effects of the Melatonin and Vitamin E (Alpha tocopherol acetate) on hot carcass weight, hot dressing percentage and cold dressing percentage, of Awassi lambs Fed a High-Energy Diet and Normal Diet was presented in Table (3).Vitamin E 400 ,200mg/lamb/day significantly ($P<0.05$) affected hot carcass weight, dressing percentage compare to no supplemented group. Higher dressing percentage recorded for vitamin E 200mg/lam/day with normal energy diet 49.5 .Present results were in line with those recorded by Adriana. (1) Indicated that lambs

fed diets with vitamin E (0.05%DL-αtocopheryl acetate supplemented diet) showed higher cold carcass weight compare to no supplemented diet of Santa Ines lambs fed for 84 days experiment. On other hand our results in contrast with those recorded by Macit. (19), who reported that there were non-significant differences between control group and 45 mg vitamin E / lamb/day supplemented group of Awassi lamb for a 75-day fattening period in carcass parameters (cold, hot carcass weight and cold, hot dressing percentage).Our findings indicate that melatonin 36 mg/lamb recorded significantly (P<0.05) effect on hot carcass weight 22.8kg, hot dressing percentage 48.4kg.intraction between high energy diet with melatonin implantation (T8) was significant (P<0.05) for hot carcass weight 22.9kg,hot dressing percentage 48.8kg. Our findings in contrast with Duan. (7) Who indicated that Melatonin implantation (2 mg/kg live weight) had no influence (P > 0.05) on carcass weight and dressing percentage of Mongolian Cashmere goat's results. In this experiment, dressing percentage was increased with the increase of fatness and this is associated with feeding high dietary energy. These results are in agreement with Hosseini (11). Similarly, Mysaa. (24) found that dressing percentage and hot carcass weight were lower (p< 0.05) in lambs fed the low energy diet compared to lambs fed the high energy diet 46.4 kg and 46.6 kg for male and female lambs in low energy group 2.20 (Mcal/kg), while 47.5 kg and 48.1 kg for male and female lambs in group high energy diet 2.70 (Mcal/kg). The economic efficiency was higher for lambs fed on high-energy diet compared with other treated groups

Minolta values of meat color during storage

The effect of vitamin E supplementation, melatonin implants on a* redness, b* yellowness and L* lightness values of LD muscles over 14 days of storage of Awassi lambs fed high and normal energy diet was shows in Tables (4). Treatments at day 2nd significantly p<0.05) affected lightness compared to day 7th and day14th of storage period, color stability redness, yellowness and light ness of lamb can be improved significantly if the animals are supplied with sufficient vitamin E 200, 400mg/lamb/day at day 7th and 14th of storage. Melatonin implantation with both doses 18, 36 mg/day recorded similarly results on color stability of lamb meat during day 7th, 14th of storage. Interacted factors was not significant on meat color parameters L*, a* and b* at day 2nd of storage, lambs fed normal energy diet and implanted with 36 mg/lamb melatonin recorded significantly (p<0.05) resulted in reducing yellowness of meat at day 7th of storage, and keeping meat color more redness. Lambs fed a normal diet and implanted with 18 mg/lamb melatonin (T2) had considerably higher redness meat color. During storage, the redness remained constant. This might be a result of the increasing antioxidant status (vitamin E and melatonin) in muscle tissues that reduces myoglobin oxidation post-slaughter and hot dressing percentage 48.7kg. Our findings in contrast with Duan.(7) who indicated that Melatonin implantation (2 mg/kg live weight) had no influence (P > 0.05) on carcass weight and dressing percentage of Mongolian Cashmere goat's results. In this experiment, dressing percentage was increased with the increase of fatness and this is associated with feeding high dietary energy. These results are in agreement with Hosseini (11). Similarly, Mysaa (24) found that dressing percentage and hot carcass weight were lower (p< 0.05) in lambs fed the low energy diet compared to lambs fed the high energy diet 46.4 kg and 46.6 kg for male and female lambs in low energy group 2.20 (Mcal/kg), while 47.5 kg and 48.1 kg for male and female lambs in group high energy diet 2.70 (Mcal/kg). The economic efficiency was higher for lambs fed on high-energy diet compared with other treated groups. It could be concluded that increasing energy levels in lamb's diet resulted in increasing growth performance, nutrient digestibility and carcass traits of lambs. According to McDowell (21), the NRC (23) recommended for ruminants, in general, from 15 to 40 mg/kg of vitamin E, but levels above the recommendation can improve performance, in addition to meat and carcass characteristics**.** Our results were in contrast with those recorded by Macit. (19) Who reported no differences in L*, a* and b* values on LD during 12 day of storage period between vitamin E supplemented (45 mg/

