EFFECT OF DIETARY SUMAC AND FIBROLYTIC ENZYMES ON SOME PRODUCTIVE AND HAEMATOLOGICAL TRAITS OF LAMBS

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ABSTRACT

The research was conducted at the Animal Farm of the University of Baghdad's College of Veterinary Medicine to assess the effect of dietary grind seeds of Sumac and Exogenous Fibrolytic Enzymes(EFE) on some productive and haematological traits of Awassi male lambs from the period 1/2/2021 to 1/6/2021. Twenty-four Awassi male lambs with 3-4 months of age, and divided into four groups based on body weight . Dietary treatments were as following: G1 (control) equal nourished concentrate diet at the rate of 2.5% body weight (B.W) with alfalfa hay daily, G2 was fed on the similar diet as control group and was given 15g/head dried grind seeds *of Rhus Coriaria* daily with diet, G3 was fed on the similar diet that was presented in G1 with 5g/head of (EFE) daily, G4 was fed on the same diet in G1 with a 15g/head dried grind seeds of *Rhus Coriaria* and 5g/head of EFE. The results of live body weight, monthly weight gain and feed conversion ratio showed significant increased ($p<0.05$) of G2, G3, G4 comparing with G1.Also values of Hemoglobin, showed significance exceed ($p<0.05$) of G2, G3, G4 compared with G1. Values of RBCs showed that G4 significance exceed ($p<0.05$) other groups from the 3rd month to the end of experiment, while G3 and G2 significance exceed G1 at the last month of experiment. Values of total WBCs showed non-significance difference among different groups. In conclusion, these result showed the significant effect of *Rhus Coriaria* and (EFE) consumption on some productive and heamatological aspects of Awassi male lambs.

Key words: treatment, weight, feed conversion ratio, Hemoglobin, WBCs.

مجلة العلوم الزراعية العراقية- 2024:55(2):683-690 **هادي والساعدي**

تأثير الأضافه الغذائيه لبذور نبات السماق المطحونه والأنزيمات المحلله للألياف في بعض الصفات الأنتاجيه والدميه في الحملان

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المستخلص

أجريت هذه التجربة في الحقل الحيواني لكلية الطب البيطري جامعة بغداد لتقييم تأثيربذور السماق المطحونه والأنزيمات الخارجيه المحلله للألياف على بعض الصفات الأنتاجيه والدميه للحملان الذكور العواسيه للمده من 2021/2/1 ولغاية 2021/6/1 استخدمت 24 حملا من الذكور العواسية، وبعمر 3–4 شهر. قسمت الحيوانات الى اربعة مجاميع (6حيوان /مجموعة) مع الاخذ بنظر الاعتبار وزن الجسم الحي وعوملت المجاميع كالاتي :المجموعة الاولى (G1) وهي مجموعة السيطرة / غذيت هذه المجموعة على العلف المركز وبنسبة 2.5% من وزن الجسم مع دريس الجت .المجموعة الثانية (G2) غذيت على العليقة نفسها كما في المجموعة الاولى وأضيف اليها 15غرام/رأس من بذور السماق الجافه المطحونه.المجموعة الثالثة (G3) /غذيت على العليقة نفسها للمجموعة الأولى وأضيف اليها 5 غم لكل رأس يوميا من الأنزيمات المحلله للألياف EFE.المجموعة الرابعة (G4) / غذيت على العليقة نفسها للمجموعة الاولى مضافا اليها 15غرام/رأس من بذور السماق الجافه المطحونه مع 5 غم لكل رأس يوميا من الأنزيمات المحلله للألياف .كشفت النتائج الزياده المعنويه في وزن الجسم، معامل التحويل الغذائي، الهيموكلوبين وكريات الدم الحمراء في المجاميع المعامله بالمقارنه مع السيطره. نستنتج التاثير المعنوي لهذه الأضافات في المعايير المذكوره في الحملان الذكريه العواسيه.

