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EFFECT OF ADDING GARDEN CRESS (LEPIDIUM SATIVUM) ON RUMEN FERMENTATION OF LOCAL AWASSI LAMBS

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Abstract: This study was to study the effect of adding Lepidium sativum to the lamb diets of Awassi sheep. Nine male lambs (their age is 3 months old and their body weight is 19±0.5 Kg) were distributed randomly into 3 treatments (3 lambs per treatment). The coarse feed (hay) was provided freely to lambs, while the concentrated feed was provided based on 3% of the body weight. All treatments were fed on similar diet and differed only in the weight of seeds, where 7.5 g was added to the second treatment (T2) and 15 g of Garden Cress to the third treatment (T3) while the control treatment (T1) left without adding seeds. The experiment continued for 60 days. The results showed a significant increase in pH at 0 hour in treatments T2 and T3 with Garden Cress of 7.5 and 15 g respectively, but there was a significant decrease at 3 hours in treatment T3 and also at 6 hours in T2 and T3 as well. For total phenols there was a decrease at 6 hours in treatment T2.When adding Garden Cress to concentrated rations, it did not significantly affect N-NH3, but improved somewhat of rumen fermentation and microorganism's numbers at 3 hours for T2 and T3 with Garden Cress of 7.5 and 15 g respectively. There was a significant increase in fatty acids at 6 hours in T2 and T3 while there was no significant effect at other times and treatments.

Keywords: Garden Cress, Rumen Fermentation, Awassi lambs

تأثير إضافة بذور الرشاد إلى العلف على تخمرات الكرش في الأغنام العواسية

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الملخص: هدفت هذه الدراسة إلى دراسة تأثير إضافة بذور الرشاد إلى علائق الحملان في الأغنام العواسي. تم توزيع تسعة حملان ذكور (عمرهم 3 أشهر ومتوسط وزن الجسم 19± 0.5 كغم) بشكل عشوائي إلى 3 معاملات (3 حملان لكل معاملة). تم إعطاء العلف الخشن بصورة حرة، في حين تم توفير العلف المركز على أساس 3% من وزن الجسم. تم تغذية جميع المعاملات بعليقة موحدة والتي اختلفت فقط في كمية البذور الرشاد، حيث تمت إضافة 7.5 غرام إلى المعاملة الثانية (T2) و 15 غرام من بذور الرشاد إلى المعاملة الثالثة (T3) بينما تركت معاملة السيطرة (T1) بدون أي إضافة. استمرت التجربة لمدة 60 يومًا. أظهرت النتائج زيادة كبيرة في الرقم الهيدروجيني عند الساعة 0 في المعاملات T2 و T3 المضاف لها بذور الرشاد بنسبة 7.5 و 15 غرام على التوالي، ولكن كان هناك انخفاض كبير في الساعة 3 في المعاملة T3 وكذلك عند الساعة 6 في T2 وT3. بالنسبة إلى الفينولات الكلية كان هناك انخفاض عند الساعة 6 في المعاملة T2عند إضافة بذور الرشاد إلى العليقة المركزة، لم يؤثر ذلك بشكل كبير علىN-NH3، لكنه حسن إلى حد ما من تخمرات الكرش وأعداد البكتريا الكلية عند الساعة 3 للمعاملات T2 وT3 المضاف لها بذور الرشاد بنسبة 7.5 و15 غرام على التوالي. كانت هناك زيادة كبيرة في الأحماض الدهنية في الساعة 6 في T2 و T3 بينما لم يكن هناك تأثير يُذكر في الأوقات الأخرى في المعاملات.

الكلمات المفتاحية: بذور الرشاد، تخمير الكرش، الأغنام العواسية.

