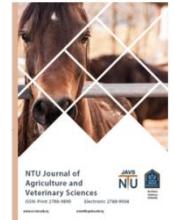




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Impact of olive leaves powder addition to diet on carcass characteristics of Awassi lambs

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ABSTRACT

The research was conducted on the Animal Production field of the College of Agriculture and Forestry / University of Mosul. Twenty-four Awassi lambs were used in study, randomly divided into four treatments. The lambs of the first treatment (control), were fed the standard diet only, while the lambs of the second, third, and fourth treatments, were fed the standard diet with the addition of 25, 50, and 75 g/kg olive leaves powder, respectively. The study lasted for 90 days, preceded by an introductory period that lasted for 10 days. At the end of the study, three lambs from each treatment, were slaughtered to study carcass characteristics. The results of the statistical analysis of live body weight showed that there was a significant superiority ($P \leq 0.05$) for all three olive leaves treatments, and the significant superiority was reflected in the hot carcass weight, and all treatments did not differ significantly in the dressing percentage relative to the hot carcass weight. The results of the physical dissection of the three ribs (9, 10, and 11), showed that there was a significant increase ($P \leq 0.05$) in ribs weight, rib eye area and ribs fat for all olive leaves treatments. While the bone weight of the three ribs decreased significantly in the second and third olive leaves treatments, lean weight increased significantly in 2nd and 4th treatments. Wide tail fat and kidney fat increased significantly in all olive leaves treatments, also recorded a significant increase in Omental and Mesenteric fat in 3rd and 4th treatments. The addition of olive leaves to the ration of Awassi lambs caused an improvement in body and carcass weight and some carcass traits.



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Introduction

Awassi sheep are the main breed in Iraq and Syria [1,2]. This strain has spread from its original homeland in Southeast Asia to all parts of the world [3]. Sheep farming is considered one of the most important economic resources for many countries [4]. It is the most important source of red meat [5]. These small ruminants are considered a good source of proteins, vitamins and amino acids [6]. Its most prominent characteristics are its tolerance to high temperatures and living in areas poor in vegetation [7]. One of the main problems facing sheep farming in Mediterranean countries is the lack of food supplies and the inadequacy of pastures that are available for a very limited period [8]. Therefore, grains are usually imported at exorbitant prices [9]. It has become important to search for feed alternatives to meet the nutritional needs of animals and achieve food security [10]. Olive leaves are a good choice to use as a feed additive for feeding sheep [11]. Because it contains substances that ruminants can digest and utilize [12]. Olive trees are considered evergreen and perennial, and their cultivation is widespread in the Mediterranean countries [13]. It is slow-growing and may live for more than 100 years, reaching a length of 15 [14]. Olive leaves represent 10% of the total weight of olives arriving at the press [15], and can be dried in the shade for 7 days at room temperature, and this is considered a simple and inexpensive procedure for preserving them [16]. The most prominent active substances found in olive leaves are alkaloids [17]. It is also rich in phenolic compounds [18]. Oleuropein is considered the main polyphenolic compound in olive leaves [19]. Olive leaves also contain tannins [20]. It is also rich in vitamins and minerals [21]. Olive leaves contain different levels of dry matter [22]. The current study aims to determine the effect of adding olive leaves powder at concentrations (25, 50, and 75 g/kg feed) to the feed on the carcass characteristics of Awassi lambs.

Materials and methods

Ethical approve

With letter number UM.VET. 2023.070.1/8/2023, the Scientific Ethical Committee accepted the research conducted at the University of Mosul/ College of Agriculture and Forestry.

Study animals

This study was carried out in the fields of animal production /College of Agriculture and Forestry/ University of Mosul. The study continued for 90 days from 8/11/2023 until 6/2/2024, preceded by a preliminary period that lasted for 10 days. The study

used 24 Awassi lambs with an average age of 4-5 months and an average weight of 25.88 ± 0.68 kg, which were purchased from the local market. The lambs were randomly divided into four treatments to study the effect of adding olive leaves powder to the diet on the carcass characteristics of Awassi lambs.

