Original Article

Effect Of Administering Artemisia Herba-Alba and Vitamin E Aqueous Extracts on Performance, Rumen and Blood Physiological Parameters in Lambs

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Abstract

The study aimed to determine the effect of administering the aqueous extract of Artemisia herba-alba and vitamin E on some physiological traits of local male lambs. Thirty local male lambs, aged between 4 and 4.5 months, with an average body weight of 21.35 kg, were randomly divided into six equal groups of five lambs each. All lambs were fed the same diet. Lambs in the first group (T1) were drenched with distilled water and served as the control group. The second group (T2) was drenched with the aqueous extract of Artemisia at a dose of 100 mg kg-1 live body weight every day. The third group (T3) received the aqueous extract of Artemisia at a dose of 200 mg kg-1 live body weight. The fourth group (T4) was drenched with vitamin E at a dose of 15 mg kg-1 live body weight. The fifth group (T5) was given a mixture of Artemisia aqueous extract and vitamin E at doses of 100 mg+15 mg kg-1 live body weight, while the sixth group (T6) received a mixture of Artemisia aqueous extract and vitamin E at doses of 200 mg+15 mg kg-1 live body weight. The results revealed a significant improvement in the parameters of Artemisia, vitamin E, and their combination compared to the control group. Improvements were observed in rumen fluid characteristics, total protein, globulin, and glutathione peroxidase enzyme activity, along with a decrease in malondialdehyde levels. No significant differences were recorded in albumin levels. Artemisia and vitamin E, alone or combined, demonstrated beneficial physiological and metabolic effects, suggesting potential as natural feed additives for lambs.

Keywords: Artemisia, Vitamin E, Lamb weight, Rumen and Blood Physiological.

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Introduction

Animal production is a crucial pillar of the national economy, and improving livestock production efficiency plays a significant role in enhancing living standards and providing essential animal products such as meat, milk, and wool, Sheep are a primary source of these products. As a result, many researchers have focused on increasing sheep productivity, enhancing their living conditions, and improving reproductive efficiency. Some have explored hormonal programs (20), while others have addressed immune system improvements, as seen in the study by (40).

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Some studies have investigated the use of dietary supplements like arginine (29), while others have emphasized better nutrition and the addition of mineral elements (2). A review of the literature highlights the use of various industrial additives, with medicinal plants now gaining popularity as alternatives to pharmaceutical drugs. Herbal plants and their derivatives, rich in active compounds, offer a range of properties, including antibacterial, antifungal, anti-inflammatory, anti-ulcer, anti-cancer, and wound-healing effects (6, 14, 19, 25 and 31), demonstrating their significant health benefits. The effectiveness of Artemisia is attributed to its content of various active substances, including essential oils, flavonoids, saponins, tannins, alkaloids, glycosides, and coumarins (33). The primary compound in most types of Artemisia is artemisinin, with its concentration varying depending on the species, cultivation location, and harvest time (12). Artemisia as a feed additive for ruminants offers numerous benefits (4), particularly in enhancing rumen fermentation and increasing the transfer of polyunsaturated fatty acids (PUFAs) such as 18:3 and 18:2 from the diet to muscle tissues, ultimately boosting the concentration of beneficial fatty acids for improved nutritional value. It also has effective effects, including the synthesis and production of protein and the improvement of the animal's general health by enhancing liver cell activity and increasing the efficiency of the digestive system, which in turn leads to increased protein production and better absorption of dietary proteins (5). Additionally, it helps maintain fluid balance and blood pressure, both of which are essential for proper albumin levels (3). It also stimulates antibody production, thereby increasing blood globulin levels (13). Vitamin E, a vital fat-soluble vitamin, is essential for maintaining health and preventing diseases. As a prominent antioxidant, it protects the body from free radical damage (30) and plays key roles in protecting polyunsaturated fatty acids (PUFAs) in cell membranes from oxidation, as well as regulating the production of reactive nitrogen species (RNS) and reactive oxygen species (ROS) (24 and 41). Its effective role as an antioxidant also promotes overall health and improves metabolic functions, thereby enhancing protein synthesis and production while reducing oxidative stress, which can negatively affect protein levels. Moreover, it helps maintain albumin levels and increases globulin levels in the blood (18). Through reviewing previous studies, which focused on the effect of vitamin E alone or Artemisia herba-alba in other fields such as its effect on blood glucose levels, but did not address other vital functions of lambs when compared together as antioxidants, this research was therefore conducted to contribute to finding safe natural alternatives to improve the health and productivity of local sheep by studying the effect of administering the aqueous extract of Artemisia herba-alba and vitamin E on some physiological traits of local male lambs.

