



EFFECT OF DRENCHING OF ZINC AND VITAMIN E ON PRODUCTIVE PERFORMANCE AND SOME CARCASS CHARACTERISTICS OF AWASSI LAMBS

Nawfal A. Mohammad Amin and Mozhir K.K Almahdawi

Animal Production Department, College of Agriculture and Forestry, University of Mosul, Iraq

E-mail: mozhir2007@uomosul.edu.iq

Abstract

In order to determine the drenching effect of Awassi lambs groups with zinc element and vitamin E and its combination between them on performance and growth of Awassi lambs. Twenty heads of Awassi lambs were used homogeneously in age (post-weaning) and initial weight ranged between (21-22 kg) in fattening experiment. This experiment was conducted in the animal field, Department of Animal Production/College of Agriculture and Forestry, University of Mosul and it was lasted for ninety days. The lambs were randomly distributed into four treatments at the beginning of experiment, the first was considered as control treatment without drenching of zinc or vitamin E, while the second treatment animals, the lambs groups were treated with zinc (30 mg/head) for three times every week. The third group was treated with vitamin E (20 mg/ head) by mouth and three times every week, and finally the fourth treatment lambs were taken with combination of (zinc + vitamin E) with the same concentrations above. The results of the statistical analysis indicated a significant superiority ($P \leq 0.05$) in most of the traits studied in this experiment, which are weight gain, final weight, hot and cold carcass weights, rib eye muscle area, subcutaneous fat, dressing percentage which was calculated by two methods (live weight of the animal and the empty body weight) and boneless ratio for the three ribs region (9-10-11), major cuts weights (thighs, back, ribs, shoulders) and minor cuts (chest, neck, flank, and forearm) weights for the second, third and fourth treatments in which rents with zinc and vitamin E and mixture between them compared to the first treatment (comparative). It was noted from the results of the current study that a significant improvement appeared ($P \leq 0.05$) in performance and growth of lambs and some characteristics of the carcass as a resulted of the effectiveness and functions of zinc and vitamin E which in increasing the activity of absorption and metabolism processes for nutrient compounds of Awassi lambs groups which treated with zinc or vitamin E and the mixture between them compared to the control group was untreated zinc and vitamin E.

Keywords : Zinc, vitamin E, carcass properties, oral drenching, Awassi lambs.

Introduction

The sheep constitute a large important and vital aspect in sustaining the national income in our country, as income from them is estimated at about 50% of the agricultural production proceeds, whether numerically or productively (Enjalbert *et al.*, 2006). The sheep feeding is one of the important and major factors to show its genetic potential for growth and milk production, wool and reproductive ability. The process of fat oxidation is one of the processes that cause damage to meat quality and accompanying change in color and thickness of meat. Therefore, it using of natural antioxidants has demonstrated efficiency in impeding of fat oxidation as well as its contribution to providing meat that meets the aspirations and desires of consumers (Mitsumoto *et al.*, 1998). To obtain healthy animal products suitable for human consumption to reduce the risk of diabetes, obesity, cancer, vascular disease, heart and foot rot (Enjalbert *et al.*, 2006 and Kilic *et al.*, 2007). Several studies were conducted (Grundy, 1999; Voight and Hagemester, 2001) to obtain high quality animal products with high levels of unsaturated acids in food, including sheep meat that occupies a special position as a protein source and a major meal in human food because of its flavor, strength, palatability and high nutritional value (AL-Aswad, 2000.; Bessa *et al.*, 2000). It was found that zinc activates the enzymes action that contribute to synthesis of new Red Blood Cells (RBC) rather than perishable ones. It is also bound to enzymes that act as a biostimulant that stabilizes synthesis of DNA, RNA and ribosomes (McDowell *et al.*, 1996). At the same time, zinc is one of the necessary elements that ruminants need to perform their vital functions in growth and reproduction, immune system and genetic mutations (Underwood and Suttle, 1999). Also the zinc participates in cell defense system against oxidative stress, and therefore animals need it because of its