Study design

Twenty-four Awassi lambs were randomly divided into four treatments (6 lambs/treatment). The first treatment (control treatment) had an average lamb weight of 25.83 ± 2.19 kg, and was fed with the standard diet only. The second treatment had an average weight of her lambs of 25.65 ± 1.15 kg. She was fed the standard diet with the addition of 25 gm/kg of dried olive leaves powder. In the third treatment, the average weight of the lambs was 25.91 ± 1.17 kg. They were fed the standard diet with the addition of 50 gm/kg of dried olive leaves powder. While the average weight of the lambs of the fourth treatment was 25.83 ± 1.08 kg, they were fed the standard diet with the addition of 75 gm/kg feed of dried olive leaves powder. Drinking water was available to all lambs throughout the study period. The lambs were subjected to the same environmental conditions, as they were raised in semi-open, adjacent pens.

Olive leaves preparing

Olive leaves were used, which were collected from trees grown on one of the local farms in the Sada and Bawiza area in the city of Mosul. They were dried in the shade for seven days and ground in a special mill before presenting to lambs, according to the proportions mentioned in the study. Olive leaves are used as animal feed without any toxic effects.

Veterinary care

The animals were examined and ensured their safety before starting the study. They were in good health and were subject to veterinary supervision throughout the study period. The lambs were dosed against internal parasites and re-dosed after two weeks with a dose of 5 ml produced by (Saudi Pharmaceutical Industries). The animals were treated with ivermectin subcutaneously at a dose of 1 ml, and the lambs were re-glazed after a week. Animals were vaccinated against enterotoxaemia with Co-Baghdad (Enterotoxaemia) vaccine at a dose of 2 ml subcutaneously, produced by Saudi Pharmaceutical Industries, and they were re-vaccinated a month later. Providing vitamins on a weekly basis with drinking water.

Lambs feeding

The lambs were placed in a preparatory period that lasted for 10 days to accustom the lambs to the standard ration, which consisted of black barley,

soybean meal, wheat bran, hay, sodium bicarbonate, limestone, and table salt. Table No. (1) Percentages of materials composing the standard diet that were provided to all treatments after grinding the black barley and mixing it well with the rest of the components of the diet to ensure homogeneity of all components of the diet. The lambs of each treatment were fed a group diet after randomly distributing them to the pens. The energy percentage was 2487 kilocalories/kg, the dry matter percentage was 93.64%, and the crude protein percentage was 14.84. The feed was provided at a rate of 3% of the live body weight for each treatment. The feed was provided in two meals, the first at seven in the morning and the second at four in the evening. Coarse fodder (hay) was provided freely to all lambs, and drinking water and salt blocks were available throughout the study period.

Carcass characteristics

After 90 days had passed and the end of the study period, the lambs fasted for 12 hours, then they were weighed so that this weight was the final weight. After that, 3 lambs from each treatment were slaughtered, and the weights of fat for each of the heart, liver, kidneys, trochanter, spleen, and testicles were also weighed. Then, the empty weight of the carcass was measured, and the thickness of the subcutaneous fat on rib 11 was recorded. The Rib eye area from rib 11 was taken by placing transparent paper on the ocular muscle, and then its area was calculated by placing the drawing on graph paper [24].

Physical dissection of three ribs

After separating the ribs 9-10-11 from the right half of the carcass, a physical inventory was conducted after freezing the pieces at a temperature of -20 degrees Celsius, then the pieces thawed at room temperature. The physical dissection of three ribs was done using a sharp knife to accurately separate the muscle, fat and bone tissues from each other and weighing them. Individually, using a balance with a sensitivity of 1 gram, the percentage of each fabric was calculated by dividing the weight of the fabric by the weight of the ribs (9-10-11).

Statistical analysis

The SAS [25], software performed a one-way ANOVA analysis on the data, and the Duncan's multiple range test was used to assess if there were statistically significant differences between the means based on the significant F value [26].

Results

Productive qualities

Table No. (2) shows the effect of olive leaves treatment (25, 50, and 75 gm/kg feed) on some productive traits of Awassi lambs. The results of the statistical analysis of live body weight showed a significant superiority ($P \leq 0.05$) for all three olive

leaves treatments. The body weight reached 44.83, 43.33, and 45.33 kg, respectively, starting from the second treatment, compared to the control treatment (39.00 kg). The significant superiority of the live body weight of the three olive leaves treatments was reflected in the hot carcass weight, as it reached 23.08, 23.16, and 23.91 kg, respectively, compared to the control treatment, in which the hot carcass weight reached 20.23 kg. All treatments did not differ significantly in the dressing percentage relative to the hot carcass weight, with an arithmetic difference in favor of the third and fourth treatment. (53.46 and 52.72%), respectively.