Materials and Methods

Experimental Animals: This study was conducted at the animal facilities of the College of Agriculture, University of Anbar, over a period of 90 days, from April 1, 2024, to July 1, 2024. A total of 30 local male lambs, aged between 4 - 4.5 months, with an average weight of 21.35 kg, were selected for the experiment. All the lambs were fed a uniform concentrated diet, which accounted for 3% of their body weight. The diet consisted of the following nutritional components: 13.6% protein, 5.89% ash, 11.56% moisture, 2.77% fat, 11.11% fiber, and 55.07% carbohydrates. In addition to the concentrated feed, green fodders were provided, and fresh water was available ad libitum throughout the experiment. The aqueous extract of Artemisia

was prepared according to the method of (32). A total of 200 grams of Artemisia powder was soaked in 1 liter of distilled water for 24 hours at room temperature. The mixture was then filtered using four layers of gauze, and the filtrate was collected and administered orally to the experimental animals at concentrations of 100 and 200 mg kg^{-1} of body weight every day for a period of 90 days.

Experimental Design: The experimental animals were randomly assigned to six equal groups, with five lambs in each group. All groups were provided with the same diet, consisting of concentrated and green fodders. The first group (T1) were drenched with distilled water and served as the control group. The second group (T2) was treated with an aqueous extract of Artemisia at a dose of 100 mg kg^{-1} body weight. The third group (T3) received the extract at a dose of 200 mg kg^{-1} body weight. The fourth group (T4) was administered vitamin E at a dose of 15 mg kg^{-1} body weight. The fifth group (T5) received a combination of the aqueous Artemisia extract and vitamin E at concentrations of 100 mg and 15 mg kg^{-1} body weight, respectively. The sixth group (T6) received a combination of the extract and vitamin E at concentrations of 200 mg and 15 mg kg^{-1} body weight.

Rumen Fluid Sampling: Rumen fluid was collected from the lambs two hours post-feeding during two periods, at 45 and 90 days into the experiment. Fluid samples were obtained using a homemade device that involved inserting a rubber tube into the animal's mouth and passing it into the rumen, from which fluid was extracted using a suction device at the opposite end. The procedure followed the method of (35). The pH of the rumen fluid was immediately measured using a portable pH Tester. The fluid was then filtered through layers of gauze and transferred into a sterile plastic container for further analysis of volatile fatty acids and ammonia.

Blood Sample Collection: Blood samples were collected from the jugular vein of the lambs at 9:00 a.m. every three weeks on the following days of the experiment: day 0, 23, 44, 65, and 90. The samples were drawn using a G21 medical syringe and placed into two types of plastic tubes: one containing an anticoagulant (EDTA – Ethylene Diamine Tetraacetic Acid) and the other without anticoagulant. The samples were then kept in a cooled container until transferred to the laboratory for the measurement of total protein, albumin, globulin levels according to the method described by (44). Malondialdehyde (MDA) (44) and Glutathione Peroxidase (GPx) levels according to the method described by (34).

Statistical Analysis: Statistical analysis was performed using one-way analysis of variance (ANOVA) with SAS software, version 9.1 (36). Differences between treatment means were evaluated using Duncan's multiple range test (10) at a significance level of ($P<0.05$).