effectiveness in stimulating enzymes and proteins that contribute to synthesis of vitamin A and the release of carbon dioxide out of the body, destroy free radicals and maintain the stability of RBC membranes. While other studies (Powell, 2000 and McCall *et al.*, 2000 and McDonal 2000, Stefanidou *et al.*, 2006, Rubio *et al.*, 2007) indicated that presence of zinc in cells plays an essential role in processes of representation of fatty acids, carbohydrates, nucleic acids and protein formation. Moreover, zinc has other vital functions that are very necessary for it activates growth processes, cell division and maintenance of epithelial cells of the reproductive organs necessary for fetal development (Hostetler *et al.*, 2003, Robinson *et al.*, 2006), as well as contributes to formation of sperm in males, perpetuation of uterine vitality, and repair of uterine tissue after the operation childbirth, especially when returning to state of estrus (Apgar, 1985). Moreover, zinc plays an essential role in sustaining pregnancy and increasing milk production in females (Smith and Akinbamijio, 2000).

As for vitamin E, it is considered one of the antioxidants of fats in tissues and plasma, as it traps free hydroxyl radicals, and therefore provides the first line of protection from lipid peroxides (McDowell *et al.*, 1996). Also, this vitamin acts to prevent oxidation of unsaturated fatty acids, especially those in the cell membranes and tissues from the Free Radicals attack (Morrissey *et al.*, 1998). This vitamin was found to prevent hemolysis and disintegration of Red Blood Cell, which is why need for vitamin E is proportional to amount of unsaturated fatty acids present in food intake, especially unsaturated linoleic acid, which is an essential acid for the body (AL-Zuhairy, 2000, Mairorao *et al.*, 2007). The researcher Grundy (1999) has indicated that giving vitamin E to the animal diet which contributes to improving animal immunity, reproductive performance and

fertility and helps in formation of fetuses and their development during the stages of pregnancy in females. The first enters the synthesis of enzymes that contribute to synthesis of erythrocytes, while the second works to prevent the decomposition and breakdown of erythrocytes present in the cell membranes and tissues. It is also involved in protecting biological membranes and enzymes from the risk of free radicals, oxidation, cholesterol, and triple chlorides (Choct *et al.*, 2004).

The current study aimed to know the effect of zinc and vitamin E doses of lambs on improving productive performance and some of characteristics of carcass in lambs treated with zinc and vitamin E compared to the control group of lambs consumed diet not treated with zinc and vitamin E.

Materials and methods

This experiment was conducted in the animal field, College of Agriculture and Forestry/ University of Mosul. Twenty heads of Awassi lamb (males) was using in this study for a period of 90 days, This lambs was purchased from local market (livestock market) in the right side of Mosul city and then placed for an introductory an acclimatization period (15 days). These lambs were homogeneous with age (post-weaning age) and initial weight. The primary weight between ranges (20-21) kg and conducted a statistical analysis of the primary weights of lambs groups to ensure that there were no significant differences between lambs groups. During the trial period, veterinary care and periodic checks were made to ensure its safety from diseases. The Awassi lambs were distribution into four treatments as follows:

First treatment (control): animals without drenching.

Second treatment : The animals were drenching by zinc by (30 mg /head) for three times a week.

Third treatment: The lambs were administered with vitamin E (20 mg/animal) for three times per week.

Fourth treatment: The animals were drenching with combination of zinc and vitamin E in same previous doses above and three times a week.

The animals were fed on a concentrated diet consisting of (61% barley, 30% wheat bran, 6.25% wheat straw, 0.75% urea, 1% salts and 1% limestone) To accustom the lambs to eating the concentrated feed gradually and then gradually increase the daily food intake. Follow the group feeding regimen to try fattening lambs was in form of a free ad lib, and feed was served to twice meals per day, the first at eight in morning and the second at three in afternoon, in order to ensure that animals to eat amount of the four diets, and next day before introducing of morning meal collects remaining feed of animals, each group separately and weighed with a balance dedicated to feed lick The amount of daily feed consumed. This process continued throughout the experiment. Moreover, the animals used to go out for daily grazing for four hours, to eat short weeds as green coarse feed, and to get vitamin A in green fodder in pastures surrounding the department's livestock fields/College of Agriculture and Forestry / University of Mosul. During the trial period, the live weight of the lambs was measured by a dedicated balance. Sheep every two weeks and before the introduction of morning feed until the end of the experiment.