The results of the current study agreed in not achieving a significant increase in the slaughter percentage with the results of researchers [27], in Awassi lambs when adding 150 g/kg of olive leaf feed. The results did not agree in terms of achieving a significant weight increase in the hot carcass weight. Olive leaf treatments achieved significant increases in live body weight (Table 2), which was reflected in achieving a significant increase in hot carcass weight compared to the control treatment, as researcher [28], recorded, the presence of phenolic compounds (Europeans) in the waste of olive trees, which prevent the breakdown of protein in the rumen and its passage to the stomach and intestines in the form of amino acids. It also breaks down sources of carbohydrates for fermentation and increases the digestibility coefficient of some nutrients. Thus, it leads to achieving weight increases in the animal, which is reflected in the weight of the carcass [29].

Physical dissection of three ribs

The results of the statistical analysis of the data on the effect of olive leaves (25, 50, and 75 g/kg feed) indicate the physical dissection of the three ribs (9, 10, and 11) of Awassi lambs. Table number (3), is evident from the results that there is a significant increase ($P \leq 0.05$) in the rib eye area for all olive leaves treatments. It reached 16.00, 14.83, and 16.83 cm², respectively, starting with the second treatment, compared with the control treatment (13.33 cm²). As the results shown in Table No. (3), the second, third and fourth olive leaves treatments were superior in the weight of the three ribs, as their values reached 459.33 and 407.66 and 434.66 gm, respectively, compared to the control treatment, in which the weight of the ribs was 373.33 gm, while the bone weight of the three ribs decreased significantly in the second and third olive leaves treatments, and recorded 100.00 and 98.00 gm, respectively, compared to the control and fourth treatments (114.00 and 109.66 gm), respectively, as was evident from the results obtained, there was a significant superiority of all olive leaves treatments in fat weight, as its values reached 153.00, 124.00, and 100.00 gm, respectively, compared to the control treatment (83.00 gm). While the lean weight increased significantly in favor of the second and

fourth treatments (195.66 and 220.00 gm), respectively, compared to the control and the third olive leaves treatments, in which the lean weight reached 172.00 and 180.33 gm, respectively, as shown by the results obtained, in the statistical analysis of the percentage of bone weight to the three ribs, there was a significant decrease ($P \leq 0.05$) for the second, third and fourth olive leaves treatments, in which the percentage of bone reached 21.78, 24.03 and 25.23% compared to the control group (30.54%), while the significant superiority of the fat percentage was in favor of the second and third treatments, as their values reached 33.30 and 30.41%, respectively, compared to the control and the fourth olive leaves treatments, which were 22.23 and 23.00% respectively. While the highest percentage of lean was recorded in the fourth olive leaves treatment (50.62%) compared to the control, second and third treatments, in which percentages of lean were recorded 46.06, 42.61 and 44.24%, respectively.

Table No. (4), shows the effect of olive leaves treatment (25, 50 and 75 gm/kg feed) on fat deposition in the carcasses of Awassi lambs, as the weight of the wide tail fat in all three olive leaves treatments increased significantly ($P \leq 0.05$) and reached 4.39, 4.25 and 4.41 kg, respectively, starting from the second treatment, compared to the control treatment in which the weight of the wide tail fat reached 2.92 kg. It is also clear from the results obtained from the statistical analysis of the weight of the omental fat that, there was a significant superiority of the third and fourth olive leaves treatments, reaching a value of (351.67 and 336.67), respectively, compared to the control and second olive leaves treatments (270.00 and 286.67 gm), respectively. While a significant increase ($P \leq 0.05$) was recorded in favor of the third and fourth olive leaves treatments in the weight of mesenteric fat (455.00 and 621.67 gm), respectively, compared to the control and second olive leaves treatments, (355.00 and 313.33 gm) respectively. while kidney fat increased significantly ($P \leq 0.05$) in the three olive leaves treatments, as kidney fat reached 111.66, 140.00 and 126.66 gm, respectively, in comparison to the control treatment in which the fat weight reached the kidneys 88.33 gm.