Results and Discussion

Effect of Treatments on Lamb Weight: Significant improvements in body weight were observed in treatments with Artemisia, vitamin E, and their combinations compared to control, particularly in T2, T4, and T5.

Table 1. Effect of Aqueous Extract of Artemisia and Vitamin E on the Weight of Local Male Lambs (kg) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
Zero	21/7±0/770*	21/0±1/39	21/0±1/44	21/9±0/623	21/1±1/40	21/0±2/13	N.S**
7	24/8±1/69	23/5±1/56	23/7±1/88	23/9±2/11	24/2±1/69	24/3±2/35	N.S
14	28/9±0/645	27/2±0/443	27/1±1/46	28/5±0/508	28/5±1/16	27/9±0/508	N.S

30	32/9±0/304	33/02±0/789	32/3±1/50	33/1±0/441	32/2±0/443	32/6±0/25	N.S
45	34/9±0/428 abc	36/2± 0/447 ab	34/8±0/529 bc	36/4±0/466 a	35/2±0/725 abc	34/5±0/229 c	0/0527
60	38/±0/141 c	42/0±0/669 a	38/4±0/492 c	41/6±0/181 a	39/8±0/227 b	39/4±0/406 bc	<.0001
75	41/0±0/261 b	44/7±0/964 a	41/4±0/321 b	43/5±0/433 ab	43/1±0989 ab	43/4±1/38 ab	0/0436
90	42/4±0/150 d	47/2±0/869 a	42/±0/592 cd	45/6±0/800 ab	44/5±0/798 bc	43/8±0/262 bcd	<.0001

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Artemisia has long been utilized in traditional medicine as an appetite stimulant and digestive aid. Its supplementation, or the use of its extracts, has been shown to stimulate gastric juice and bile secretion, thereby enhancing feed digestibility in animal diets. The flavonoid compounds present in Artemisia are well recognized for their ability to improve nutritional efficiency and promote growth, likely through their beneficial effects on metabolism, as well as on immune and antioxidant functions (15). Similarly, Vitamin E plays a crucial role in the formation of fat cell membranes within muscle tissue, which contributes to greater muscle mass development (25). This effect is often associated with an increase in appetite, resulting in higher feed intake and, consequently, improved weight gain over time. Additionally, the antioxidant properties of Vitamin E may enhance nutrient absorption in body tissues, thereby promoting muscle deposition and leading to improvements in both daily and total weight gain in lambs supplemented with Vitamin E. These findings are consistent with the observations of (21), who reported that dietary inclusion of Artemisia, either alone or in combination with rosemary, led to improved body weight in rams. Likewise, (9) demonstrated that supplementing lamb diets with 0.4 mg selenium and 100 mg Vitamin E/kg significantly improved various production traits, including final body weight and daily weight gain. Conversely, (11) reported no significant effects on final body weight, daily weight gain, or feed conversion ratio when Artemisia was incorporated at 25% and 50% of the diet.

Effect of Treatments on volatile fatty acids: the concentrations of volatile fatty acids (acetate, propionate, and butyrate) in the 2 and 3 treatments, with the 4, 5, and 6 treatments also showing notable differences when compared to the control group.

Table 2. Effect of Aqueous Extract of Artemisia and Vitamin E on Concentrations in Ruminal Fluid of Local Male Lambs (U/L) (Means ± Standard Error).

FFA	**Treatments**						**Morale level**
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	
Acetic	10/6±0/176 de	15/0±0/057 a	14/4±0/095 b	12/8±0/105 c	10/9±0/087 d	0/142±10/3* e	<.0001
Propionic	4/45±0/072 d	8/96±0/075 a	9/08±0/154 a	7/98±0/080 b	5/35±0/069 c	4/34±0/137 d	<.0001
Butyric	16/2±0/141 e	23/6±0/215 a	23/6±0/224 a	18/1±0/074 c	19/0±0/040 b	16/9±0/103 d	<.0001

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Effect of Treatments on pH: Table 3 indicates significant differences on the ninetieth day of the experiment, with the 5, 3, 4, and 6 treatments surpassing the first treatment when compared to the control group.