At the end of the experiment, all lambs were fasted for 12 hours before slaughtering, and on the next day dedicated to slaughter, the slaughtering process was carried out for lambs, and after the completion of the slaughtering process, weights of the carcasses were recorded, and counted the weight of hot carcass, and then the carcasses were placed at 4 °C for 18 hours period in meat laboratory belonging to the Animal Production Department, and next day after animal slaughtering process, the carcasses were weighed and counted the weight of cold carcass, and kidneys and fat deposits around them were removed, as well as the mechanism, and each was weighed separately, and the carcasses were cut into pieces Major cuts (thigh, back, ribs and shoulder) and secondary cuts (neck, chest, flank and forearm) according to the segmentation shown by Abdur Rahman *et al.* (2013), and was counted of separate fats. The dressing percentage was calculated in two ways, the first of which was based on the percentage of the cold carcass weight attributed to live weight and the second method attributed to empty body weight (Al-Jalili *et al.*, 1985; Gardner *et al.*, 2015). The rib muscle area at the twelfth rib was measured between the twelfth and thirteenth ribs, according to Rouse *et al.* (1970), Yaqoub *et al.* (1987), by translucent with small sequential squares and the area of each (1cm²), and by matching these transparency across the boundaries of the ocular muscle, the area of the ocular muscle was calculated, and layer fat thickness over the twelfth rib was measured by taking a three-readout rate with a small transparent ruler. The statistical analysis of the data was performed using Completed Randomized Design according to the AL-Zubaidy and AL-Falahy (2016), to know the effect of zinc and vitamin E dosage on the studied traits. Duncan test (1955) is a polynomial between the averages of the traits studied by applying the statistical program (SAS, 2012) by electronic computer.

Results and Discussion

1. Performance and growth of lambs

From a review of the results of this study (table 1) showed that initial weight rates for all lambs in this experiment were non-significant differences and this means that lambs were high homogeneity in weight, size and age. As for the final weight of lambs at the end of experiment, the results revealed (Table 1) that there were highly significant differences ($P \leq 0.01$) between the first, second treatments than for third and fourth treatments and they were in favor of the second, third and fourth treatments in rates of this trait than for the first (control) treatment. The final weight rates of lambs were 33.25, 36.70, 38.75, and 39.85 kg for four consecutive transactions. As for empty body weight, which was calculated by calculating the amount of rumen contents minus the live weight of lambs at the end of experiment (Al-Jalili *et al.*, 1985), therefore from this results (table 1) showed that there were highly significant differences ($P \leq 0.01$) between the third treatment (vitamin E) and fourth (a mixture of vitamin E and zinc) for both first (control) and second (zinc) treatments. The empty body weight rates were 30.86, 34.21, 36.14 and 37.33 kg for four treatments, respectively. As for the daily and total weight gain rates, the results (table 1) indicated a highly significant superiority ($P \leq 0.01$) in favor of experimental treatments treated with zinc and vitamin E and combination between of them than for control group. The averages of daily weight increase was reached 135, 176, 200, 214 gm/day, and total weight increase

by 12.15, 15.85, 18.00 and 19.30 kg for four treatments according to the sequence. The results observed a high significant difference ($P \leq 0.01$) in rates of final weight, daily and total weight gain, and empty body weight in favor of the lambs groups were treated with zinc and vitamin E and combination of them compared to the control group. The reason is a zinc which is attributed and works to break lignocellulosic bonds in the food, thereby improving activity of microorganisms in the rumen. Thus, zinc works to maintain the microbial balance within rumen environment, and this leads to an improvement in efficiency of nutritional conversion, and thus improves animal's response to deposition of muscle tissue of lambs during growth (Hilal *et al.*, 2016 and Ballantin *et al.*, 2002) eventually lead to improved daily weight gain. While vitamin E which acts to increase the animal's appetite and therefore leads to an increase in feed intake and thus gradually improves rates of weight gain in the animal's body on one hand and other hand, the reason may be that vitamin E has an anti-oxidant role which leads to an increase in speed of absorption processes nutrients in body tissues and this is reflected in increased sedimentation of muscle tissue of animal's body, thereby improving the daily and total weight gain of lambs treated with vitamin E (Hatfield *et al.*, 2000, Kharoufa and Abdel-Rahman, 2013).

