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The Role of Sumac Powder in Enhancing Physiological Parameters in Awassi Lambs

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ABSTRACT

The objective of the study was to know biological effect for the Sumac powder in the diets of Awassi lambs. A total of 24 Awassi lambs (12 male and 12 female) were used (age 3-4 months) (16.5±1.5g male and 20±2.5 g female) and divided to four groups (6 animals / 3 replicated). The experimental animals were fed into four individually in case (2.5*1.5 cm). Group 1 were fed on a diet without adding 0 % (control); groups 2, 3 and 4 were fed 1, 3 and 5% sumac powder. The results showed indicate that adding Sumac powder to the feed significant differences between the groups in both AST and ALT. There were not significant between the groups in creatinine, urea, total protein, albumin, and globulin levels in the blood serum of the animals compared to the control group. Our results suggested that the sumac could be used in the animal food without any effect on their health.

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دور مسحوق السماق في تحسين بعض الصفات الفسيولوجية في الحملان العواسية

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INTROUCTION

Rhus coriaria plant, has garnered attention for its potential health benefits and applications in various fields, including nutrition and pharmacology (Jamir & Sibian, 2023). Sumac is increasingly used in food science, exemplified by its incorporation into gummy candies, which received high sensory ratings for taste and texture (Jamir & Sibian, 2023). Despite these benefits, some studies suggest that sumac may not significantly impact measures like body weight (Nouri *et al*., 2023). The chemical composition of sumac powder, reveals a rich profile of bioactive compounds and nutrients. This composition contributes to its culinary and medicinal applications, and the contains significant amounts of carbohydrates (approximately 66.05%), moisture (32.61%), and minimal levels of fat (0.52%) and protein (0.52%)(Jamir & Sibian, 2023), and it is a source of dietary fibers, which are essential for digestive health(Nagib, 2017).

Sumac is rich in phenolic compounds, including gallic acid and its derivatives, which are linked to various health benefits such as antioxidant and anti-inflammatory properties(Grassia *et al*., 2021; Khaled *et al*., 2023), flavonoids, particularly quercetin and myricetin, enhances its therapeutic potential (Grassia *et al*., 2021). Khaled *et al* (2023) a showed sumac exhibits strong antioxidant properties, making it beneficial for combating oxidative stress (Khaled *et al*., 2023). On another hands, some studies indicate that sumac powder can help reduce cholesterol levels, supporting cardiovascular health (Nagib, 2017). A study demonstrated that lambs receiving a diet supplemented with 3% sumac powder exhibited significant improvements in wool traits, including staple length and clean wool weight (Al-Saadi, 2023).

The combination of sumac and exogenous fibrolytic enzymes further amplified these benefits, highlighting its role as an effective appetite stimulant (Al-Saadi, 2023). Increasing levels of sumac powder in lamb diets led to improved digestibility of nutrients, with organic matter digestibility reaching up to 84.50% at 5% sumac inclusion (Hussein *et al*., 2022). Enhanced feed conversion ratios were also observed, indicating better nutrient utilization(Hussein *et al*.,

2022).Sumac supplementation positively influenced blood parameters, including hemoglobin and red blood cell counts (Hadi & Al-Saadi, 2024). While the benefits of sumac powder are evident, Hussein *et al*., (2022) indicate that the effects on growth rates may not be as pronounced, suggesting that further research is needed to optimize its use in lamb nutrition. The aim of this study to role of the sumac as a medical plants added to the Awassi lambs diet and affected to the some physiological parameters.

MATERIAL AND METHODS

The current study's procedures were carried out in conformity with the guidelines of the Ethics Research Committee of the College of Agriculture, Tikrit University.

