Effect of Using Treated and Untreated Wild Reed with Fibrolytic Enzymes on Some Blood Parameters in Awassi Lambs

Abdulhamid .M. Mohammed1 ,Saleh .F.H 2 Noaman .A.I 3
3 ,2 ,1Department of Animal Production, College of Agriculture, Tikrit University, Salah Al-Din, Iraq
E-mail: abd.mu.mm336@st.tu.edu.iq ,falahhasan1984@tu.edu.iq ,Abdullah.noaman@tu.edu.iq

Abstract:
The experiment was conducted at the livestock field of Al-Ardh Al-Tayyiba Meat Processing Plant under the "Zorou'" brand located in the Dijla subdistrict, Samarra district. The study lasted 90 days, from December 9, 2023, to March 9, 2024, preceded by a 20-day adaptation period. A total of 20 local lambs, aged 3 to 4 months and with an initial average weight of 20.76 ± 0.95 kg, were purchased from local markets in Salah al-Din Province. The lambs were divided into four groups and fed a ration composed of 50% wild reed and 50% concentrate. Treatments varied according to the feeding regimen and enzyme addition:Group 1 received an untreated open ration,Group 2 received an enzyme-treated open ration,Group 3 was fed a restricted untreated ration at 3.5% of body weight, Group 4 received a restricted ration treated with enzymes.No significant differences were observed in hematological parameters (WBC, RBC, hemoglobin, hematocrit, MCV, MCH, MCHC) at 45 and 90 days. However, enzyme treatment had a significant effect on blood serum: Groups 2 and 4 showed a significant decrease in globulin levels compared to Group 1 in the first period, but not significantly different from Group 3. Albumin and total protein levels were not significantly affected during both periods.
Regarding the lipid profile (cholesterol, triglycerides, HDL, LDL, VLDL), no significant effects were noted during the first period. However, at 90 days, Groups 1, 2, and 4 showed significantly reduced cholesterol levels compared to Group 3. Triglycerides were significantly lower in Group 1 compared to Group 4, with no difference from Groups 2 and 3. LDL levels were significantly lower in Groups 2 and 4 than in Group 3. No significant differences were found for HDL and VLDL.
Creatinine levels were significantly lower in Groups 1, 2, and 3 compared to Group 4 at day 45. Urea and glucose showed no significant changes during the first period. At day 90, creatinine levels were lower in Groups 1 and 4 compared to Groups 2 and 3. Urea levels were significantly reduced in Groups 2, 3, and 4 compared to Group 1. Glucose levels remained statistically unaffected throughout the study.

Keywords:Wild reed , Awassi lambs , Fibrolytic enzymes

Introduction

The limitation of conventional feed resources in Iraq necessitates the search for alternative, non-traditional local feeds such as wild reed (Phragmites australis), in order to reduce feeding costs and improve the efficiency of available resources. However, the high crude fiber content of reed reduces its nutritive value, which requires processing methods to

ISSN 2072-3857

enhance its digestibility. One of the most effective approaches is the use of fibrolytic enzymes, which are exogenous enzymes added to lamb diets to improve fiber degradation and increase nutrient utilization [5]. Previous studies have indicated that such treatments contribute to better energy and protein utilization in ruminant diets [8].Among these, cellulase is considered one of the most important fibrolytic enzymes. It hydrolyzes the β-1,4-glycosidic bonds of cellulose polymers, converting them into simple sugars such as glucose. Its supplementation in lamb diets improves the utilization of plant fiber and enhances productive performance [5].Hematological and biochemical blood traits are important indicators for evaluating the physiological status of lambs. In the present study, the evaluated traits included hematological parameters (red blood cell count, white blood cell count, hemoglobin concentration, and packed cell volume) [2,8]; blood proteins (total protein, albumin, and globulin) [4,9]; lipid profile (cholesterol, triglycerides, high-density lipoproteins, and low-density lipoproteins) [7]; as well as indicators of kidney function (urea and creatinine) [7] and blood glucose concentration [8].Therefore, this study aimed to investigate the effect of adding fibrolytic enzymes to the diets of Awassi lambs containing wild reed, under two different feeding systems (restricted and ad libitum), through the evaluation of these physiological and biochemical parameters in order to clarify the nutritional and health effects of such treatment.