الكلمات المفتاحيه: المعالجه، معدل التحويل الغذائي, الوزن، الهيموكلوبين، كريات الدم البيضاء

Received: 14/2/2022, Accepted:11/5/2022

INTRODUCTION

Medicinal plants and their extracts may be incorporated into ruminant diets to increase nutrient digestibility, rumen fermentation, immune function, milk production, and conformation (17). Medicinal plants have stimulatory effects on the digestive system and are often good sources of some minerals and vitamins. Medicinal plants like *Rhus coriaria* (sumac) contain organic acids such as malice, citric and tartaric acids, and have shown health-promoting attributes including antiviral, anti-inflammatory, anti-gastric, antioxidant, antibacterial, antidiarrhoeal, antispasmodic, astringent, hepatoprotective, antiulcer, fungicide, cyclooxygenase-inhibitor and lipoxygenase inhibitors due to their contents of flavones, phenolic acids as gallic acid, myricetin, quercetin, isoquercitrin and tannic acid (11) Some medicinal plants have antibacterial activity (20). *Rhus coriaria* has an appealing economic significance due to its expanding usage in food, cosmetic and therapeutic industries, coloring or conservation of foods and veterinary practices (22). Sumac seeds existing in Iraqi markets can be a good source for tannins. Tannin owned great antioxidant effects as free radical scavenger (2). The cost of using grains in ruminant diets is high. Certainly, there should be a focus on lowering production costs, whether for milk or mutton. Here, the EFE's intervention is required to lower production costs by incorporating fibrous feeds into total mixed rations (TMR) (6). Exogenous fibrolytic enzymes supplementation in early lactating buffalo diets high in oat silage (60 or 70%) resulted in greater milk production and fat content. Improved digestible nutrient intake, digestion coefficients, nitrogen balance, and feed conversion could all contribute to higher milk output and composition (5). Several workers reported that adding EFE to the TMR improved the digestibility of dry matter (DM), nutrient detergent fiber (NDF), and acid detergent fiber (ADF), resulting in increased productivity and feed conversion efficiency (34). When additional tissue-related data are unavailable, growth performance and blood parameters have been regarded valuable for assessing body condition, nutritional state, and immunological status in animals. When blood is drawn, it is possible to clinically assess the existence of various metabolites and other elements in an animal's body (25). Therefor this study aimed to evaluate the effects of the supplementation of grind seeds of *Rhus Coriaria* and exogenous fibrolytic enzymes (EFE) as feed additives on some productive and blood parameters in Awassi male lambs.

MATERIALS AND METHODS

Design of experiment: The experiment was carried out in Animal's Farm, College of Veterinary Medicine, University of Baghdad and for the period from 1/2/2021 to 1/6/2021. Twenty-four Awassi local breed male lambs weighting (21.56±0.77) Kg with 3 - 4 months of age from a trusted and familiar source were used. Lambs were divided into 4 groups (6 animals for each group). Dietary treatments for 4 month were as follow: Control group (G1) was nourished concentrate diet at the rate of 2.5% body weight (B.W) with alfalfa hay daily, G2 was fed on the same diet as control group and was given 15g/head dried grind seeds of *Rhus Coriaria* daily with diet, G3 was fed on the similar diet that was presented in G1 with 5g/head of exogenous fibrolytic enzyme (EFE), G4 was fed on the similar diet in G1 with a 15g/head dried grind seeds of *Rhus Coriaria* and 5g/head of EFE daily with diet.

Management and feeding system:

Lambs were divided into 4 groups in pens sized 2 × 4 m for each group, at the same farm and all pens were provided with two cans to be utilized for concentrate and roughage diets separately. Clean freshwater was available at all times before starting of the experiment. The diets were gradually introduced to the lambs for 20 days preliminary period, starting with wheat straw and followed by concentrate. The amount of concentrated diet offered for each lamb was monthly adjusted according to the body weight gain which was weighed monthly in order to ensure that the intake would be around 2.5% of the recorded live body weight (LBW). Before starting of the experiment, concentrated diet were offered twice daily and alfalfa hay was offered *ad libitum*. Sheep were released after the morning feeding in a closed bran contains only a source of water for the sport until the noon meal.