Discussion

The results of the current study, in achieving a significant increase in muscle percentage and rib eye area, and achieving a significant decrease in bone percentage, did not agree with the results of [30], as the researchers did not record any significant differences in lean and fat weights, when adding olive pomace (75 and 150 grams). /Kg of feed) in black goat rations.

The reason for achieving an improvement in the lean ratio and the rib eye area may be that olive leaves improved the efficiency of feed utilization

when added to the feed, which led to an improvement in the weight of some cuttings also may be due to the fact that medicinal plants or herbs have the ability to destroy or prevent the growth of organisms, especially microbes in the animal's stomach, causing an improvement in the animal's immune response [31].

Conclusion

The results indicated an improvement in some carcass characteristics, such as final live weight and hot carcass weight, and thus some elements of physical dissection and fat deposition were improved in the lambs to which olive leaves powder (25, 50, and 75 gm/kg feed) was added to their diet. The need for further studies to evaluate the replacement of different percentages of roughage with olive leaves. The results of these studies help sheep breeders overcome obstacles related to providing feed, as well as reduce production costs and thus increase the profit margin.

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Competing Interests

The authors state that there are no conflicts of interest with the publication of this work.

References

- [1] Galal, S., Gürsoy, O., & Shaat, I. (2008). Awassi sheep as a genetic resource and efforts for their genetic improvement—A review. *Small Ruminant Research*, 79(2-3), 99-108.
- [2] Shomo, F., Ahmed, M., Shideed, K., Aw-Hassan, A., & Erkan, O. (2010). Sources of technical efficiency of sheep production systems in dry areas in Syria. *Small Ruminant Research*, 91(2-3), 160-169.
- [3] Awawdeh, M. S. (2011). Alternative feedstuffs and their effects on performance of Awassi sheep: a review. *Tropical animal health and production*, 43, 1297-1309.
- [4] Alemu, Y., (2008). Castration of sheep and goats. ESGPIP Technical Bulletin 18. Addis Ababa: ESGPIP.
- [5] Olfaz, M., Ocak, N., Erener, G., Cam, M. A., & Garipoglu, A. V. (2005). Growth, carcass and meat characteristics of Karayaka growing rams fed sugar beet pulp, partially substituting for grass hay as forage. *Meat Science*, 70(1), 7-14.
- [6] Bin Abdullah Juma, A. B. H. (2007). The effects of *Lepidium sativum* seeds on fracture-induced healing in rabbits. *Medscape General Medicine*, 9(2), 23.
- [7] Kridli, R. T., Abdullah, A. Y., & Al-Smadi, N. M. (2007). Reproductive performance and milk yield in

Awassi ewes following crossbreeding. *Small Ruminant Research*, 71(1-3), 103-108.

[8] Awawdeh, M. S., & Obeidat, B. S. (2011). Effect of supplemental exogenous enzymes on performance of finishing Awassi lambs fed olive cake-containing diets. *Livestock Science*, 138(1-3), 20-24.

[9] Awawdeh, M. S., Dager, H. K., & Obeidat, B. S. (2019). Effects of alternative feedstuffs on growth performance, carcass characteristics, and meat quality of growing Awassi lambs. *Italian Journal of Animal Science*. 18 (1), 777-785.

[10] Servili, M., Esposto, S., Taticchi, A., Urbani, S., Selvaggini, R., Di Maio, I., & Veneziani, G. (2011). Innovation in extraction technology for improved virgin olive oil quality and by-product valorisation. *Acta Hortic*, 888, 303-16.

[11] Berbel, J., & Posadillo, A. (2018). Review and analysis of alternatives for the valorisation of agro-industrial olive oil by-products. *Sustainability*, 10(1), 237.

[12] Tzamaloukas, O., Neofytou, M. C., & Simitzis, P. E. (2021). Application of olive by-products in livestock with emphasis on small ruminants: Implications on rumen function, growth performance, milk and meat quality. *Animals*, 11(2), 531.

[13] Shafey, T. M., Almufarij, S. I., & Albatshan, H. A. (2013). Effect of feeding olive leaves on the performance, intestinal and carcass characteristics of broiler chickens.

[14] Habibi, I. S; Khalid, I. J.; Hisham, F. D. and Sami, I. (2015). The effect of olive (*Olea europaea* L.) on Hemato-Biochemical and Tissues alterations and reproductive performance of some species of Egyptian Rams. *Egyptian J. of Anim. Sci.* 12(6) 1-14.