Table 3. Effect of Aqueous Extract of Artemisia and Vitamin E on pH in Rumen Fluid of Local Male Lambs (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
45	7/02±0/026	7/08±0/133	6/92±0/043	6/95±0/088	6/90±0/144	0/051±6/98*	N.S**
90	6/45±0/044 c	6/56±0/101 bc	6/69±0/041 ab	6/70±0/031 ab	6/80±0/085 a	6/73±0/026 ab	0/0216

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Effect of Treatments on Ammonia Concentration: Table4 highlights significant differences on the 90th day of the experiment, with a distinct positive reduction observed in the 3 and 5 treatments compared to the others.

Table 4. Effect of Aqueous Extract of Artemisia and Vitamin E on Ammonia Concentration in Rumen Fluid of Local Male Lambs (ppm) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
90	3/84±0/044 a	3/53±0/270 a	2/71±0/146 b	3/85±0/145 a	2/70±0/173 b	0/062±3/51* a	0/0004

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Artemisia serves as a valuable feed additive for ruminants, offering multiple benefits (4), particularly in enhancing rumen fermentation activity to optimize nutrient utilization. Vitamin E functions not only as an antioxidant but also plays a crucial role in stimulating the growth of cellulose-degrading bacteria in the rumen and promoting acid production. When animals consume concentrated feeds, especially grains rich in rapidly fermentable carbohydrates, the pH of rumen fluid declines, which suppresses bacterial activity, particularly that of cellulose-degrading bacteria (8).

The findings of this study align with those of (22), who observed improved rumen fermentation characteristics when Artemisia silage was used as a substitute for rice straw in sheep diets with low rumen pH. This substitution reduces the bio hydrogenation of polyunsaturated fatty acids (PUFAs) in the rumen and enhances the transfer of PUFAs, such as 18:3 and 18:2, from the diet to muscle tissues, ultimately increasing the concentration of beneficial fatty acids in bull muscles. On the other hand, (11) reported that supplementing lamb diets with Artemisia for 64 days resulted in a lower molar percentage of acetate and a higher proportion of propionate in the rumen fluid compared to the control group ($p<0.05$). However, other volatile fatty acids (VFAs), including butyrate, isobutyrate, total VFA, and pH levels, remained unchanged among the different experimental treatments.

Effect of Treatments on Total protein: Table 5 showed a significant superiority (P≤ 0.05) starting from the middle of the experiment on day 44, where Treatment 2 outperformed the others, followed by Treatments 4, 6, and 5, respectively, compared to the control group. On the final day of the experiment, all treatment groups showed a significant superiority compared to the control group.

Table 5. Effect of Aqueous Extract of Artemisia and Vitamin E on Total Blood Protein in Local Male Lambs (g/dl) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
zero	6/16±0/123*	6/07±0/084	6/41±0/303	6/07±0/109	6/39±0/202	6/16±0/247	N.S**
23	6/65±0/134	6/34±0/140	6/97±0/261	6/52±0/163	6/50±0/208	6/38±0/093	N.S
44	6/57±0/150 c	7/85±0/036 a	7/06±0/200 bc	7/45±0/154 ab	7/24±0/158 b	7/34±0/287 ab	0/001
65	6/39±0/125 c	7/86±0/050 a	7/44±0/145 b	6/51±0/095 c	7/43±0/096 b	7/51±0/204 ab	<.0001
90	6/17±0/058 c	7/91±0/025 a	7/32±0/162 b	7/11±0/258 b	7/38±0/206 b	7/11±0/140 b	<.0001

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Effect of Treatments on Albumin: The results of Table 6 showed no significant differences (P≥ 0.05) in albumin concentration among the treatment groups compared to the control group.