Materials and Methods

Experimental Animals

This study was conducted at the animal field of Al-Ardh Al-Tayyiba Meat Products Factory (Zuroo') located in the Samum area, Salah al-Din Governorate, Samarra District. The experiment lasted 90 days, from November 19, 2023, to March 29, 2024. A total of 20 local Iraqi lambs were used, purchased from local markets in Samarra City at an average age of 3.5 months. The lambs were fed a basal diet for 20 days prior to the experiment (Table 1) as an adaptation period. They were weighed for two consecutive days using a digital livestock scale, with an average initial body weight of 19.27±0.54 kg.

The animals were then individually tagged with plastic ear tags and divided into four groups based on body weight, with five lambs per group. The animals were housed in individual pens. The first and second groups were fed ad libitum (the first group received untreated feed, the second group received enzyme-treated feed). The third and fourth groups were fed a restricted diet at 3.5% of body weight (the third group received untreated feed, the fourth group received enzyme-treated feed.(

.1 Feeding Management

The lambs were fed a pelleted, complete diet composed of 50% reed and 50% concentrate (Table 1). The first and second treatments were fed ad libitum, with the second treatment receiving exogenous fibrolytic enzymes. The third and fourth treatments were fed at a level of 3.5% of body weight, with the enzyme added only to the fourth treatment.

Feed was offered in two meals per day (morning and evening), and both feed offered and leftovers were recorded daily throughout the trial. Table 2 shows the chemical composition of the feed ingredients. The enzyme was added at 3.0% of dry matter weight (i.e., 3 kg of enzyme per 1000 kg of feed), mixed with the concentrate using a feed mixer to ensure homogeneity. The mixture

was then pelleted using a feed press, dried using a moisture dryer, and packed in sacks.

Table 1. Composition of the experimental concentrate diet:(%)

Feed ingredient	Inclusion rate (%)
Barley	53%
Wheat bran	15%
Wheat	15%
Yellow corn	15%
Salt	1%
Vitamin-mineral premix	1%

Table 2. Chemical composition of the diet ingredients:(%)

Ingredient	Dry Matter)	Crude Protein	Ether Extract	Crude Fiber	Ash	Soluble Carbohydrates	*Metabolized Energy (MJ/kcal)
Barley	92.85	10.72	1.42	6.5	3.82	70.39	11.91
Wheat bran	90.42	15.86	4.05	10.63	4.99	54.89	11.80
Yellow corn	89.02	9.03	1.28	2.01	2.33	71.48	11.59
Wild reed	33.08	12.25	3.27	22.80	11.56	50.12	10.65

*Metabolizable Energy (MJ/kg) = (CP × 0.012) + (CF × 0.005) + (EE × 0.031) + (Sol. CHO × 0.014( )(

Chemical Analysis of Diets

The chemical analysis of feed components was carried out in the nutrition laboratory of the Department of Animal Production, College of Agriculture, University of Tikrit.

Veterinary Health Program

All lambs were subjected to a veterinary care program that included dosing and vaccinations throughout the experimental period. Dosing was performed in the morning before feed was offered, which was given two hours later, following the schedule shown in Table 3.

Table 3. Veterinary health care program.

No.	**Dose or Vaccine Name**	Method	**Quantity (ml)**	**Number of doses**	Treatment
1	**Oxytocin**	Injection	**3**	**1**	Antibiotic
2	**Ivarmictine**	Injection	**1**	**1**	External parasites
3	**Bendazole**	Dosage	**5**	**2**	Stomach and intestinal worms
4	**Co-Baghdad**	Injection	**1**	**1**	Anti-intestinal poisoning
5	**Levamizole**	**Dosage**	**6**	**1**	Lungworms

ISSN 2072-3857

.2 Blood Sampling

Blood samples were collected at mid-trial (January 27, 2024) and at the end (March 27, 2024). Feed was withdrawn 12 hours before sampling. Blood was collected from the jugular vein using 5 ml syringes. Two ml were transferred into sterile tubes containing EDTA (Ethylene Diamine Tetraacetic Acid) for hematological analyses, while the rest was placed in serum separator tubes. Samples were transported to the laboratory, where serum was separated and stored at −18°C until biochemical analyses were performed.