Twelve female Awassi lambs were used in this research, with ages ranging between (3-4) months approximately, and they were purchased from the local market. The research was conducted in the (Sumum) area of the Samarra city. The lambs were placed inside a large closed hall with a paved floor and divided into several pens of 4 * 10 meters in size. One of them was exploited and inside it was placed cages measuring 2.5 * 1.5 by 12 cages where the feeding was individual and each cage was equipped with a feeder. And a bowl to drink water. After purchasing the animals and transporting them to the fields, they were placed under observation for a period of ten days, in order to ensure that they were free of diseases, and were included in a health and preventive program for many common diseases in the region. Four rations were used in this research as shown in Table 1. The first ration included barley, wheat bran and soybean meal. In this diet, needs were taken into account.

Table 1. Experiment diet ingredients and percentage of use (A) Male (B) Female

Ingredients (%)	Treatments (A)				Treatments (B)			
	C-non	S_1	S_2	S_4	S_1	S_2	S_4	S_1
Barley	40	40	40	39	40	40	40	40
Wheat bran	39	40	40	39	40	40	40	39
Soybean meal (SBM)	10	10	11	11	9	8	7	7
Corn	10	8	5	5	10	10	9	8
Sumac	0	1	3	5	0	1	3	5
Min. & Vit. Mixture	1	1	1	1	1	1	1	1

C-non: control; S_1 , S_2 and S_3:Datie with 1,2 and 3 % sumac powder

Hematology parameters

Blood samples (20 ml) were collected from the animals' jugular veins from all lambs, blood was collected into two different types of vacutainer collecting tubes: one type was coated with ethylene diamine tetra acetic acid (EDTA) as an anticoagulant for evaluating the hematological parameters, and the other type was plain vacutainer tubes for separating serum to measure the parameters, separate serum samples were kept at -20°C pending further examination. Total protein was determined calorimetrically using the Biuret method as described by Yousef *et al*.,(2006); Albumin was determined calorimetrically by the method described by Doumas *et al*.,(1971); Globulin was determined by subtracting albumin from total protein; ALT and AST were determined by White *et al*.,(1970). Blood urea concentration was estimated by Nessler's reaction (Tanis and Naylor, 1968).

Statistical analysis

The SAS appropriate statistical program was used to do a one-way ANOVA on the data (SAS, 2005). The Duncan significant differences (Duncan, 1953) approach was used to find the variance in the mean ($P \leq 0.05$).

RESULTS AND DISSCUSION

The results of the statistical analysis in table (2) indicate that adding Sumac powder to the feed recorded significant differences between the groups in both AST and ALT. It is noted that the Sumac powder additions recorded an increase in the AST level compared to the control group. On the other hand, it is noted that the second group recorded the highest level of ALT compared to S_1 group, while no significant differences were recorded between it and the C-non (control) and S_3 group (table 2)**.**

Table 2: Effect of the Sumac powder in the diets of ALT and AST in Awassi lambs

Groups	Parameters	
	AST (mg/dL)	**ALT(mg/dL)**
C-non	8.50 ± 1.44 b	34.50 ± 0.32 ab
S_1	13.25 ± 4.97 a	38.00 ± 0.24 a
S_2	13.00 ± 1.47 a	32.50 ± 0.49 b
S_3	14.00 ± 2.79 a	34.25 ± 0.94 ab

C-non: control; S_1 , S_2 and S_3:Datie with 1,2 and 3 % sumac powder

The results of the statistical analysis in table (3) indicate that adding Sumac powder to the feed recorded non-significant differences between the groups in creatinine and urea levels in the blood serum of the animals compared to the control group.

Table 3: Effect of the Sumac powder in the diets of Creatinine and Urea in Awassi lambs

Groups	Parameters	
	Creatinine (mg/dL)	**Urea (mg/dL)**
C-non	0.99 ± 0.03 a	41.65 ± 5.92 a
S_1	1.09 ± 0.10 a	52.78 ± 7.16 a
S_2	1.07 ± 0.04 a	43.64 ± 4.70 a
S_3	0.97 ± 0.03 a	51.33 ± 4.43 a

C-non: control; S_1 , S_2 and S_3:Datie with 1,2 and 3 % sumac powder

On another hands, the results in table (4) showed non-significant differences between the groups in total protein, albumin, and globulin levels in the blood serum of the animals compared to the control group.