[15] Delgado-Pertíñez, M., Chesson, A., Provan, G. J., Garrido, A., & Gómez-Cabrera, A. (1998). Effect of different drying systems for the conservation of olive leaves on their nutritive value for ruminants. In *Annales de zootechnie* (Vol. 47, No. 2, pp. 141-150).

[16] Martín-García, A. I., & Molina-Alcaide, E. (2008). Effect of different drying procedures on the nutritive value of olive (*Olea europaea* var. *europaea*) leaves for ruminants. *Animal feed science and technology*, 142(3-4), 317-329.

[17] Cai, Y., Luo, Q., Sun, M., & Corke, H. (2004). Antioxidant activity and phenolic compounds of 112 traditional Chinese medicinal plants associated with anticancer. *Life sciences*, 74(17), 2157-2184.

[18] Quirantes-Piné, R., Lozano-Sánchez, J., Herrero, M., Ibáñez, E., Segura-Carretero, A., & Fernández-Gutiérrez, A. (2013). HPLC-ESI-QTOF-MS as a powerful analytical tool for characterising phenolic compounds in olive-leaf extracts. *Phytochemical Analysis*, 24(3), 213-223.

[19] Žugčić, T., Abdelkebir, R., Alcantara, C., Collado, M. C., Garcia-Pérez, J. V., Meléndez-Martínez, A. J., ... & Barba, F. J. (2019). From extraction of valuable compounds to health promoting benefits of olive leaves through bioaccessibility, bioavailability and impact on gut microbiota. *Trends in Food Science & Technology*, 83, 63-77.

[20] Marcos, C. N., de Evan, T., García-Rebollar, P., de Blas, C., & Carro, M. D. (2019). Influence of storage time and processing on chemical composition and in vitro ruminal fermentation of olive cake. *Journal of animal physiology and animal nutrition*, 103(5), 1303-1312.

[21] Vijaimohan, K., Jainu, M., Sabitha, K. E., Subramanyam, S., Anandhan, C., & Devi, C. S. (2006). Beneficial effects of alpha linolenic acid rich flaxseed oil on growth performance and hepatic cholesterol metabolism in high fat diet fed rats. *Life sciences*, 79(5), 448-454.

[22] Rahmanian, N., Jafari, S. M., & Wani, T. A. (2015). Bioactive profile, dehydration, extraction and application of the bioactive components of olive leaves. *Trends in Food Science & Technology*, 42(2), 150-172.

[23] Al-Khawaja, A. K., Al-Bayati, E. A., & Matti, S. A. (1978). Chemical composition and nutritional value of Iraqi feed materials. Ministry of Agriculture and Agrarian Reform, General Directorate of Animal Resources.

[24] Duckett S.K., Neel J.P.S., Sonon Jr. R.N., Fontenot J.P., Clapham W.M., Scaglia G., (2007). Effects of winter stocker growth rate and finishing system on: II. Ninth-tenth-eleventh-rib composition, muscle color, and palatability. *Journal of Animal Science*. 85, 2691-2698.

[25] SAS Institute, (2003). *SAS/STAT user's guide for personal computers*. Release V. 9.1. SAS Institute Inc., Cary, NC (USA).

[26] Steel R.G.D., Torrie J.H., (1984). *Principles procedures of statistics*. McGraw Hill Book Company, Inc., New York (USA).

[27] Obeidat, B. S., & Thomas, M. G. (2023). Assessing the influence of feeding olive leaves on the productivity and economic viability of growing Awassi lambs. *Cogent Food & Agriculture*, 9(2), 2277518. <https://doi.org/10.1080/23311932.2023.2277518>.

[28] Abbas, Rabia Jadou. (2016). Components of some local plant leaves are evaluated as unconventional fodder substitutes for poultry. *Kufa Journal of Agricultural Sciences*, 8(3) 239-308.

[29] Apak, R., K. Guclu, B. Dernirata, M. Ozyurek, S.E. Celik, B. Bekta oilu, K. I. Berker, and D. Ozyurt. (2007). Comparative Evaluation of Various Total Antioxidant Capacity Assays Applied to Phenolic Compounds with the CUPRAC Assay Molecules, 12: 1496-1547.