Introduction

Awassi sheep are one of the largest small ruminants. It constitutes an important sector of the national income in Iraq for its products such as meat, milk and wool (Al-Mourrani, et al 1980). Nutrition is one of the main factors affecting livestock production because it affects metabolism and growth. Several attempts have been made to improve feed digestibility using food additives (Nagpal et al., 2007). Sheep can eat coarse, high-fiber feeds and fermentation within the rumen by microorganisms that can produce enzymes that convert these fibers into animal products (Olivera, 1998). The use of medicinal plants is known by ancient civilizations as used by Egyptians, Chinese and Greeks (Singh et al., 1993). Most of the attention of breeders and entrepreneurs in the field of animal production has turned to medicinal plants in ruminant feeding, which has a positive impact on animal health (Ahmed et al., 2009; Abbas, 2010; Khattab et al., 2011). Many medicinal plants, including Garden Cress, as one of the most consumed medicinal plants (Snehal, 2014). It is a good source of protein, vitamins, fats, sugars, amino acids and minerals, as well as its role in improving feed consumption and increasing body weight (Juma, 2007, Shawle et al., 2016) and contains active substances such as alkaloid, polyphenols, Tannins and saponins that improve animal health (Paranjape and Mehta, 2006). The effectiveness of Garden Cress against harmful microorganisms, which inhibit them, which helps to create a good biological environment as well as the treatment of diarrhea, digestive disorders, stomach pain, indigestion, fever and skin diseases (Gedif and Hahn, 2003 and Teklehaymanot Et al., 2007). The use of Garden Cress in sheep diets has a clear effect on increasing animal growth, improving overall weight gain and improving digestibility due to the content of Garden Cress from saponins that stimulate anaerobic fermentation of organic substances, which improve the efficiency of nutrient use and increase the number of bacteria in the rumen (Balgees et al., 2013). To create a good biotic environment in the animal rumen, the effectiveness of microorganisms inside the rumen must be increased to produce higher microbial protein. The processing of microorganisms should coincide with protein and energy (Saleh, 2008). This experiment aims to determine the effect of Garden Cress on rumen fermentation.

Materials and Methods

This experiment was carried out in the field of animal production of the Faculty of Agriculture at Diyala University for the period from 27/ 2/ 2019 to 27/ 4/ 2019. The lambs have been checked by a veterinarian to ensure its safety and free from diseases. This study included 9 male lambs from the local Awassi strain. The lambs were taken after weaning from the local markets at the age of 3 months with an average weight of 19 ± 0.5 kg. The lambs were placed in semi-enclosed enclosures containing individual cages, 1.5 m long and 1 m wide per cage. 3 lambs for each treatment and the lambs were accustomed to

eating the amount of fodder allocated to them and gradually as a preliminary period lasted 14 days to make sure that they became accustomed to the place and the feeds provided to them and adapted to the cages and then weighed animals to record the initial weight, provided concentrated diet based on live weight 3% of body weight, this amount is adjusted every two weeks based on the new weight of each animal. The feed is provided in the form of two meals in the morning and evening. The coarse feed (hay) was provided freely and green fodder was provided according to the availability in equal quantities among the animals of the experiment and was a green jet and continued veterinary medical care throughout the experiment and doses of lambs Benazol against intestinal and hepatic worms by 15 cm ^{3}/ animal Ivermactine has been subcutaneously administered to prevent external and internal parasites. After the initial weight of the lambs was recorded and Garden Cress was added to the concentrated diet after crushing daily and the first treatment (Control) was without any adding and the second treatment was added 7.5 g/ animal/ day and the third treatment was added 15 g/ animal/ day of Garden Cress to Concentrated diet.

Method of collecting rumen liquid:

The rumen fluid was collected after one month from the beginning of the experiment by gastric tube where it was inserted into the rumen and pulled by a large syringe (large syringe measuring 50 ml) as described by (Saeed, 2011) before 0 hour before morning feeding, after 3 hours of morning feeding and after 6 hours of morning feeding, pH was measured immediately after which the liquid was filtered by a dull cloth and placed in a test tube bearing the animal number and time of withdrawal and was frozen for later sample analysis.

Measurement of rumen fluid variables:

Measurement of pH in Rumen Liquid

The pH of the samples from the rumen fluid was measured by a pH meter digital PW Philips 9909 portable device immediately after the rumen was withdrawn from the animal.

Determination of Ammonia Nitrogen in Rumen Liquid

Ammonia nitrogen was determined in the animal production laboratory of the College of Agriculture/ University of Baghdad. Ammonia nitrogen was measured in the rumen liquid according to the method indicated (AOAC, 2005).

Using the following law:

$$NH3 - N\ (MLg|100ML) = \frac{volume\ HCL \times\ 0.05 \times\ 100 \times\ 14.008}{sample\ value\ (ml)}$$

Concentration of total fatty acids TVFA in Rumen Liquid

Total fatty acids in rumen liquid were measured according to the method indicated (Warner, 1964) and using the following law:

$$TVFA\ (MLg|100ML) = \frac{volume\ NaOH \times\ 0.1 \times\ 100}{sample\ value\ (ml)}$$

The total number of bacteria in Rumen Liquid

The total bacterial count in the rumen liquid was calculated according to the method indicated (Roberts and Greenwood, 2003) using the following law:

Number of bacteria/ cm3 = number of colonies per dish× inverted sample dilution

Total phenols in Rumen Liquid

The total phenols in the rumen liquid were calculated according to the method indicated (AOAC, 2005) using the following law:

$$\text{phenols}(100\text{ml}) = \frac{\text{first result} \times\ 100}{\text{weight} \times\ \text{volum}} \times\ 100$$

Statistical Analysis

Data were analyzed statistically using SPSS (2008) by complete random design (CRD).

$$Yij = \mu + T + eij$$

They represent:

Yij Value of transaction j attributed to transaction i.