.3 Hematological Analyses

The following physical blood parameters were measured using a Mindray MR 3200 automated hematology analyzer:

Packed Cell Volume (PCV(

Hemoglobin concentration (Hb(

Total Red Blood Cell Count (RBC(

Total White Blood Cell Count (WBC(

Biochemical Analyses of Blood Serum

Total Protein: Determined using the Biuret method with commercial kits (Biomérieux, France), absorbance was measured at 550 nm[8[

Albumin: Determined using bromocresol green method with Biolabo kits, absorbance was read at 630 nm[2.[

Globulin: Calculated by subtracting albumin from total protein[4.[

Triglycerides: Measured enzymatically using Biolabo kits, absorbance read at 500 nm[9.[

Glucose: Determined using Biosystem kits, absorbance read at 500 nm.

Urea and Creatinine:

Conducted using Cobas 6000 auto-analyzer (Japan) with specific commercial kits.

Urea: Determined by the Wootton method (1974) [7], absorbance measured at 600 nm.

Creatinine: Measured using Randox kits following the method of Schirmeister[4[

Statistical Analysis

Data were statistically analyzed using SAS software (2012) under a 2×2 factorial arrangement in a completely randomized design (CRD) to evaluate the effects of feeding system and enzyme treatment. Duncan's Multiple Range Test was used to detect significant differences between means at $P \leq 0.05$[7[

Statistical model:

Where:

:Observed value for the ith feeding system and jth enzyme treatment.

:Overall mean.

:Effect of the ith feeding system.

:Effect of the jth enzyme treatment.

:Interaction effect.

:Random error assumed to be normally distributed with mean zero and variance.

.4 Results and Discussion

Effect of Feeding System and Fibrolytic Enzyme Treatment on Hematological Parameters of Local Lambs

Table 4 shows that the experimental treatments had no significant effect ($P>0.05$) on the physical blood parameters during the experimental periods. All values remained within the normal physiological range for lambs.

This could be attributed to the relatively high levels of iron and copper in reed, which might be more bioavailable in silage or fresh form compared to hay[8.[

ISSN 2072-3857

Table 4. Effect of Feeding System and Fibrolytic Enzyme Treatment on Hematological Parameters of Local Lambs (Mean ± SE(