Calculated chemical composition diet (%)

Dry matter	91.08
Crud protein	16.35
Crude fiber	16.94
Ether extract	3.77
Ash	11.54
Nitrogen free extract	54.46
ME (Kcal/Kg DM)	2384.6

ME=Metabolizable energy, calculated by using formula adopted from (21).

***Rhus coriaria* classifications**

Rhus coriaria was purchased from the local market. The plant classification was done at the ministry of agriculture/ Directorate of seeds testing and certification D.S.T.C in Abu Graib /Baghdad at certificate number 2676 data 16/12/2020.

Supplementation of Exogenous Fibrolytic Enzyme (EFE): (EFE) powder (Safizym-France) was purchased from the local market and was given at 5 gm/head, mixed with a concentrated diet of G3 and G4 as an addition to the daily feeding.

Monthly Body weight, Monthly weight gain and Feed conversion ratio (FCR):

FCR= (feed intake(dry matter)/ weight gain) for each lamb(27).

Blood samples: Blood samples were taken at monthly intervals from the jugular vein after sterilization the site of blood drawn by using disposable sterilized syringes. The samples of the blood kept in 5 ml tubes containing anti-coagulant Ethyl Diamine Tetra Acetic Acid (EDTA) to estimate blood hemoglobin concentration, red blood cell count, white blood cell count.

Blood analysis: Automated hemoanalyzer: Blood samples placed in the anticoagulant were analyzed using Auto- analyzer (Genex) to obtaine the blood picture parameters Hb, RBCs and WBCs (30)

Statistical analysis: Statistical analysis of data was performed using SAS (Statistical Analysis System - version 9.1). Two-way analysis of variance (ANOVA) and Least significant differences (LSD) post hoc test were performed to assess significant differences among means. $P < 0.05$ is considered statistically significant (35).

RESULTS AND DISCUSSION

Monthly live body weight, Weight gain and Feed Conversion Ratio (FCR): The results showed a significant ($P \leq 0.05$) increase of live body weight, monthly weight gain and feed conversion ratio of G2, G3 and G4 compared with the control group (Tables 1,2 and 3). These increase could be due to numerous reasonable reasons. It may be due to the increase in the age of growing lambs which was mixed with suitable medical and managements care during the time of experiment, and then lead to increase of skeletal and muscle mass and this illustrations agrees with Mahdi, (24) who found that good management and health care can make the lambs reach the best weight and with Molina *et al.* (26), who found that age of sheep had a significant effect on the live weights during rearing, or it may be due to the growth of the rumen, which was rely on the concentrated diet presented and lambs grown age, the rumen growth represented by an increase in the size of rumen and papillae, which help to extend of a large amount of feed and good nutrient utilizing such as fermentation, digestion and absorption. These details agree with Carballo *et al.*(9) who found Somatic growth of the rumen can be divided into 2 aspects: increases in bulk and growth of papillae. Ruminal mass was stimulated by the amount and physical structure of the diet eaten by the animal. Also weight increase in lambs in the G2, G3 and G4 specially at the 3rd and 4th months of the experiment could be accelerate the incidence of the puberty which may yield some hormones who play important role as promote factor for body building and enhance metabolic reaction. This explanation agrees and confirms with Ghanim *et al*., (15) who found that steroidal hormones are a main regulated for myostatin manifestation in skeletal muscle, and that may influence to the enlarge in muscle mass. Dried sumac is mainly composed of moisture, essential oil content, protein, fiber, minerals, water-soluble extract, and fatty oil, which were the ideal feed to the ruminants , and that agrees and confirms with Ouyang *et al*., (31), who found that carbohydrates are the most important organic nutrients for ruminants, as the rumen microorganisms use them to produce many volatile fatty acids. Fiber was also very important in maintaining the normal rumen environment, as it was slowly digested solid