μ The overall mean of the studied trait.

Ti Effect of treatment i.

eij Random error that is normally distributed.

Significant differences between the mean were compared with Duncan (1955) polynomial test.

Results and Discussions

pH in Rumen Liquid

Table (1) shows the effect of adding Garden Cress to the concentrated diet on the pH of the rumen fluid before 0 hour and after 3, 6 hours of the morning feeding, after the addition of Garden Cress by 0, 7.5 and 15g to the concentrated feed and taken by the animal. There were significant differences before morning feeding, where the pH value of the second and third treatments at 0 hours was 6.43 and 6.33 respectively compared with the control treatment of 6.2 and at 3 hours after morning feeding there was a significant decrease in pH value for the third treatment, which amounted to 5.20 compared with the

control treatment which was 6.16 and the second treatment was 6.10. As for the model drawn after 6 hours in the morning feeding, there was a significant decrease in the pH value of the second and third treatments, which averaged 5.06 and 5.03, respectively, compared with the control treatment which was 5.26. The decrease in pH may be due to the intake of concentrated feed after morning feeding, which reduces the pH in contrast to the coarse feed, or the decrease in pH may be due to the increase of microbial fermentation and thus increase the activity of microorganisms in the rumen.

Table (1) Effect of adding different concentrations of Garden Cress in the pH in rumen liquid (Mean± standard error)

Treatments	The pH concentration of the rumen fluid at (0, 3, 6) hours		
After one month	0 before morning feeding	3 hours after morning feeding	6 hours after morning feeding
T1	0.00± 6.2[b]	0.03±6.16[a]	0.03±5.26[a]
T2	0.03±6.43[a]	0.00±6.10[a]	0.03±5.06[b]
T3	0.06±6.33[a]	0.05±5.20[b]	0.03±5.03[b]

Ammonia nitrogen NH3-N in Rumen Liquid

Table (2) shows the effect of adding Garden Cress to concentrated diets on the concentration of ammonia nitrogen in rumen liquid for periods before 0, after 3 and 6 hours of morning feeding after adding Garden Cress in the amount of 0, 7.5 and 15 g/ animal/ day to the concentrated diet. There were no significant differences before morning feeding at 0 hours between the three treatments T1, T2 and T3 which were 0.23, 0.22 and 0.22 mg/ 100 ml respectively, and no significant differences were shown at 3 hours after morning feeding between the three treatments T1, T2 and T3, and their rates were 0.21, 0.22 and 0.22 mg/ 100 ml, respectively. The sample withdrawn after 6 hours in the morning feeding showed no significant differences between the three treatments and their rates for treatments T1, T2 and T3 were 0.20, 0.23 and 0.21 mg/ 100 ml, respectively. The absence of significant differences may be due to the concentrations of Garden Cress in the treatment a little or the effect of the duration (increase or decrease), as well as note that although Garden Cress contain the active substance tannin, but did not have an effect on nitrogen ammonia

Table (2) Effect of Adding Different Concentrations of Garden Cress in Ammonia Nitrogen in Rumen Liquid (Mean ± Standard Error)

Treatments	Concentration of total fatty acids (mg/ 100 ml) of rumen liquid at (0, 3, 6) hours		
After one month	0 before morning feeding	3 hours after morning feeding	6 hours after morning feeding
T1	0.17±2.40	0.03±2.43	2.10± 0.00[b]

Treatments	Concentration of total fatty acids (mg/ 100 ml) of rumen liquid at (0, 3, 6) hours		
T2	0.20±2.30	0.10±2.60	2.40± 0.17[a]
T3	0.17±2.24	0.10±2.50	2.40 ±0.17[a]