Factors	Treatments	WBC (×10³/µL)	RBC (×10⁶ / µL)	HGB (g/dL)	HCT (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)
	After 45 Days							
Feeding System: Ad libitum	T1	12.28 ± 0.92[a]	10.09 ± 0.36[a]	12.15 ± 0.45[a]	35.32 ± 1.38[a]	34.95 ± 0.21[a]	12.11 ± 0.47[a]	34.62 ± 1.25[a]
Feeding System: Restricted	T2	11.45 ± 0.75[a]	9.57 ± 0.61[a]	11.05 ± 0.15[a]	32.90 ± 2.13[a]	34.35 ± 0.17[a]	11.87 ± 0.60[a]	34.59 ± 1.80[a]
Without Enzyme	E1	10.94 ± 0.88[a]	9.22 ± 0.32[a]	11.56 ± 0.32[a]	31.90 ± 1.26[a]	34.52 ± 0.18[a]	12.58 ± 0.32[a]	36.48 ± 0.99[a]
With Enzyme	E2	12.79 ± 0.71[a]	10.44 ± 0.58[a]	11.64 ± 0.43[a]	36.32 ± 2.01[a]	34.78 ± 0.23[a]	11.40 ± 0.63[a]	32.74 ± 1.74[a]
	T1 * E1	10.89 ± 1.14[a]	9.55 ± 0.39[a]	11.88 ± 0.61[a]	33.22 ± 1.58[a]	34.75 ± 0.29[a]	12.44 ± 0.43[a]	35.79 ± 1.11[a]
	T1 * E2	13.66 ± 1.27[a]	10.64 ± 0.55[a]	12.42 ± 0.71[a]	37.42 ± 1.96[a]	35.16 ± 0.29[a]	11.78 ± 0.87[a]	33.46 ± 2.27[a]
	T2 * E1	10.98 ± 1.47[a]	8.90 ± 0.51[a]	11.24 ± 0.20[a]	30.58 ± 1.96[a]	34.29 ± 0.21[a]	12.73 ± 0.52[a]	37.18 ± 1.73[a]
	T2 * E2	11.91 ± 0.54[a]	10.24 ± 1.11[a]	10.86 ± 0.21[a]	35.22 ± 3.72[a]	34.40 ± 0.29[a]	11.02 ± 0.98[a]	32.01 ± 2.87[a]
Significance		NS	NS	NS	NS	NS	NS	
	After 90 Days							
Feeding System: Ad libitum	T1	a0.84± 9.08	a0.16± 8.90	a 0.28± 11.03	a0.66± 30.67	a0.16± 34.43	a 0.25± 12.40	a 0.70± 36.00
Feeding System: Restricted	T2	a1.25± 12.51	a0.28± 8.89	a 0.23± 11.13	a1.00± 30.29	a0.31± 34.07	a 0.45± 12.63	a 1.19± 37.03
Without Enzyme	E1	a0.63± 9.15	a0.18± 8.85	a 0.13± 11.07	a0.58± 30.10	a0.29± 34.03	a 0.33± 12.56	a 0.83± 36.89
With	E2	a1.39±	a0.27±	a	a1.03±	a0.19±	a	a

ISSN 2072-3857

Enzyme		12.45	8.94	0.34± 11.10	30.86	34.48	0.41± 12.47	1.12± 36.14
	T1 * E1	a1.17± 8.59	a0.09± 9.12	a 0.05± 11.29	a0.32± 31.48	a0.02± 34.51	a 0.17± 12.38	a 0.51± 35.88
	T1 * E2	a1.32± 9.57	a0.28± 8.68	a 0.58± 10.78	a1.23± 29.86	a0.33± 34.36	a 0.52± 12.42	a 1.39± 36.13
	T2 * E1	a0.54± 9.70	a0.32± 8.58	a 0.24± 10.85	a0.70± 28.72	a0.51± 33.54	a 0.67± 12.74	a 1.53± 37.90
	T2 * E2	a1.69± 15.32	a0.46± 9.20	a 0.37± 11.42	a1.68± 31.86	a0.22± 34.60	a 0.69± 12.52	a 1.93± 36.16
	Significance		NS	NS	NS	NS	NS	NS

<NS = Not Significant at P≤0.05.

Different superscript letters within a row indicate significant differences at P≤0.05.
Total experimental units = 20 (5 lambs per treatment.(

Effect of Feeding System and Fibrolytic Enzyme Treatment on Serum Proteins of Local Lambs

As shown in Table 5, after 45 days of treatment, there were no significant effects (P>0.05) of feeding system, enzyme treatment, or their interaction on the concentrations of albumin and total serum protein. However, globulin concentration was significantly affected by enzyme treatment, where lower values were observed in enzyme-treated groups (E2) compared to untreated groups (E1). Also, specific interactions such as T1E2 and T2E2 showed lower globulin levels than T1*E1.

After 90 days, no significant differences (P>0.05) were observed in total protein, albumin, or globulin concentrations among all treatments. This suggests that the enzyme-supplemented complete diets provided nutrients exceeding the recommended requirements without negatively affecting plasma protein profile and maintained normal liver and kidney function.