With regard to the daily food intake and feed conversion efficiency (table 1), these two traits were not

analyzed due to the group feeding of lambs groups in this experiment. The amount of daily feed consumption for total lambs were 1.228, 1.343, 1.359, 1.446 kg fodder/day and the feed conversion efficiency was 9.09, 7.63, 6.80, and 6.74 kg fodder / kg weight gain, respectively.

The results of this study came in line with what Mallaki *et al.* (2015), Towaje *et al.* (2018), Ramadan *et al.* (2018) who found a significant increase in rates of daily weight gains and total increase of animals when drenching with zinc compared to the control group, As well as the results of the study agree with Koyuncu and Yerlikaya (2007), Aref (2013), Ahmed *et al.* (2019), Ibrahim *et al.* (2019), Thamer *et al.* (2020) who those noticed a significant increase in rates of final weight, empty body weight, total weight gain and daily weight gain in favor of treatments added to vitamin E.

While the results were different from results of researchers Turner *et al.* (2005) and Mei *et al.* (2009) and Tameem Eladar (2012), Olivia *et al.* (2018), Budde *et al.* (2019) who found a mathematical improvement and non-significant improvement in rates of daily weight gain at added zinc to the animal diets in their scientific experiments. Also, the results were not consistent with the findings of Aleksandra *et al.* (2005) and Silliman *et al.* (2012), Mohammad *et al.* (2015) who did not notice any significant effect of vitamin E on rates of weight gain between different levels of vitamin E for fattening Awassi lambs.

Table 1: Effect of drenching by zinc and vitamin E on growth and productive performance of Awassi lambs.

Traits	First treatment (control)	Second treatment (zinc)	Third treatment (vitamin E)	Fourth treatment (zinc + vitamin E)
1. No. of lambs :	5	5	5	5
2. Initial weight (kg). ^{NS}	21.10 ± 0.40 A	20.85 ± 0.26 A	20.75 ± 0.25 A	20.55 ± 0.72 A
3. Final weight (kg). ^{**}	33.25 ± 0.27 C	36.70 ± 0.58 B	38.75 ± 0.24 A	39.85 ± 0.26 A
4. Empty body weight (kg). ^{**}	30.86 ± 0.19 C	34.21 ± 0.62 B	36.14 ± 0.06 A	37.33 ± 0.16 A
5. Daily weight gains : ^{**} (gm/day/lamb)	135 ± 5.11 C	176 ± 5.06 B	200 ± 3.57 A	214 ± 10.03 A
6. Total weight gains:(kg/lamb) ^{**}	12.15 ± 0.46 B	15.85 ± 1.22 A	18 ± 0.33 A	19.30 ± 0.92 A
7. Feed intake (kg).	1.228	1.343	1.359	1.446
8. Feed conversion (kg feed/kg live weight).	9.09	7.63	6.80	6.74

NS: Non Significant . * ($P \leq 0.05$). ** ($P \leq 0.01$).