Total Numbers of microbial microorganisms in in Rumen Liquid

Table (3) shows the effect of adding Garden Cress in different quantities 0, 7.5 and 15 g/ animal/ day to the concentrated diet on the total number of bacteria in the animal's rumen liquid at 0, 3 and 6 hours. There were differences between the three treatments T1, T2 and T3 which were 546.33, 584.66 and 580.33× 10^7, respectively. As for the pulled pattern at 3 hours after the morning feeding, we notice a significant effect between the treatments as we find that the second and third treatments were significantly superior, which averaged 624.66 and 595.00× 10^7, respectively, on the control treatment of 530.33× 10^7. While the pulled pattern at 6 hours, the results indicated that there were no significant differences between treatments and the mean bacterial numbers for T1, T2 and T3 were 501.00, 511.66 and 513.00× 10^7, respectively. When feeding Awassi ewes on a diet containing Garden Cress, Balgees et al. (2013) found no negative effect on the total number of bacteria in the rumen fluid. The reason for the increase in the total number of bacteria at 3 hours after morning feeding treated with Garden Cress and the role of the active substance in those seeds (saponins) in increasing the growth and activity of microorganisms in the liquid rumen.

Table (3) Effect of Addition of Different Concentrations of Garden Cress on Total Bacteria number in Rumen Liquid (Mean ±Standard Error)

Treatments	Total number of bacteria in the rumen fluid (colony formation/ ml)× (107) at (0, 3 and6) hours		
After one month	0 before morning feeding	3 hours after morning feeding	6 hours after morning feeding
T1	22.36±546.33	530.33 ± 14.94[b]	501.00± 9.53
T2	18.66±584.66	624.66 a±14.16[a]	511.66± 3.75
T3	31.68±580.33	595.00 ±36.90[a]	513.00± 0.57

Total phenols in Rumen Liquid

Table (4) shows the effect of adding Garden Cress in different quantities 0, 7.5 and 15 g/ animal/ day to the concentrated diet on total phenolic compounds in the animal's rumen liquid at 0, 3 and 6 hours. There were significant differences between the three treatments T1, T2, and T3, which averaged 382.66, 390, 00 and 405, 00, respectively. The results showed that there was no significant difference between the treatments T1, T2, and T3, which averaged 342.33, 350.66 and 349.33, respectively. The results showed that there was a significant decrease in the total phenolic compounds of the rumen fluid for the second

treatment with Garden Cress amounted to 7.5 g/ animal/ day which was 329.000 compared with the control treatment which was 340.000 while the third treatment which contain 15 g/ animal/ day of Garden Cress was 355.33 and there is no significant difference between them and control treatment, which amounted to 340.00. The decrease in total phenols at 6 hours after morning feeding may be due to the active ingredient which Garden Cress (phenol) contain it, which reduces the solubility and rumen secretion of phenols due to its high protein and binding method.

Table (4) Effect of Adding Different Concentrations of Garden Cress in Total Phenols in Rumen Liquid (Mean ±Standard Error)

Treatments	Concentration of total phenols (mg/ 100 ml) in rumen liquid at (0, 3, 6) hours		
After one month	0 before morning feeding	3 hours after morning feeding	6 hours after morning feeding
T1	19.67± 382.66	342.33± 9.02	340.000 ±6.42[a]
T2	390.000±22.54	350.66± 2.90	329.000±6.08[b]
T3	405.000±7.50	349.33± 8.29	355.33 ±23.24[a]

Total fatty acids in Rumen Liquid

Table (5) shows the effect of adding Garden Cress to the concentrated diets on the concentration of total fatty acids in the rumen fluid for periods before 0 hour, after 3 and 6 hours after morning feeding after the addition of Garden Cress in the amount of 0, 7.5 and 15 g/ animal/ day to the concentrated diet. There were no significant differences before 0 hour of morning feeding between the three treatments T1, T2 and T3 were 2.40, 2.30 and 2.24 mg/ 100 ml respectively, and no significant differences were shown after 3 hours of morning feeding between the three treatments T1, T2 and T3 averaged 2.43, 2.60 and 2.50 mg/ 100 ml, respectively. The results indicated that there were significant differences between the three treatments as the second treatment and the third treatment significantly, and their rates were 2.40 and 2.40 mg/ 100 ml, respectively, on the control treatment of 2.10 mg/ 100 ml. It may be because the Garden Cress contains fatty acids to increase their concentrations in the rumen.

Table (5) Effect of Addition of Different Concentrations of Garden Cress in Total Fatty Acids in Rumen Liquid (Mean ± Standard Error)

Treatments	Concentration of total fatty acids (mg/ 100 ml) of rumen liquid at (0, 3, 6) hours		
After one month	0 before morning feeding	3 hours after morning feeding	6 hours after morning feeding
T1	0.17±2.40	0.03±2.43	2.10± 0.00[b]
T2	0.20±2.30	0.10±2.60	2.40 ±0.17[a]
T3	0.17±2.24	0.10±2.50	2.40 ±0.17[a]

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