[30] Obeidat, B. S., & Thomas, M. G. (2024). Growth performance, blood metabolites and carcass characteristics of Black goat kids fed diets containing olive cake. *Animals*, 14(2), 272.

[31] Morteza, K., Alimon, A. R., Goh, Y. M., Sazili, A. Q., & Ivan, M. (2010). Effects of dietary herbal antioxidants supplemented on feedlot growth performance and carcass composition of male goats.

Table 1. Components and chemical composition of the diet used in the study.

Feed material	%
Black barley	65
Soybeans	8
Wheat bran	20
Wheat hay	4
Urea	0.5
Sodium bicarbonate	1
Limestone	1
Table salt	0.5
Total	100
Chemical composition	
Dry matter	93,64
Protein	14,84
Metabolic energy Calories / kg	2487

The chemical composition and chemical analysis table of Iraqi feed materials were calculated According to [23]

Table 2. Mean ± (standard error) Effect of adding olive leaves to the diet on some productive traits of Awassi lambs.

Traits Treatments	Live body weight (kg)	Hot carcass weight (kg)	Dressing Percentage %
T1	39.00 c ±0.57	20.23 b ±0.41	51.87 a ±0.61
	44.83 a ±0.44	23.08 a ±0.30	51.48 a ±0.17
T2	43.33 b ±0.33	23.16 a ±0.43	53.46 a ±0.87
	45.33 a ±0.22	23.91 a ±1.04	52.72 a ±2.03

Different letters within one column differ significantly at the probability level (P≤0.05).

T¹: Control group, T²: Olive leaves 25 g/kg ration, T³: Olive leaves 50 g/kg ration, T⁴: Olive leaves 75 g/kg ration.

Table 3. Mean ± (standard error) Effect of adding olive leaves to the diet on the dissection of three ribs (9, 10, and 11) of Awassi lambs.

Traits Treatments	T1	T2	T3	T4
Rib eye area (cm ²)	13.33 d ±0.12	16.00 b ±0.28	14.83 c ±0.33	16.83 a ±0.20
	1.13 ab ±0.06	1.26 a ±0.03	1.16 ab ±0.04	1.10 b ±0.02
Fat thickness (cm)	373.33 d ±4.80	459.33 a ±8.87	407.66 c ±3.71	434.66 b ±4.33
	114.00 a ±1.52	100.00 b ±1.52	98.00 b ±2.08	109.66 a ±2.60
Ribs weight (gm)	83.00 d ±1.73	153.00 a ±3.05	124.00 b ±2.08	100.00 c ±2.64
	172.00 c ±4.16	195.66 b ±2.96	180.33 c ±2.84	220.00 a ±5.03
Bone weight (gm)	30.54 a ±0.59	21.78 c ±0.47	24.03 b ±0.32	25.23 b ±0.54
	22.23 c ±0.32	33.30 a ±0.06	30.41 b ±0.41	23.00 c ±0/58
Fat percentage %	46.06 b ±0.66	42.61 c ±0.49	44.24 bc ±0.89	50.62 a ±1.18

Horizontally different letters differ significantly at the probability level (P≤0.05).

T¹: Control group, T²: Olive leaves 25 g/kg ration, T³: Olive leaves 50 g/kg ration, T⁴: Olive leaves 75 g/kg ration.

Table 4. Mean ± (standard error) Effect of adding olive leaves to the diet on fat deposition in the carcasses of Awassi lambs.

Treatments Traits	T1	T2	T3	T4
Wide tail fat (kg)	2.92 b ±0.08	4.39 a ±0.18	4.25 a ±0.28	4.41 a ±0.07
Omental fat (gm)	270.00 b ±23.62	286.67 b ±13.33	351.67 a ±7.26	336.67 a ±8.81
Mesenteric fat (gm)	355.00 c ±20.81	313.33 c ±15.89	455.00 b ±10.40	621.67 a ±14.52
Kidney fat (gm)	88.33 d ±3.33	111.66 c ±1.66	140.00 a 5.77	126.66 b ±4.40
Heart fat (gm)	48.33 a ±1.66	48.33 a ±4.40	41.66 a 2.02	48.33 a ±0.88

Horizontally different letters differ significantly at the probability level (P≤0.05).

T¹: Control group, T²: Olive leaves 25 g/kg ration, T³: Olive leaves 50 g/kg ration, T⁴: Olive leaves 75 g/kg ration.