2. The characteristics of the carcass

From a comprehensive review of the results in table (2), it was found that there were highly significant differences ($P \leq 0.01$) in mean of the two characteristics which are hot and cold carcass weights of the Awassi lamb between the second (zinc) and the third (vitamin E) coefficients than for the first (control) and fourth treatment (mixture between of them). While there were no significant differences between the second and third treatments in weights of the hot carcass and cold carcass of Awassi lambs (table 2). The weights of hot carcass reached 16.59, 19.00, 19.63, 22.46 kg, and weight of the cold carcass reached 16.42, 18.81, 19.42, 21.86 kg for four treatments in sequence. The results observed (table 2) the emergence of a highly significant improvement ($P \leq 0.01$) in weights of hot and cold carcass in favor of the lambs groups treated with zinc and vitamin E and combination of them. This is attributed to the role of zinc, which acts as a stimulant in increasing the effectiveness of bacteria in rumen, and this improved the digestibility factors of nutrient compounds and thus contributed to stimulating absorption and nutritional metabolism in the body tissues and thus

reflected to increase in weights of hot and cold carcasses (Towaje *et al.*, 2018). There is another reason due to the presence of a highly significant positive correlation coefficient ($P \leq 0.01$) between the final weight of the lambs and weights of hot and cold carcass and its amount (0.93, 0.93). This explains the significant increase of weights of hot and cold carcasses. The results of this experiment are consistent with results of Towaje *et al.* (2018), Budde *et al.*, (2019) who found significant differences in weights of the hot and cold carcass between animal groups treated with zinc than for control group which was not treated with zinc. Also, the results of this study are not consistent with results of Netto *et al.* (2013), Olivia *et al.* (2018) who observed disappearance significant differences between lambs groups treated and untreated groups by zinc. Likewise, this result did not agree with Mohammad *et al.* (2015), Atay *et al.* (2009), Zhao *et al.* (2013) who did not notice any significant differences between levels of vitamin E in diet on weights of the hot and cold carcass.

As for rib eye muscle area and subcutaneous fat thickness layer mentioned in table (2), the results showed that

there were highly significant differences ($P \leq 0.01$) in rates of rib eye muscle area between four treatments and were not significant differences in rates of skin fat thickness between four factors. The average of rib eye muscle area was 10.95, 12.75, 14.20, 15.75 cm^2 , while the thickness of the subcutaneous fat layer was 4.70, 4.65, 4.55, 4.40 mm for the first, second, third and fourth coefficients respectively.

The results of this experiment indicates a highly significant increase ($P \leq 0.01$) in area of the ocular muscle in favor of lambs groups treated with zinc and vitamin E and mixture between of them than comparison with control group. This may be due to increase in the muscle and bone ratio at the expense of the fat percentage in the result of this study. Through results above (Table 2) have a slight math decrease in thicknesses of subcutaneous fat layer with experimental treatments which zinc and vitamin E and mixture between them compared with the comparison treatment. The reason for this is due to the inverse relationship between the rib eye muscle area and thickness of the fatty layer in a result this study (Turner and colleagues, 2002 and Maict and colleagues, 2003 and Maiorano and colleagues, 2007 and Zhao and his colleagues, 2013). The results of this study are consistent with the results of ATAY *et al.*, (2009), Mohammad *et al.* (2015), Netto *et al.* (2013), Olivia *et al.* (2018) who reported that there was no significant effect of the vitamin E dose on the lipid thicknesses layer of Awassi lamb carcasses. While the results were not identical with the results of Netto *et al.* (2013) and Olivia *et al.* (2018) who confirmed in their results that level of zinc used in drenching of hybrid calves showed no significant effect between the ratios of rib eye muscle area of calves groups.

With regard to dressing percentage was calculated by two methods, the first according to live body weight and second on the basis of the empty body weight (Al-Jalili and others, 1985), the results indicated that there were significant

differences ($P \leq 0.05$) between than first treatment for the last three factors in average of the dressing percentage was calculated on the basis of live weight, Whereas appeared clearance of highly significant differences ($P \leq 0.01$) on dressing percentage which calculated on the basis of empty body weight and boneless percentage between the first treatment than for the second, third and fourth treatments of lambs sacrifices. The dressing percentage calculated on the basis of live weight was 49.80, 50.99, 51.96, 52.86%, and dressing percentage calculated on the basis of empty body weight was 52.00, 55.18, 55.68, 56.02%, and boneless percentage was 61.18, 68.33, 69.66, 69.88% for transactions according to precedence in sequence.

