Effect of fenugreek seeds supplementation on growth performance, digestion coefficient, rumen fermentation and some blood metabolites of Awassi lambs

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Abstract

Twelve Awassi lambs with 5-6 month average 25.13±0.33 kg body weight (BW) were used to investigate the effect of adding graded levels of fenugreek seeds (FS) to the diet on growth performance, nutrient digestibility, rumen fermentation, and some blood metabolites. The lambs were randomly assigned to four treatments (3 lambs per treatment) in a completely randomized design. Treatment diets were control diet without FS 0 g/head/day (FS0), control diet plus 2.5gFS/head/day (FS1), control diet plus 5gFS/head/day (FS2), and control diet plus 7.5gFS/head/day (FS3). Lambs were housed in individual pens and received 600g of concentrate diet once a day with ad libitum choice of rice straw as roughage. Body weight and feed intake were recorded. At the day 42, the digestibility trial was performed for all lambs with same diets. Rumen liquor and blood samples were withdrawn from all the lambs at the last day of digestibility trial. Results showed that increasing level of FS did not improve (P>0.05) feed intake, live weight gain (LWG) and feed conversion ratio (FCR). Fenugreek seeds addition had no effect (P>0.05) on diet digestibility of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF). Results also showed that fenugreek seeds administration did not affect (P>0.05) ruminal pH, ammonia-nitrogen (NH3-N) and total volatile fatty acids (TVFA’s) concentration. The NH3-N and TVFA’s concentrations were tended (P>0.05) to decrease as levels of FS increased in the diet. Serum glucose (SG), serum total protein (STP) and serum urea nitrogen (SUN) were not affected also by increasing levels of FS.

It can be concluded; supplementation of fenugreek seeds in the diets of fattening Awassi lambs did not improve growth performance, nutrient digestibility and ruminal fermentation without adverse effects on blood metabolites.

Keywords: Fenugreek seeds, growth performance, digestibility, rumen fermentation, blood metabolite, Awassi lambs
تأثير اضافة بذور الحلبة على الإداة الانتاجي ،الهمض، تخمرات الكرش وبعض معايير الدم لدى الحمالة

المستخلص

تم استخدام اثني عشر حملا عواميا بعمر 6-7 أشهر ويشمل وزن جسم 25.13±0.33 كغم لبيان تأثير اضافة مستويات تربيعية من بذور الحلبة في زيادة الوزن، ف嗜اع العناصر الغذائية، مختبرات التخمر في الكشر وبعض صفات الدم. وتم توزيع الحمالة عشوائيا على أربعة ماعومات (3 حمالة لكل معاومة) في تصميم نمطي تجريبي، وكانت المعالق علية قياسية بدون أي اضافات (FS0)، علية قياسية مع اضافة 2.5 غم حلبة أراس/يوم (FS1)، علية قياسية مع اضافة 5 غم حلبة أراس/يوم (FS2)، علية قياسية مع اضافة 7.5 غم حلبة أراس/يوم (FS3). ووضعت الحملان في اقفاص فردية وعشرية عند الواحدة يوميا على 600جم من المركب وعلى تبن الزر المقطع بشكل جزئي. وتم تسجيل وزن الجسم والسبيل من العلائم. وفي اليوم 42 تم أجراء تجربة هضم على جميع الحمالة واستخدام نفس العلائق. كما تم سحب عينات من سائل الكشر والدم في نهاية التجربة. أظهرت النتائج أن زيادة مستوي المعادلة بذور الحلبة لم يؤدي إلى حصول زيادة معنوية (P>0.05) في النتائج. وبناء على النمو، ف嗜اع العناصر الغذائية، وتعليقات التخمر في الكرش، ومستويات الأحماض الأمونية، والبروتينات الخام، ومستويات الأحماض الأمونية، والبروتينات الخام لم تتأثر معنويًا (P>0.05). كما أن الإس الهيدروكربونات والأنابيب الدهنية الطريق في سائل لم تتأثر معنويًا (P>0.05). وبناء على النتائج، يمكن الاستنتاج بأن زيادة ماء الاعضاء بذور الحلبة في علاج تحسن كفاح الماعومات العاداتية وتعزيز التخمر في الكشر وليس لها تأثير سلبي على الدم. 

الكلمات المفتاحية: بذور الحلبة، الإداة الانتاجي، الهمض، تخمرات الكرش، معايير الدم، حمالة عوامية

Introduction:

Fenugreek (Trigonella foenum-graecum L.) is an annual legume, is extensively cultivated in most regions of the world for its medicinal value and it is one of the oldest known medicinal plant from ancient times (1). During last decade, great attentions towards using of medicinal plants as natural feed additive for animal nutrition not only public concern about the potential of growth promoters and antibiotic residue in meat and milk (2), but these natural feed additive contain many of secondary components such as galactomannans, diosgenin and free amino acid which were good sources of well-known medicinal values to both humans and animals (3,4). Fenugreek seeds contain a substantial amount of phospholipids, glycolipids, oleic acid, linolenic acid, linoleic acid, choline, vitamins A, B1, B2, C, niacin acid, niacin, and many other functional elements as recently reviewed by Ahmed et al. (5).