Table 4: Effect of the Sumac powder in the diets of total protein, albumin, globulin, and ALB/GLU in Awassi lambs

Groups	Parameters			
	Total Protein (g/dL)	**Albumin (g/dL)**	**Globulin (g/dL)**	**ALB/GLU**
C-non	6.59 ± 0.13	3.12 ± 0.31	3.47 ± 0.32	0.95 ± 0.21
S_1	6.56 ± 0.11	2.21 ± 0.31	4.35 ± 0.24	0.52 ± 0.10
S_2	7.19 ± 0.22	2.55 ± 0.59	4.63 ± 0.49	0.61 ± 0.18
S_3	6.80 ± 0.27	2.99 ± 0.65	3.80 ± 0.90	0.99 ± 0.31

C-non: control; S_1 , S_2 and S_3:Datie with 1,2 and 3 % sumac powder

Our results showed that sumac powder effect to the liver enzyme, and one of the primary factors may be the antioxidant properties of Sumac, which is rich in phenolic compounds and flavonoids known to mitigate oxidative stress in the liver (Chung *et al*., 2012). Reducing oxidative stress can improve liver function, which may lead to changes in enzyme levels (Liu et al., 2018). Sumac's antioxidant properties are impressive, but its anti-inflammatory effects are also important. Research suggests that the bioactive compounds in sumac can help reduce inflammation, a condition often associated with high liver enzyme levels (Muhaimeed et al., 2021). By reducing inflammation in the liver, sumac may positively impact liver enzyme activity, supporting its role in promoting liver health. In addition, the nutritional composition of sumac is important. A variety of bioactive compounds can influence metabolic processes in animals, leading to changes in enzyme activity (Khan et al., 2018). Dietary changes can significantly impact nutrient absorption and metabolism, which may indirectly impact liver enzyme levels (Hajialyani et al., 2019). Furthermore, sumac may help promote healthy gut microbiota, which is crucial for healthy liver function through gut-liver communication. A balanced gut microbiome is associated with improved metabolism and overall liver health, which may explain the observed changes in AST

and ALT levels (Lau et al., 2021). One possible reason for the results in this study is that the concentrations of sumac powder used (1%, 3%, and 5%) may not have been high enough to significantly impact protein synthesis or metabolism. Previous studies suggest that dietary changes often need to exceed a certain level to meaningfully impact protein levels (Tieland et al., 2017). Additionally, the proteins in the animals' diets may have been sufficient to meet their physiological needs, which may have masked any effects from sumac. It is also worth noting that sumac is primarily known for its antioxidant and anti-inflammatory benefits rather than its effects on protein metabolism. While its bioactive components may support liver health, they may not directly impact pathways involved in the synthesis or degradation of serum proteins (Khan et al., 2020; Kamil et al., 2021). This means that while sumac may enhance liver function, it does not necessarily lead to changes in total protein levels or its various fractions in the bloodstream. Furthermore, the physiological state of the animals could also be a factor. Since the lambs in this study were young and relatively healthy, their protein metabolism may have been stable and less affected by feed additives. Factors such as age and health status can significantly influence protein metabolism and serum protein synthesis (Hajialyani et al., 2019; Hussein et al., 2022). Finally, it is important to consider that the balance of different nutritional components can affect protein levels. The overall composition of the diet, including other feed components, may have mitigated any potential effects of sumac on protein metabolism (Portugal et al., 2021).

CONCLUSION

This study revealing significant findings regarding on liver enzymes, no significant changes were observed in other important blood parameters compared to the control group. Sumac powder shows promise as a beneficial dietary supplement in lamb nutrition, warranting further investigation into its long-term effects and potential benefits

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CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

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