Through look carefully at the results, were found a significant increase ($P \leq 0.05$) of calculated ratio in the first method and a high significant increase ($P \leq 0.01$) calculated in second method, as well as a high significant increase ($P \leq 0.01$) in ratio of cure in favor of experimental groups that lambs groups treated with zinc and vitamin E, mixture of them was compared to the control group. It perhaps this is due to significant increase in final weight rates of the lambs treated with zinc and vitamin E and mixture between them compared to non-treatment control group. The results of this study are consistent with Towaje *et al.* (2018) who found significant differences in dressing percentages was calculated on the basis of live weight and on the basis of empty body weight when using different levels of zinc. It does not agree with Olivia *et al.* (2018), Budde *et al.* (2019) who found no significant effect on dressing percentage when they were using different levels of zinc, nor did not agree with results with ATAY *et al.* (2009), Mohammad *et al.* (2015), Zhao And others (2013) who noted that there were no significant differences on dressing percentage between added and non-added of vitamin E. treatments.

Table 2: Effect of drenching by zinc and vitamin E on some carcass characteristics of Awassi lambs.

Traits	First treatment (control)	Second treatment (zinc)	Third treatment (vitamin E)	Fourth treatment (zinc + vitamine)
1. Hot carcass weight (kg). ^{**}	16.59 ± 0.24 C	19.00 ± 0.50 B	19.63 ± 0.38 B	22.46 ± 0.04 A
3. Cold carcass weight (kg). ^{**}	16.42 ± 0.25 C	18.81 ± 0.49 B	19.42 ± 0.37 B	21.86 ± 0.54 A
4. Rib eye muscle area (cm^2). ^{**}	10.95 ± 0.35 D	12.75 ± 0.15 C	14.20 ± 0.60 B	15.75 ± 0.05 A
5. Subcutaneous fat:(ml) . ^{NS}	4.70 ± 0.10 A	4.65 ± 0.15 A	4.55 ± 0.15 A	4.40 ± 0.10 A
6. Dressing percentage ¹ (%). [*]	49.80 ± 0.10 B	50.99 ± 0.10 AB	51.96 ± 0.10 A	52.82 ± 0.10 A
7. Dressing percentage ² (%). ^{**}	52.00 ± 0.10 B	55.18 ± 0.10 A	55.68 ± 0.10 A	56.02 ± 0.10 A
8. Boneless percentage (%). ^{**}	61.18 ± 0.65 B	68.33 ± 0.49 A	69.66 ± 0.04 A	69.88 ± 0.01 A

NS: Non Significant . * ($P \leq 0.05$). **($P \leq 0.01$).

3. Carcass cuts

From a review of this results presented in table (3), we find that there were significant differences ($P \leq 0.05$) in characteristics means of weights of thighs, back, shoulders and ribs (major cuts) and weights of the forearm and flank (minor cuts) between the first treatment (control) for both third treatment (Vitamin E) and fourth (zinc + vitamin E) on the one hand and on the other hand, the results showed highly significant differences ($P \leq 0.01$) in means of the characteristics which were neck and chest weights between both of first (control), second (zinc) treatments. The results indicate a significant superiority in most of mentioned traits (table 3) in favor of experimental coefficients compared to the control treatment free of zinc and vitamin E. The values

of thigh weight were 3.43, 4.15, 4.66, 5.45 kg and Back 1.82, 2.51, 3.08, 4.39 kg and Shoulder 2.02, 2.44, 3.51, 4.41 kg, Ribs 2.42, 3.21, 3.76, 4.38 kg, Neck 1.08, 1.48, 1.72, 2.58 kg, Chest 0.75, 1.36, 1.82, 2.78 kg, Forearm 1.43, 1.67, 1.97, 3.20 kg, Flank 0.80, 1.09, 1.39, 1.70 kg for four transactions in succession. From the above results, was observed a significant improvement in weights of the major and minor carcasses in favor of the second, third and fourth treatments compared to the control treatment. The reason is due to role of zinc as a stimulant in muscular structure due to precipitation of protein tissue in body of animals treated with zinc compared to the control treatment (Elokil *et al.*, 2019), and there is another reason to explain the highly significant increase ($P \leq 0.01$) in weights of major pieces (Thighs, Loin, Ribs, Shoulders) and the secondary pieces (Neck, Chest,