fraction. It has been shown that neutral detergent fiber intake was positively related to the daily rumination and body size of ruminants, as it resolves insoluble matrix carbohydrate. Also Rhus coriaria is very rich in phenolics mainly and tannins. Tannins are a group of polyphenolic compounds which has effectively been useful to ruminant nutrition to reduce protein degradation in the rumen, and thereby improve protein utilization and animal production efficiency and that agrees and confirms with Jafari et al., (19) who found that polyphenols protect digested protein from degradation, increase fiber digestion and decrease unsaturated fatty acid from bio hydrogenation, which supports the animal digestion and general health. Medicinal plants like Sumac (*Rhus coriaria*) have stimulatory effects on the digestive system and are often good sources of some minerals, vitamins, organic acids such as malice, citric and tartaric acids, and have shown health-promoting attributes due to their contents of flavones, phenolic acids as gallic acid, myricetin, quercetin, isoquercitrin and tannic acid (11), and also that medicinal plants are commonly used as feed supplements in the livestock nutrition (16). Furthermore tannins used to control intestinal parasite and when employed in suitable approach lead to improve intestinal microbial ecosystem, enhanced gut health and later increased productive achievement (18). From the results the *Rhus Coriaria* and Exogenous Fibrolytic Enzymes (EFE) combination or supplemented alone as feed additive in complete diets of lambs yielded a significant increase in weight, weight gain and FCR. EFE as mentioned above may play an important role in this increase, and with the *Rhus Coriaria* supplementing lead to an addition effect, and this agreed with Elsidding, (12) who found that (EFE) treatment significantly improved body weight gain and feed conversion ratio in growing lambs and also a agreed with Abid *et al*., (1) who indicated that the use of olive cake(contain poly phenols and tannins) with the fibrolytic enzyme, even at relative low concentration, improve lamb growth performance as a result of increasing feed intake and improving fibre digestibility with no unfavorable effects on animal health. Furthermore the supplementing EFE to the diet of young lambs which have undeveloped rumen could help in the development of rumen structure and rumen microflora, stimulate feed intake, fermentation, and absorption, all that will obtain lambs more weight in premature age, this explanation agreed and confirmed with Abid *et al*.(1) who found a considerable increase in fibre digestibility with the supplementation of EFE, begin in the breakdown of structural carbohydrates and perform synergistic effect with the rumen microbiota thereby enhancing the hydrolytic action within the rumen ecosystem.

Table 1 . Effect of grind seeds of *Rhus coriaria* and exogenous fibrolytic enzymes on monthly live body weight (kg) of local Awassi male lambs (Mean± SE).

Groups	Initial weight	1st Month	2nd Month	3rd Month	4th Month
Control (G1)	E21.00±0.73a	D27.16±0.74b	C34.66±0.33c	B42.00±0.57c	A49.66±0.42c
Sumac (G2)	E21.33±0.66a	D29.00±0.36ab	C36.66±0.55bc	B45.66±1.06b	A55.66±1.17b
Enzyme (G3)	E22.33±0.76a	D29.33±0.71a	C37.50±0.56b	B46.50±0.42b	A56.00±0.44b
Sumac + Enzyme (G4)	E21.66±0.91a	D30.00±1.00a	C40.33±0.88a	B50.00±0.81a	A60.50±0.84a
LSD	2.06				

The means in the same column with a different tiny letter are considerably different (P≤0.05).
Means in the same row with a different capital letter are substantially different (P≤0.05).

Table 2. Effect of grind seeds of *Rhus coriaria* and exogenous fibrolytic enzymes on monthly weight gain (kg) of local Awassi male lambs (Mean± SE).

Groups	1st Month	2nd Month	3rd Month	4th Month
Control (G1)	B6.16±0.40c	A7.50±0.56b	AB7.33±0.42b	A7.66±0.21b
Sumac (G2)	B7.66±0.76ab	B7.66±0.49b	A9.00±0.68a	A10.00±0.25a
Enzyme (G3)	C7.00±0.36bc	BC8.16±0.40b	AB9.00±0.36a	A9.50±0.42a
Sumac+Enzyme(G4)	B8.33±0.41a	A10.33±0.33a	A9.66±0.61a	A10.50±0.41a
LSD	1.31			

The means in the same column with a different tiny letter are considerably different (P≤0.05).
Means in the same row with a different capital letter are substantially different (P≤0.05).