Table 6. Effect of Aqueous Extract of Artemisia and Vitamin E on Blood Albumin in Local Male Lambs (g/dl) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
zero	2/93±0/077	2/78±0/082	2/83±0/130	2/76±0/215	3/14±0/223	3/06±0/079	N.S
23	2/93±0/095	2/88±0/052	2/99±0/055	2/95±0/164	2/77±0/107	2/86±0/076	N.S
44	3/45±0/096	3/40±0/053	3/30±0/043	3/26±0/092	3/21±0/099	3/27±0/064	N.S
65	3/78±0/090	4/01±0/083	3/98±0/148	3/90±0/119	3/83±0/080	3/90±0/081	N.S
90	3/49±0/103	3/57±0/067	3/33±0/102	3/40±0/113	3/45±0/055	3/58±0/050	N.S

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Effect of Treatments on Globulin: Table 7 shows a significant difference (P≤ 0.05) starting from the middle of the experiment on day 44, continuing through day 65, and up to the end of the experiment on day 90. Treatment 2 showed the highest superiority, followed by the other treatments in sequence, compared to the control group.

Table 7. Effect of Aqueous Extract of Artemisia and Vitamin E on Blood Globulin in Local Male Lambs (g/dl) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
Zero	3/23±0/150*	3/29±0/116	3/57±0/293	3/31±0/124	3/25±0/322	3/09±0/253	N.S**
23	3/72±0/099	3/45±0/157	3/98±0/282	3/56±0/192	3/73±0/200	3/51±0/139	N.S
44	3/12±0/203 c	4/44±0/060 a	3/76±0/233 b	4/18±0/132 ab	4/02±0/152 ab	4/06±0/258 ab	٠.٠٠١٠
65	2/60±0/140 b	3/84±0/091 a	3/46±0/268 a	2/60±0/137 b	3/59±0/146 a	3/60±0/202 a	<.0001
90	2/7±0/124 c	4/34±0/054 a	3/99±0/181 ab	3/70±0/234 b	3/93±0/183 ab	3/52±0/145 b	<.0001

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

The superiority of the Artemisia treatment may be attributed to several mechanisms, including enhanced protein synthesis and production and overall animal health, achieved by stimulating hepatic cell activity and improving digestive efficiency, which in turn boosts protein output and allows better absorption of dietary proteins (5). Serum albumin contributes to the construction of various body tissues—especially immune cells, hormones, and others—so the absence of a rise in albumin concentration, one of the serum proteins, could be explained accordingly, as suggested by (16). Among the key functions of Artemisia extract is its stimulation of antibody production, leading to increased globulin levels in the blood (13). Vitamin E also plays an effective antioxidant role, promoting general health and improving metabolic functions, thereby enhancing protein synthesis and production while reducing oxidative stress that might otherwise negatively impact protein levels (18). (42) reported that changes in the concentrations of total protein, albumin, and globulin in the blood reflect the animal's health and metabolic status, as well as the quality of nutrition and environmental conditions; thus, these changes can serve as indicators of the animal's physiological state.

The results of the current study are consistent with those reported by (23), who found that infection of lambs with *H. contortus* larvae led to a decrease in total serum protein. However, a gradual increase in total protein was observed in animals treated with Artemisia after two weeks of supplementation, indicating an improvement due to the supplement and a reduction in worm burden on the animal's health. The findings also align with (11), who reported no changes in serum albumin levels when Artemisia extract was added at various levels to the diets of lambs and sheep in general.

Similarly, the results are in agreement with those of (18), who found that supplementing Vitamin E at doses of 200 and 400 mg/lamb/day for 60 days led to an increase in total protein. On the other hand, no changes in total serum protein were reported by (5 and 11); however, they noted a significant positive effect on globulin concentration when Artemisia extract was added at different levels to the diets of lambs and sheep. Similarly, no significant differences in total protein, albumin, or globulin were observed by (39) when Vitamin E was administered either by injection or in capsule form.