ISSN 2072-3857

Table 5. Effect of Feeding System and Fibrolytic Enzyme Treatment on Serum Proteins of Local Lambs (Mean ± SE(

factors	treatments	Serum proteins (g/dL)		
		Total protein	Albumin	globulin
		After 45 days of the transaction		
Open feeding system	T1	6.74 ± 0.13a	3.38 ± 0.07a	3.36 ± 0.11a
3.5% specific feed	T2	6.55 ± 0.22a	3.42 ± 0.08a	3.12 ± 0.16a
Non-enzyme-treated feed	E 1	6.88 ± 0.13a	3.43 ± 0.06a	3.44 ± 0.13a
Enzyme-treated feed	E2	6.41 ± 0.20a	3.37 ± 0.09a	3.04 ± 0.13b
Open feeding system not	T 1*E1	7.02 ± 0.09a	3.36 ± 0.08a	3.66 ± 0.05a
Open feeding system treated	T 1*E2	6.46 ± 0.19a	3.40 ± 0.13a	3.06 ± 0.12b
Specified feeding	T2*E1	6.74 ± 0.25a	3.51 ± 0.09a	3.23 ± 0.23ab
Specified feeding	T2*E2	6.36 ± 0.38a	3.34 ± 0.15a	3.02 ± 0.25b
significant		NS	NS	*
factors	treatments	After 90 days of treatment		
Open feeding	T1	7.47 ± 0.28a	2.73 ± 0.05a	4.73 ± 0.28a
3.5% specific	T2	7.40 ± 0.24a	2.65 ± 0.04a	4.75 ± 0.24a
Non-enzyme-	E 1	7.35 ± 0.22a	2.73 ± 0.02a	4.64 ± 0.22a
Enzyme-treated	E2	7.52 ± 0.30a	2.65 ± 0.06a	4.87 ± 0.30a
Open feeding	T 1*E1	7.43 ± 0.36a	2.82 ± 0.00a	4.61 ± 0.36a
Open feeding	T 1*E2	7.51 ± 0.49a	2.65 ± 0.10a	4.86 ± 0.48a
Specified feeding system	T2*E1	7.27 ± 0.30a	2.64 ± 0.00a	4.62 ± 0.30a
Specified feeding	T2*E2	7.54 ± 0.41a	2.66 ± 0.10a	4.88 ± 0.48a
significant		NS	NS	NS

* <

NS = Not Significant; * = Significant at P≤0.05.

ISSN 2072-3857

Different superscript letters within the same column indicate significant differences at P≤0.05.

Total experimental units = 20 (5 per treatment.(

Effect of Feeding System and Fibrolytic Enzyme Treatment on Blood Lipid Profile of Local Lambs

As shown in Table 6, after 45 days of treatment, no significant differences (P>0.05) were observed in cholesterol, HDL, LDL, or VLDL levels among all treatments. However, triglyceride levels were significantly affected (P≤0.05), with the interaction group T1E2 recording the highest triglyceride concentration compared to T1E1.

After 90 days, the type of feeding system (ad libitum vs. restricted) had no significant effect on any lipid parameter. However, enzyme treatment significantly reduced cholesterol and LDL levels, while no significant effects were noted on HDL, VLDL, or triglycerides.

Additionally, specific interactions (T2E2 and T1E1) showed significantly lower cholesterol and LDL concentrations. This decrease in some lipid parameters, such as cholesterol, triglycerides, and LDL, may be attributed to the high fiber content in the reed-based diets, leading to increased utilization of lipids as an energy source, thereby reducing their levels in the blood.

Table 6. Effect of Feeding System and Fibrolytic Enzyme Treatment on Serum Lipid Profile of Local Lambs (mg/dL, Mean ± SE(