Table 3. Effect of Grind Seeds of Rhus Coriaria and Exogenous Fibrolytic Enzymes on monthly feed conversion ratio (FCR) of local Awassi male lambs (Mean± SE).

Groups	1st Month	2nd Month	3rd Month	4th Month
Control (G1)	D2.97±0.17a	C3.70±0.28a	B4.98±0.27a	A5.89±0.17a
Sumac (G2)	C2.45±0.21ab	B3.60±0.23a	AB4.12±0.33b	A4.36±0.19b
Enzyme (G3)	D2.60±0.13ab	C3.35±0.17a	B4.03±0.16b	A4.78±0.22b
Sumac+Enzyme(G4)	B2.18±0.11b	B2.62±0.09b	A3.80±0.24b	A4.32±0.17b
LSD	0.58			

The means in the same column with a different tiny letter are considerably different (P≤0.05).
Means in the same row with a different capital letter are substantially different (P≤0.05).

Hemoglobin and red blood cell: The results revealed that there were a significant (P≤0.05) increase in the Hb and RBC_s in the supplemented groups (G2, G3 and G4) compared with G1 (Tables 4 and 5 respectively). This achievement subject to several possible explanations. The result could be related to the fact that *Rhus Coriaria* includes significant amounts of iron, which is incorporated in its composition. (32), the major vitamins found in sumac were identified to be thiamin (B1), riboflavin (B2), pyridoxine (B6), B12, nicotinamide, biotin and ascorbic acid (23). Vitamin B2 and B12 play a role in the formation of RBC_s , and vitamin B12 plays a role in the maturation of erythrocytes (33). Furthermore, the high quantities of mineral compounds in the sumac extract, mainly calcium, zinc, and potassium, all of which are required for blood formation, indicated that mineral compounds were among the bioactive chemicals that regulated haematological parameters or by the acting of phenolic acids which found in sumac as a protecting factor to hemoglobin and Red blood cells from the lipid peroxidation through its antioxidant properties (10). Also, Anghileri and Thouvenot,(4) found that polyphenols from green tea extract defend against iron-induced lipid peroxidation of mouse liver tissue suspensions, this explanation also agreed with Nair and Augustine, (28) who showed that polyphenols help the body remove the excess iron by forming a polyphenol iron-binding complex with waste, chelate and eliminate iron from iron-loaded hepatocytes, and that the binding of these polyphenols to iron is reduced to free, solvent, non-pretentious iron. On the other hand Gallardo *et al*.(14) noticed that increased polyphenols in the body significantly lead to iron deficiency in vitro studies but at the same time decrease the oxidation of hemoglobin and myoglobin by dealing with iron-free radicals. The results reveal that (EFE) and sumac combination group recorded the highest significance in Hb and RBC's compared to the control. This notion was in line with Millam *et al*. (25) who found that the (EFE) supplementation has been shown to have significant ($p<0.05$) effects on some hematological parameters in Yankasa rams. It does appear that the supplementation of the diets with (EFE) could enhance the ruminal hydrolysis of cell wall contents, due to increased capacity of the microbial binding capacity to digest, stimulation of microbial populations, and the development of synergy between the enzymes synthesized in the rumen and polysaccharides contained in the products (7), and then (EFE) supplemented lambs had a better physiological health state than non-supplemented animals, according to their blood metabolic profile (BMP) (8).

Table 4. Effect of grind seeds of *Rhus coriaria* and exogenous fibrolytic enzymes on hemoglobin concentration (g/dl) of local Awassi male lambs (Mean± SE).