Fenugreek seeds contain 10, 3.8, 27.3g/kg of total phenol, total tannin and saponins, respectively (6). Numerous studies focus on the positive effect of FS on enhancing lactation performance of ewes and doses (7, 8, 9). However, few studies have been conducted to ascertain the effect of FS on growth performance (10, 11, 12), rumen fermentation and nutrient digestibility (13) in lambs. Therefore, the objective of the present study was to investigate the effect of graded levels of FS addition on growth performance, nutrient digestibility, rumen fermentation and some blood metabolites of Awassi lambs.

Materials and Methods:

The study was conducted at Ruminant Animal Farm belong to Department of Animal Production, Faculty of Agriculture, University of Kufa, Al-Najaf, Iraq.

Animal, feeding and management
Twelve Awassi male lambs of 5-6 months of age with an average live initial body weight (BW) of 25.13±0.33 kg were randomly assigned to four dietary treatments (3 lambs per treatment) in a completely randomized design. Lambs were housed in individual pens (1.5m×2m) and fed a standard diet consisting of concentrate and roughage. The experimental animals were received 600g concentrate diet once a day at 8.30 a.m. with ad libitum choice of chopped rice straw as roughage. Fresh drinking water was available all the time. Treatment diets were FS0=Fenugreek seeds 0 g/head/day, FS1=Fenugreek seeds 2.5 g/head/day, FS2 =Fenugreek seeds 5 g/head/day, FS3=Fenugreek seeds 7.5 g/head/day. Fenugreek seeds were added to the concentrate diet and mixing daily just before feeding.

**Feeding trail**

An adaptation period of 7 days was allowed prior to the experimental period started. Feed offered and refused were recorded daily to measure feed intake and sampled weekly and stored for subsequent analysis. Lamb weights were recorded weekly before the morning feeding. Then, daily live weight gain (DLWG) was calculated by subtraction the initial BW (IBW) from the final BW (FBW) and then divided by the duration of the experiment (42 days).

**Digestibility trail**

Digestibility trial was conducted at the end of feeding trial with same lambs and diets. Lambs were fitted with facial collection bags for 2 days as an adaptation period followed by 5 days for feces collection during which daily feed intake and refusal feed of each lamb was recorded before morning feeding. Representative samples (10%) of feces were collected over conclusive days, kept at -18ºC. On the last day of the collection period, the composite feces samples were thawed and thoroughly mixed and subsamples of fecal were dried in an oven at 60ºC for 72 h and ground in a Wiley mill, to pass a 1 mm sieve screen and kept in airtight plastic bags pending analysis. Samples of feed offered and feed refused were also collected every day and subsampled at the end of digestibility trail.

**Rumen fermentation characteristics**

At the last day of digestibility trail, rumen liquor samples were withdrawn using stomach tube from all lambs before morning feeding (0 h), 3 and 6 h post feeding. Ruminal pH was measured immediately after obtaining sample using digital portable pH meter (HANNA instrument). Rumen liquor samples were stained through four layers of cheesecloth and preserved by adding of 2 ml of 0.2N HCl and kept frozen for later analysis. Ammonia-N (NH₃-N) concentration (mg/100ml) was determined following the procedure of AOAC (14), while total volatile fatty acids (TVFA’s) concentration (Mm) was assayed according to procedure of Warner (15).

**Blood sampling and Sera harvesting**

Blood samples were withdrawn by the jugular vein puncture from all the lambs at the last day of digestibility trail (2h post feeding) in Vacutainer® tubes without anticoagulant allowed to clot for 2h before centrifugation at 3000 rpm for 20 minutes. Sera were harvested, labeled and stored at -18ºC till biochemical analysis. Serum glucose (SG), serum total protein (STP), and serum urea nitrogen (SUN) concentrations were determined by an automated biochemical analyzer using the commercial kits (Biomagrib, Tunisia) according to the manufacture’s instruction based on the methods of Trinder (16) Henry et al.(17), Patton and Crouch (18), for SC, STP and SUN respectively.

**Chemical analysis and calculations**

Ingredient of the concentrate diet and Chemical analysis of concentrate diet, rice straw and fenugreek seeds used in this study are shown in Table 1. Fenugreek seeds (Trigonella-foenum-graecum L.), chopped
rice straw and concentrate feed ingredients were purchased from the local market in Al-
Najaf. Feed and fecal samples were ground in a Wiley mill through a 1 mm screen and
analysis for dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF)
and Ash according to standard methods of AOAC (14), Nitrogen free extract (NFE) was
calculated by difference \[NFE= OM-(CF + CP+ EE)\]. Neutral detergent fiber (NDF)
and Acid detergent fiber (ADF) were completed according to Van Soest et al. (19)
without sodium sulfate and α amylase for NDF analysis. Both NDF and ADF were
expressed without residual ash. Metabolizable energy (ME) was calculated
following the equation described by MAFF (20): ME (MJ/kg DM) = 0.012CP
+0.031EE+0.005CF+0.014NFE.