factors	treatments	Serum lipids (mg/dL(				
		TRI	CHOLES	HDL	LDL	VLDL
		After 45 days of treatments				
Open feeding system	T1	54.20±2.32a	45.97±2.59a	30.60±0.60a	9.70±2.10a	11.10±0.34a
3.5% specific feed	T2	56.10±2.22a	41.60±1.34a	30.20±0.55a	4.50±0.80b	10.90±0.45a
Non-enzyme-treated feed	E 1	52.30±2.04a	42.17±1.76a	29.90±0.54a	7.70±0.98a	10.70±0.36a
Enzyme-treated feed	E2	58.00±2.13a	45.40±2.42a	30.90±0.56a	6.50±2.34a	11.30±0.42a
Open feeding system not treated with enzymes	T 1*E1	48.60±1.01b	42.95±2.70a	30.60±0.74a	9.60±1.91a	10.60±0.40a
Open feeding system treated with enzymes	T 1*E2	59.80±2.76a	49.00±4.27a	30.60±1.02a	9.80±4.36a	11.60±0.50a
Specified feeding system not treated with enzymes	T2*E1	56.00±3.31ab	41.40±2.52a	29.20±0.73a	.5.80 ±1.30a	10.80±0.66a
Specified feeding system treated with enzymes	T2*E2	56.20±3.36ab	41.80±1.31a	31.20±0.85a	3.20±0.58a	11.00±0.70a
significant		*	NS	NS	NS	NS

ISSN 2072-3857

		After 90 days of treatments				
Open feeding system	T1	39.70±2.59a	71.50±1.94a	25.50±0.80a	36.40±1.83a	7.70±0.55a
3.5% specific feed	T2	45.80±1.65a	75.40±4.50a	24.50±0.92a	40.20±4.22a	8.70±0.38a
Non-enzyme-treated feed	E 1	40.90±1.73a	78.40±2.23a	75.50±0.76a	45.10±1.95a	7.80±0.31a
Enzyme-treated feed	E2	44.60±2.78a	68.50±3.80b	24.50±0.95a	32.50±3.13b	8.60±0.61a
Open feeding system not treated with enzymes	T 1*E1	36.20±1.45b	72.00±1.04b	24.80±1.14a	40.20±2.17ab	7.00±0.31a
Open feeding system treated with enzymes	T 1*E2	43.20±4.69ab	71.00±3.97b	26.20±1.15a	32.60±1.80b	8.40±1.02a
Specified feeding system not treated with enzymes	T2*E1	45.60±0.67ab	84.80±0.96a	26.20±1.01a	50.00±0.68a	8.60±0.18a
Specified feeding system treated with enzymes	T2*E2	46.00±3.43a	66.00±6.78 b	22.80±0.15a	32.40±6.40b	8.80±0.80a
significant		*	*	NS	*	NS

* <NS = Not Significant; * = Significant at P≤0.05.

Different superscript letters within the same column indicate significant differences at P≤0.05.

Total experimental units = 20 (5 per treatment.(

Effect of Feeding System and Fibrolytic Enzyme Treatment on Kidney Function and Blood Glucose Levels

As presented in Table 7, after 45 days of treatment, there were no significant differences (P>0.05) among treatments in blood glucose or urea levels. However, creatinine concentration was significantly lower (P≤0.05) in T1E1 compared to T2E2.

After 90 days, a significant decrease (P≤0.05) in urea levels was observed in treatments T2, T3, and T4 compared to T1. Also, creatinine levels were significantly lower (P≤0.05) in T1 and T4 compared to T2 and T3. No significant differences were found in blood glucose levels throughout the entire experiment.

The observed reduction in urea and creatinine in enzyme-treated lambs, especially under restricted feeding, may indicate better protein utilization and metabolic efficiency, reducing renal workload and improving physiological status.

ISSN 2072-3857

Table 7. Effect of Feeding System and Fibrolytic Enzyme Treatment on Blood Glucose and Kidney Function (mg/dL, Mean ± SE(