Forearm, Flank) in the carcasses of lambs treated with zinc and vitamin E and combination of them is due to the presence of a positive and highly significant correlation coefficient ($P \leq 0.01$) between the final live weight of the lambs and weights of the major and minor cuts (table 4) of Awassi lambs carcasses, which reached (0.89, 0.81, 0.92, 0.87, 0.86, 0.80, 0.69, 0.96) for major and minor parts respectively. The results were consistent with the results of Elokil *et al.*, (2019) who observed significant differences in rates of major and minor segment weights between lambs

groups treated with zinc than to the control group. The results of this study were also consistent with the results of ATAY *et al.* (2009) who found a significant effect of vitamin E on averages of major, minor carcass weights when adding vitamin E at different levels in fattening rations of lambs. While the results of this study did not match with results of Mohammed *et al.* (2015) who reported no significant compatibility in most characteristics of major and minor cuts between lambs groups treated with vitamin E than for the comparison group.

Table 3 : Effect of drenching by zinc and vitamin E on weights of carcass cuts of Awassi lambs.

Traits	First treatment (control)	Second treatment (zinc)	Third treatment (vitamin E)	Fourth treatment (zinc + vitamine)
1. Thighs weight (kg).*	3.43 ± 0.03 C	4.15 ± 0.19 BC	4.66 ± 0.07 AB	5.45 ± 0.53 A
2. Back weight (kg).*	1.82 ± 0.09 B	2.51 ± 0.06 B	3.08 ± 0.59 AB	4.39 ± 0.45 A
3. Shoulders weight (kg).*	2.02 ± 0.22 C	2.44 ± 0.45 BC	3.51 ± 0.01 AB	4.41 ± 0.53 A
4. Ribs weight (kg)*.	2.42 ± 0.14 C	3.21 ± 0.27 BC	3.76 ± 0.03 AB	4.38 ± 0.46 A
5. Neck weight:(kg/lamb)**	1.08 ± 0.15 C	1.48 ± 0.03 B	1.72 ± 0.07 B	2.58 ± 0.46 A
6. Chest weight (kg).**	0.75 ± 0.37 C	1.36 ± 0.42 BC	1.82 ± 0.03 B	2.78 ± 0.17 A
7. Forearm weight (kg).*	1.43 ± 0.01 B	1.67 ± 0.01 AB	1.97 ± 0.19 AB	3.20 ± 0.75 A
8. Flank weight (kg)*.	0.80 ± 0.02 C	1.09 ± 0.24 BC	1.39 ± 0.04 AB	1.70 ± 0.04 A

NS: Non Significant . * ($P \leq 0.05$). **($P \leq 0.01$).

Table 4 : Correlation coefficients between final weight of lambs and the major, minor carcass cuts of Awassi lamb carcasses.

Traits studies	Correlation coefficients
1.final weight × final weight	1.0000
2.final weight × hot carcass weight**	0.93
3.final weight × cold carcass weight**	0.93
4.final weight × thighs weight**	0.89
5.final weight × rack weight**	0.81
6.final weight × ribs weight**	0.92
7.final weight × shoulders weight**	0.87
8.final weight × neck weight**	0.86
9.final weight × chest weight**	0.80
10.final weight × hand weight*	0.69
11.final weight × flank weight**	0.96

NS: Non Significant . * ($P \leq 0.05$). **($P \leq 0.01$).

Conclusions

The dosage of Awassi lambs groups with zinc and vitamin E, or both, was resulted in significant improvement in daily and total weight gain rates compared to control lambs group. Thus, was increased significantly in hot and cold carcass weights and dressing percentage for experimental lambs groups, and thus showed a significant increase in weights of the major and minor carcass cuts in favor of the lambs groups treated with zinc and vitamin E or the mixture together compared to the untreated control group.

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