Groups	1st Month	2nd Month	3rd Month	4th Month
Control (G1)	A11.51±0.38a	A11.05±0.20b	A11.50±0.33b	A10.96±0.20b
Sumac (G2)	B11.65±0.40a	B12.63±0.41a	A13.81±0.57a	A14.40±0.33a
Enzyme (G3)	B12.03±0.26a	AB13.00±0.18a	A13.35±0.25a	A14.05±0.59a
Sumac+Enzyme(G4)	C11.61±0.44a	B13.13±0.25a	AB13.45±0.61a	A14.53±0.36a
LSD	1.09			

The means in the same column with a different tiny letter are considerably different (P≤0.05).
Means in the same row with a different capital letter are substantially different (P≤0.05).

Table 5. Effect of grind seeds of *Rhus Coriaria* and exogenous fibrolytic enzymes on red blood cells count (10^6/µL) of local Awassi male lambs (Mean± SE).

Groups	1st Month	2nd Month	3rd Month	4th Month
Control (G1)	A3.25±0.21a	A3.90±0.29a	A3.50±0.39b	A3.91±0.47c
Sumac (G2)	B3.81±0.33a	B3.94±0.41a	B3.65±0.43b	A5.39±0.67b
Enzyme (G3)	B3.71±0.47a	B3.99±0.33a	B4.11±0.34b	A5.73±0.69b
Sumac+Enzyme(G4)	C3.78±0.27a	C3.90±0.23a	B5.16±0.31a	A7.18±0.35a
LSD	0.90			

The means in the same column with a different tiny letter are considerably different (P≤0.05).
Means in the same row with a different capital letter are substantially different (P≤0.05).

White blood cells count: The results showed in Table (6) revealed non-significant (p≤0.05) difference between the groups during the time of experiments. This may be due to ability of sumac polyphenol to replace immune system role due to its antioxidant property, this explanations agreed with Duke *et al*. (11) and Alsamri *et al.* (3), who showed that sumac (*Rhus coriaria*) contain organic acids such as malice, citric and tartaric acids, and have shown health- supporting properties including antioxidant, anti-inflammatory, antibacterial, antiviral and hepatoprotective due to their contents of flavones, phenolic acids as gallic acid, myricetin, quercetin, isoquercitrin and tannic acid. Also agree with Nudda *et al*. (29) who refer to the property of polyphenols to act as an immunomodulatory effect in dairy ewes. Therefore During the study of antimicrobial activity of the hydroalcoholic extract of sumac on Klebsiella pneumonia in the laboratory, Taha (36) showed that after 16 days of treatment with sumac extract, the number of WBCs in sick rats returned to normal levels. Furthermore, the rats were healthy and exhibited normal physiological behavior, but WBC rates and other immunological indicators were still high 16 days after infection in the rats infected but not treated with sumac extract. Also Vahid-Dastjerdi *et al*. (37) found that sumac powder, like levamisole, can increase the activity of the immune system and increase phagocytosis. EFE play an important synergistic role with the sumac in immune defense improvement, it may be reduce pathogenic bacteria by nutrient competition and remove or reduce toxic metabolites in the rumen, this explanation agrees with Gado *et al*. (13) who found that (EFE) supplementation disintegrate the anti-nutritional factors present in many tropical feed ingredients, many of which are not susceptible to digestion by the animal's endogenous enzymes.

Table 6. Effect of grind seeds of *Rhus coriaria* and exogenous fibrolytic enzymes on white blood cells count (10^3/µL) of local Awassi male lambs (Mean± SE).

Groups	1st Month	2nd Month	3rd Month	4th Month
Control (G1)	12.12±0.32	12.17±0.74	12.27±0.56	11.91±0.29
Sumac (G2)	11.93±0.40	11.59±1.15	11.89±0.81	11.13±0.78
Enzyme (G3)	11.83±1.01	11.31±1.11	11.78±0.61	11.70±0.72
Sumac+Enzyme(G4)	11.82±1.24	11.82±1.06	11.21±0.88	11.76±0.61
LSD	1.15			

All differences were not significant

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