lamb/ day for 75 days and control group of Awassi lambs. There are few studies on the impact of melatonin treatments on meat quality, and none for Awassi lambs have been reported in the scientific literature. Present findings of melatonin implant to lamp results in contrast with Duan.(7) who demonstrated that meat from cashmere goats received melatonin after implantation for 1 month, (2 mg/kg live weight) light scattering properties of meat and is critical for maintaining an attractive appearance of the flesh,. According to diet effect on meat color parameters, results obtained were in the line with Yagoub (34) who established that when Hu lambs fed diets with 5 levels of metabolizable energy (ME) 9.17 (E1), 9.59 (E2), 10.00 (E3), 10.41 (E4), and 10.82 MJ/kg (E5) the meat color of the E5 group tended to be relatively more redness (a*), indicating that energy level improved muscle color. Present results are consistent with a study by Lauzurica (15), who reported that energy compensation growth decreased a* value and tended to decrease L* and b* values of meat colour.

Malondialdehyde (MDA) level of the muscle longissimus dorsi (LD) during storage

MDA values during storage are given in Table (5) .A non-significant effect of a normal and high energy diet on MDA value during 1, 7 and 14 days of storage. Was found MDA values increased after day 1 of storage and differed significantly ($P \leq 0.05$) on days of 7th, 14 th of storage. Melatonin implantation (18 mg/lamb, 36 mg /lamb) significantly at day 7 of storage reduced MDA value, but at day 14 of storage vitamin E 200 and 400 mg/day/lamb affected significantly on reduction of MDA value. The interaction high energy diet with 18 mg/lamb melatonin (T7) and 200 mg/day/lamb vitamin E (T9) was significant at day 7 of storage, while at day 14 of storage high energy diet with 200 mg, 400 mg/lamb/day (T9, T10) reduced significantly MDA value. Present findings are consistent with of Lopez. (17), reported that keeping of meat in fridge and at dark conditions during 9 days of storage the MDA value was 0.45 mg/kg in muscle for lambs supplemented with 1000 mg of vitamin E/kg, whereas the MDA value for non-supplemented lambs was 3.1 mg/kg in muscle. Present results agreed with findings recorded by Macit. (18) found that MDA values on LD of Morkaraman male lambs fed vitamin E supplemented diet were lower ($P<0.05$) compared to non-supplemented diet.it was concluded that exogenous (melatonin 3mg/day) was able to reduce significantly the level of MDA in LD muscle .

Table 2. Effect of normal and high energy diet, vitamin E (Alpha tocopherol) supplements, melatonin Implants on body weight performance (gram) in Awassi lamb

Item Diet	Initial weight kg	Final weigh kg	Average W.G.(g)	Total.G Kg	Feed.C g daily	FCR
Normal Diet	29.06	45.42	0.273	16.3	1710.0	6.2
High Diet	29.07	46.3	0.287	17.2	1714.0	6.0
Treatments						
Diet	29.0	44.1c	0.251c	15.1c	1627.5d	6.4a
M18mg	29.4	46.4b	0.283b	17.0b	1697.5c	6.0ab
M36mg	29.0	47.1b	0.301ab	18.1ab	1682.5c	5.8b
VIT.E200mg	29.0	47.1b	0.301ab	18.1ab	1750.0b	5.8b
VIT.E400mg	28.9	48.2a	0.321a	19.3a	1802.5a	5.6b
Interaction						
NDC	28.9	42.1d	0.220d	13.2d	1600g	7.3a
ND×M18mg	29.2	44.9cd	0.261bc	15.7bc	1650f	7.3a
ND×M36mg	29.4	46.0b	0.278abc	16.6ac	1665ef	6.3ab
ND×VIT,E 200mg	29.5	46.5ab	0.283abc	17.0ac	1775b	6.3ab
ND×VIT.E 400mg	29.1	47.4b	0.305b	18.3ab	1860a	6.9ab
HDC	29.1	43.8cd	0.245c	14.7c	1655f	6.7ab
HD × M18mg	29.7	45.4c	0.261bc	15.7bc	1745bc	6.6ab
HD ×M36mg	28.6	47.0b	0.306b	18.4ac	1700de	5.5b
HD×VIT.E200g	28.5	47.4b	0.315abc	18.9ac	1725cd	5.5b
HD ×VIT.E400mg	28.8	48.1a	0.321a	19.3a	1745bc	5.4b
SEM*	0.131	0.429	0.007	0.419	16.52	0.135
Mean	29.01	45.8	0.278	16.82	1712	6.21
P-value						
Diet	N.S.**	N.S.	N.S.	N.S.	N.S	N.S
Treatments	N.S.	0.0003	0.0020	0.0013	<.0001	0.0381
Interaction	N.S.	0.0021	0.010	0.0069	<.0001	0.092