Effect of Treatments on Malondialdehyde (MDA): Table 8 shows a significant decrease in MDA concentration in the middle and at the end of the experiment, with a noticeable reduction observed in all five treatment groups—namely, Treatments 5 and 6 showing the greatest decrease, followed by Treatments 2, 3, and 4, respectively—compared to the control group.

Table 8. Effect of Aqueous Extract of Artemisia and Vitamin E on MDA Concentration in the Blood of Local Male Lambs (n mol/ml) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
zero	0/421±0/002*	0/429±0/007	0/431±0/005	0/425±0/004	0/423±0/002	0/41±0/001	N.S**
45	0/457±0/005 a	0/361±0/013 b	0/357±0/011 b	0/385±0/007 b	0/329±0/010 c	0/310±0/005 c	<.0001
90	0/508±0/008 a	0/264±0/006 bc	0/243±0/011 cd	0/268±0/006 b	0/228±0/006 de	0/213±0/002 e	<.0001

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15

mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

Effect of Treatments on Glutathione Peroxidase (GPx): The results of Table 9 showed a significant superiority (P≤ 0.05) in GPx concentration at the end of the experiment on day 90, with all five treatment groups showing higher levels compared to the control group. The order of superiority was as follows: Treatment 6, followed by Treatments 5, 3, 4, and then 2.

Table 9. Effect of Aqueous Extract of Artemisia and Vitamin E on GPx Enzyme Concentration in the Blood of Local Male Lambs (U/L) (Means ± Standard Error).

Days	Treatments						Morale level
	T1	T2	T3	T4	T5	T6	
zero	24/6±1/06*	24/9±0/992	24/±0/208	24/7±0/345	24/5±0/871	24/0±2/23	N.S**
45	24/7±0/939	26/0±0/733	26/1±0/847	26/4±0/82	27/2±0/243	27/0±0/916	N.S
90	15/5±0/233 e	17/4±0/063 d	18/6±0/184 c	18/9±0/063 c	19/6±0277 b	21/1±0/075 a	<.0001

* Values represent the mean ± standard error. ** N.S: Indicates no significant differences between treatments at a significance level of (P≤0.05). a, b, c: Different lowercase letters indicate significant differences between the experimental treatments. T1: Control (distilled water). T2: Artemisia extract (100 mg kg^{-1} live body weight). T3: Artemisia extract (200 mg kg^{-1} live body weight). T4: Vitamin E (15 mg kg^{-1} live body weight). T5: Combination of Artemisia extract + Vitamin E (100 + 15 mg kg^{-1} live body weight). T6: Combination of Artemisia extract + Vitamin E (200 + 15 mg kg^{-1} live body weight).

The superiority of the treatment groups in MDA and GPx levels compared to the control group may be attributed to the antioxidant activity of Artemisia essential oil and its extracts, which is likely due to its flavonoid components (such as rutin and quercetin), thymol, carvacrol, and other phenolic compounds (38). Additionally, Artemisia contains essential minerals—most notably iron, calcium, magnesium, and zinc—which help prevent and eliminate free radical reactions, thereby improving various bodily functions (17). Antioxidants stabilize these highly reactive free radicals, thus preserving the structural and functional integrity of cells. Furthermore, Vitamin E plays a crucial role in the cellular defense system against oxidation at both intracellular and extracellular levels. Alpha-tocopherol, in particular, is integrated into the cell membrane and protects lipids from oxidation, preventing their attack by reactive oxygen species and free radicals (7).

The results are consistent with the findings of (13), who reported that supplementing lamb diets with Artemisia at doses of 500, 1000, and 1500 mg/kg feed led to a significant increase ($p < 0.05$) in GPx levels and a decrease in MDA levels. In contrast, (28) observed no significant differences among treatment groups in GPx and MDA levels after using Artemisia as a feed additive for 75 days in lambs aged 3–4 months that had been experimentally infected with 5000 third-stage larvae.