factors	treatments	traits		
		Glucose mg/dL	Urea mg/dL	Creatinine mg/dL
		After 45 days of treatments		
Open feeding	T1	a3.00± 63.50	a1.21± 16.62	a0.07± 0.90
3.5% specific	T2	a2.61± 67.60	a0.80± 18.46	a0.09± 1.14
Non-enzyme-	E 1	a2.08± 62.00	a0.79± 16.99	a0.05± 0.91
Enzyme-treated feed	E2	a3.10± 69.10	a1.26± 18.10	a0.10± 1.13
Open feeding	T 1*E1	a0.83± 58.00	a1.31± 15.65	b 0.04± 0.83
Open feeding	T 1*E2	a4.96± 69.00	a2.11± 17.60	b a0.14± 0.98
Specified feeding	T2*E1	a3.30± 66.00	a0.48± 18.32	b a0.08± 1.00
Specified feeding	T2*E2	a4.30 ± 69.20	a1.63± 18.60	a0.14± 1.28
significant		NS	NS	*
factors	treatments	After 90 days of treatments		
Open feeding	T1	a3.92± 108.80	a0.76± 14.60	a0.08± 1.02
3.5% specific	T2	a5.40± 97.63	a0.65± 12.66	a0.09± 1.03
Non-enzyme-treated feed	E 1	a4.57± 99.63	a0.47± 14.66	a0.08± 1.03
Enzyme-	E2	a5.27± 106.80	b0.87± 12.60	a0.09± 1.02
Open feeding	T 1*E1	a5.79± 105.00	a0.31± 16.00	b0.09± 0.83
Open feeding	T 1*E2	a5.34± 112.60	b a1.24± 13.20	a0.09± 1.18
Specified feeding	T2*E1	a6.78± 94.26	b a0.18± 13.32	a0.08± 1.20
Specified feeding	T2*E2	a8.92± 101.00	b1.30± 12.00	b a0.14± 0.86
significant		NS	*	*

<NS = Not Significant at P≤0.05.

ISSN 2072-3857

Conclusions

The results of this study indicate that the inclusion of enzyme-treated wild reed in the diets of lambs did not cause any significant changes in the evaluated hematological parameters, including red and white blood cell counts and hemoglobin concentration. This confirms the physiological safety of using treated reed in lamb nutrition.

On the other hand, some indicators of the blood lipid profile showed significant decreases, particularly total cholesterol, triglycerides, and low-density lipoprotein)LDL), reflecting improvements in lipid metabolism and general animal health.

Moreover, lambs fed diets containing enzyme-treated wild reed exhibited significant reductions in blood urea and creatinine levels, suggesting enhanced efficiency in protein utilization and reduced degradation products. This indicates a lowered metabolic burden on the kidneys and improved overall physiological condition

.

References

[1] Ahmed, M. E., Shehata, E. I., Ammou, F. F. A., Khalifa, E. I., & El-Zolaky, O. A. (2009). Productive and reproductive performance of Rahmani sheep fed rations containing reed forage (Arundo donax, L.) either fresh, hay or silage.

[2] Bishop, M. L., Dube-Engerlik, J. L., & Fody, E. P. (2000). Clinical Chemistry: Principles, Correlations, and Procedures (4th ed.). Philadelphia: Lippincott Williams & Wilkins.

[3] Duncan, D. B. (1955). Multiple Range and Multiple F Test. Biometrics, 11, 1–42.

[4] Fossati, P., & Prencipe, L. (1982). Serum triglycerides determination colorimetrically with an enzyme that produces hydrogen peroxide. Clinical Chemistry, 28, 2077–2085.

[5] Lynd LR, Weimer PJ, van Zyl WH, Pretorius IS. Microbial cellulose utilization: fundamentals and biotechnology. Microbiol Mol Biol Rev. 2002;66(3):506–577.

[6] MAFF. (1975). Ministry of Agriculture, Fisheries and Food Department of Agriculture and Fisheries for Scootland . Energy allowance feeding system for ruminanats . Technical Bulletin 33.

[7] Schirmeister, J., Willmann, H., & Kiefer, H. (1964). Clinical determination of creatinine. Klinische Wochenschrift, 42(7), 268–270.

[8] Tietz, N. W. (1986). Textbook of Clinical Biochemistry. W.B. Saunders Co., Philadelphia, USA, p. 135.

[9] Wootton, I. D. P. (1974). Microanalysis in Medical Biochemistry (5th ed.). Willmer Brothers Ltd., UK

.

ISSN 2072-3857