*** SEM: Standard Error Mean.**

**** N.S.: Non-Significant at probability value (P>0.05)**

.a, b, c: means in the same Columns with different superscripts differ significantly at probability value (P≤0.05).NDC: normal diet control.HDC: high diet control. ND:Normal diet.HD:High diet

M18mg: melatonin 18mg.M36mg: melatonin 36mg.

Table 3.Effect of normal and high energy diet, vitamin E (Alphatocopherol) supplement, melatonin implants On carcass parameters in Awassi lamb

Item	Slaughter weight kg	Hot carcass weight kg	Dressing %
Diet			
Normal Diet	**45.64b**	**20.8**	**44.6**
High Diet	**46.21a**	**21.6**	**44.8**
Treatments			
Diet	**44.77c**	**18.0c**	**40.1d**
M18mg	**46.32ab**	**20.2b**	**43.5c**
M36mg	**47b**	**22.8a**	**48.4a**
VIT.E200mg	**47b**	**22.3a**	**47.3b**
VIT.E400mg	**48.11a**	**22.9a**	**47.5b**
Interaction			
NDC	**41.63d**	**17.7d**	**42.5e**
ND×M18mg	**44.82c**	**19.5cd**	**43.5d**
ND×M36mg	**46.40ab**	**22.7ab**	**48.9ab**
ND×VIT,E200mg	**46.45ab**	**23.0a**	**49.5a**
ND×VIT.E 400mg	**45.36bc**	**21.1bc**	**46.5bc**
HDC	**43.68c**	**18.3d**	**41.9f**
HD × M18mg	**45.33bc**	**20.9bc**	**46.1c**
HD ×M36mg	**46.92b**	**22.9ab**	**48.8ab**
HD ×VIT.E200mg	**47.26b**	**21.6bc**	**45.7bc**
HD ×VIT.E400mg	**48.10a**	**22.7ab**	**47.2b**
SEM*	**113.90**	**0.508**	**0.446**
Mean	**47.43**	**21.2**	**44.7**
***P*-value**			
Diet	**0.0001**	**N.S.****	**N.S.**
Treatments	**0.0001**	**0.0001**	**0.0001**
Interaction	**0.0009**	**0.0005**	**0.0009**

*** SEM: Standard Error Mean.**

**** N.S.: Non-Significant at probability value (P≤0.05).**

a, b, c: means in the same Columns with different superscripts differ significantly at probability value (P≤0.05).NDC: normal diet control.HDC:high diet control.ND:Normal diet.HD:High diet .M18mg:melatonin.18mg.M36mg:melatonin 36mg.

Table 4. Effect of normal and high energy diet , vitamin E (Alphatocopherol) supplement, melatonin implants on Minolta values of meat lightness (L*), redness (a*) and yellowness (b*) of Awassi lamb meat at storage period at day 2, 7 and 14