Vitamin E, in synergy with selenium, functions as an antioxidant and strengthens the immune system. Together, they play a crucial role in protecting cell walls and cellular structures from oxidative damage (37). These compounds complement each other in providing antioxidant resistance and mitigating the effects of oxidative stress (27). Accordingly, the current findings align with those of (1), who found that oral administration of Vitamin E at a concentration of 75 mg/kg to rams subjected to transportation stress over three days resulted in significantly lower MDA levels in the Vitamin E group compared to the control group. In the control group, serum MDA rose from 2.13 ± 0.51 ng/ml in the first hour of transport to 2.43 ± 0.22 µg/ml by the eighth hour ($P < 0.05$).

Conclusion

Oral administration of Artemisia herba-alba aqueous extract, vitamin E, and their combination improved growth performance, rumen fermentation, and antioxidant status in lambs. These findings suggest their potential as natural alternatives to enhance lamb production and health, supporting sustainable livestock management

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Supplementary Materials
No Supplementary Materials.

Author Contributions
M. K. Aremmt: study concept, design analysis, and interpretation of results; T. R. Mohammed: data collection and draft manuscript preparation. Both authors reviewed the results and approved the final version of the manuscript.

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The authors declare no conflict of interest.

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مقالة أصيلة

تأثير إعطاء المستخلصات المائية لنبات الشيح الأبيض وفيتامين هـ على الأداء وبعض الصفات الفسيولوجية للكرش والدم في الحملان

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الخلاصة

هدفت الدراسة الى معرفة تأثير اعطاء المستخلص المائي لنبات الشيح الابيض وفيتامين هـ في بعض الصفات الفسلجية للحملان الذكرية المحلية، استعمل فيها ٣٠ حملاً ذكرياً محلياً وبأعمار تراوحت بين ٤ – ٤.٥ شهر وبمعدل وزن يتراوح ٢١.٣٥ كغم، قسمت الحملان عشوائياً الى ست مجاميع متساوية العدد وبواقع ٥ حملان للمجموعة الواحدة، تم تغذية الحملان على نفس العليقة. جرعت حملان المجموعة الأولى (T1) بالماء المقطر واعتبرت مجموعة السيطرة، وجرعت حملان المجموعة الثانية (T2) بالمستخلص المائي لنبات الشيح وبجرعة (١٠٠ ملغم كغم $^{-١}$ وزن حي يومياً)، وجرعت المجموعة الثالثة (T3) بالمستخلص المائي لنبات الشيح وبجرعة (٢٠٠ ملغم كغم $^{-١}$ وزن حي يومياً). اما المجموعة الرابعة (T4) فجرعت بفيتامين E وبجرعة (١٥ ملغم كغم $^{-١}$ وزن حي يومياً)، في حين جرعت المجموعة الخامسة (T5) بخليط من المستخلص المائي لنبات الشيح مع فيتامين E وبجرعة (١٠٠ ملغم + ١٥ ملغم كغم $^{-١}$ وزن حي يومياً)، اما المجموعة السادسة (T6) فجرعت بخليط من المستخلص المائي لنبات الشيح مع فيتامين E وبجرعة (٢٠٠ ملغم + ١٥ ملغم كغم $^{-١}$ وزن حي يومياً). أظهرت النتائج وجود تحسن معنوي في معاملات الشيح وفيتامين هـ ومزيجهما مقارنةً بمجموعة السيطرة، حيث لوحظ تحسن في صفات سائل الكرش ومستويات البروتين الكلي والغلوبيولين وإنزيم الجلوتاثيون بيروكسيداز، مع انخفاض مستوى المالوندايهايد. كما لم تُسجل فروق معنوية في مستوى الألبومين. وبذلك يمكن الاستنتاج أن الشيح الأبيض وفيتامين هـ، سواء منفردين أو مجتمعين، أظهرا تأثيرات فسيولوجية وأيضية إيجابية، مما يشير إلى إمكانية استخدامهما كإضافات علفية طبيعية للحملان.

كلمات مفتاحية: نبات الشيح، فيتامين هـ، وزن الحملان، سائل الكرش، الصفات الكيموحيوية.

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