	2nd day			7th day			14th day		
Item	L*	a*	b*	L*	a*	b*	L*	a*	b*
Diet									
Normal Diet	45.4	17.9	7.62	45.3	16.0	7.51	43.7	16.2	4.57
High Diet	45.5	17.6	7.58	45.3	15.8	7.47	43.8	16.0	4.49
Treatments									
Diet	45.9a	18.5	7.73	45.5a	17.4a	7.78a	44.6a	17.2a	5.35a
M18mg	44.4b	17.4	7.63	45.5a	15.6b	7.35cd	43.4bc	16.2b	4.32bc
M36mg	45.3ab	17.9	7.47	44.5b	15.4b	7.22d	43.9b	15.7b	4.30bc
VIT.E200mg	45.7a	17.6	7.67	45.3a	15.3b	7.61ab	43.3c	15.7b	4.45b
VIT.E400mg	46.0a	17.4	7.50	45.7a	15.6b	7.48bc	43.4bc	15.6b	4.22c
Interaction									
NDC	45.9	18.6	7.70	45.1a	17.6a	7.78a	44.3ab	17.3a	5.30a
ND×M18mg	44.4	17.6	7.78	45.3a	16.0b	7.48abd	44.2b	16.4ab	4.45bc
ND×M36mg	45.3	18.0	7.45	45.3a	15.3b	7.10d	43.5bc	15.7b	4.30bc
ND×VIT, E200mg	45.6	17.7	7.75	45.2a	15.3b	7.65ab	43.3cd	15.9b	4.50b
ND×VIT.E 400mg	45.9	17.7	7.45	45.6a	15.7b	7.54abc	43.2cd	15.5b	4.30bc
HDC	45.9	18.4	7.77	46.0a	17.2a	7.78a	45.0a	17.2a	5.40a
HD × M18mg	44.4	17.3	7.48	45.7a	15.3b	7.22cd	42.6d	16.0b	4.20bc
HD ×M36mg	45.2	17.8	7.50	43.7b	15.6b	7.34bcd	44.3ab	15.6b	4.30bc
HD ×VIT.E200mg	45.8	17.5	7.60	45.5a	15.4b	7.58abc	43.4cd	15.5b	4.40bc
HD ×VIT.E 400mg	46.0	17.2	7.55	45.8a	15.5b	7.43abd	43.6bc	15.7b	4.15c
SEM*	0.169	0.130	0.049	0.148	0.193	0.055	0.162	0.162	0.098
Mean	45.5	17.8	7.60	45.3	15.9	7.49	43.7	16.1	4.53
P-value									
Diet	N.S.**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Treatments	0.0362	N.S.	N.S.	0.0095	<.0001	0.0042	0.0011	0.0018	<.0001
Interaction	N.S.	N.S.	N.S.	0.0074	0.0007	0.0197	0.0011	0.0133	<.0001

*** SEM: Standard Error Mean.**
**** N.S.: Non-Significant at probability value (P≤0.05).**
a, b, c: means in the same Columns with different superscripts differ significantly at probability value (P≤0.05).NDC: normal diet control.HDC:high diet control.
ND:Normal dietHD:High diet .M18mg:melatonin.18mg.M36mg:melatonin 36mg.

Table 5. Effect of Normal and High energy diet, Vitamin E (Alphatocopherol) supplement, Melatonin implants On Malondialdehyde (MDA nmol/g) of the m. Longissimus dorsi (LD) in Awassi lamb.

Item	1st day	7th day	14th day
Diet			
Normal Diet	42.17	63.59	54.76
High Diet	35.64	60.62	59.96
Treatments			
Diet	38.57	71.95a	82.49a
M18mg	47.51	58.75bc	57.86b
M36mg	35.84	56.95c	53.71b
VIT.E200mg	36.35	59.67bc	46.47b
VIT.E400mg	36.25	63.20b	46.28b
Interaction			
NDC	42.24	76.60a	78.07a
ND×M18mg	60.38	61.05bcd	58.60b
ND×M36mg	36.04	54.95d	53.20b
ND×VIT,E200mg	36.24	61.55bcd	41.18b
ND×VIT.E 400mg	36.00	63.80bc	42.78b
HDC	34.90	67.30b	86.91a
HD × M18mg	34.65	56.45cd	57.13b
HD ×M36mg	35.66	58.95bcd	54.22b
HD ×VIT.E200mg	36.48	57.80cd	51.77b
HD ×VIT.E400mg	36.52	62.60bcd	49.78b
SEM*	2.683	1.471	3.409
Mean	38.90	62.10	57.36
P-value			
Diet	N.S.**	N.S.**	N.S.**
Treatments	N.S.**	0.0007	0.0004
Interaction	N.S.**	0.0032	0.0032

*** SEM: Standard Error Mean.**
**** N.S.: Non-Significant at probability value (P≤0.05).**
a, b, c: means in the same Columns with different superscripts differ significantly at probability value (P≤0.05).NDC: normal diet control.HDC:high diet control.
ND:Normal dietHD:High diet .M18mg:melatonin.18mg.M36mg:melatonin 36mg.

CONCLUSION

This experiment provides evidence of potential usefulness of providing lambs vitamin E supplementation and melatonin implant to enhance fattening performance, carcass and meat quality traits**.** It was conducted that Lambs received 400g /day /lamb vitamin E and 36 mg/lamb melatonin with high energy diet surpassed other treatment significantly (P≤0 .05) in final weigh gain**,** and normal diet with 200 mg/lamb/day vitamin E on hot dressing percentage. Lambs fed normal energy diet and implanted with 36mg/lamb melatonin recorded significant (p<0.05) effect on reducing yellowness of meat at day 7^{th} of storage, Lipid oxidation of meat, especially during the storage periods was reduced by Melatonin implantation of 18 mg- 36 mg /lamb significantly at day 7 of storage reduced MDA value, while at day 14 of storage vitamin E 200mg and 400mg / day/lamb affected significantly on reduction of MDA values.

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