Table1. The ingredient and chemical composition of concentrate diet, rice
straw and fenugreek seed used in this experiment on DM %basis

<table>
<thead>
<tr>
<th>Item</th>
<th>Concentrate diet</th>
<th>Rice straw</th>
<th>Fenugreek seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ingredient %</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley grain</td>
<td>44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn grain</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soybean meal</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat bran</td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemical composition %</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Matter (DM)</td>
<td>91.73</td>
<td>94.91</td>
<td>93.32</td>
</tr>
<tr>
<td>Organic Matter (OM)</td>
<td>94.18</td>
<td>90.08</td>
<td>96.37</td>
</tr>
<tr>
<td>Crude protein (CP)</td>
<td>15.35</td>
<td>2.86</td>
<td>26.64</td>
</tr>
<tr>
<td>Crude Fiber (CF)</td>
<td>7.88</td>
<td>35.06</td>
<td>8.42</td>
</tr>
<tr>
<td>Ether Extract (EE)</td>
<td>2.99</td>
<td>1.30</td>
<td>7.79</td>
</tr>
<tr>
<td>Nitrogen Free Extract (NFE)</td>
<td>67.96</td>
<td>50.86</td>
<td>53.52</td>
</tr>
<tr>
<td>Neutral Detergent Fiber (NDF)</td>
<td>31.94</td>
<td>72.92</td>
<td>35.45</td>
</tr>
<tr>
<td>Acid Detergent Fiber (ADF)</td>
<td>9.56</td>
<td>40.49</td>
<td>16.49</td>
</tr>
<tr>
<td>ME(Mej/Kg DM)*</td>
<td>12.68</td>
<td>9.62</td>
<td>13.53</td>
</tr>
</tbody>
</table>

* Metabolizable energy (ME) ME (MJ/kg DM) = 0.012CP +0.031EE+0.005CF+0.014NFE

**Statistical Analysis:**

Data were statistically analyzed as a completely randomized design (CRD) using
ANOVA procedures of the statistical analysis system SAS (21) with the following
model: \[Y_{ij}= \mu +L_i + e_{ij}\], Where: \(Y_{ij}\) = the
observation of the parameter; \(\mu\) =overall
means; \(L_i\) = is effect of the graded level of
FS; \(e_{ij}\) = the random error. Significant
differences among means were detected
using Duncan's multiple range test (22). Data were presented as mean ± standard
error (SE).

**Results**

**Growth performance and Feed intake**

Statistical analysis revealed that final
body weight (FBW), total body weight gain
(TBWG), daily body weight gain (DBWG) and feed conversion ratio (FCR) of Awassi lambs were not significantly (P > 0.05) affected by increasing levels of FS supplemented to the diet (Table 2). No significant differences (P>0.05) were observed in DM, OM, CP and ME intakes for lambs fed diet supplemented with graded levels of FS (Table 2).

Table 2. Growth performance and feed intake of Awassi lambs fed graded levels of FS (Means±SE)

<table>
<thead>
<tr>
<th>Item</th>
<th>Fenugreek seeds dose (g/head/day)</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS&lt;sub&gt;0&lt;/sub&gt;(0)</td>
<td>FS&lt;sub&gt;1&lt;/sub&gt;(2.5)</td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBW(kg)</td>
<td>25.48±0.68</td>
<td>24.47±0.57</td>
</tr>
<tr>
<td>FBW(kg)</td>
<td>31.18±0.66</td>
<td>30.19±0.42</td>
</tr>
<tr>
<td>TBWG (kg)</td>
<td>5.70±0.16</td>
<td>5.73±0.34</td>
</tr>
<tr>
<td>DBWG (g)</td>
<td>135.79±1.75</td>
<td>136.35±2.16</td>
</tr>
<tr>
<td>FCR(g/ g)</td>
<td>9.32±0.78</td>
<td>9.34±0.65</td>
</tr>
<tr>
<td>Feed intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM (g/day)</td>
<td>1263.56±17.03</td>
<td>1265.32±13.35</td>
</tr>
<tr>
<td>OM (g/day)</td>
<td>1085.23±14.63</td>
<td>1085.14±20.06</td>
</tr>
<tr>
<td>CP (g/day)</td>
<td>142.27±1.92</td>
<td>142.91±2.64</td>
</tr>
<tr>
<td>ME(MJ/day)</td>
<td>12.72±0.18</td>
<td>12.73±0.25</td>
</tr>
</tbody>
</table>

None of the difference reached significant levels, NS = Non-significant; SE = Standard error; IBW = Initial body weight; FBW = Final body weight; TBWG = Total body weight gain; DBWG = Daily body weight gain, FCR = Feed conversion ratio.

FS<sub>0</sub> = Fenugreek seeds 0 g/head/day, FS<sub>1</sub> = Fenugreek seeds 2.5 g/head/day, FS<sub>2</sub> = Fenugreek seeds 5 g/head/day, FS<sub>3</sub> = Fenugreek seeds 7.5 g/head/day

Nutrient digestibility

The apparent nutrients digestibility of diet in Awassi lambs fed graded levels of FS are shown in Table 3. The digestibility of DM, OM, CP, NDF and ADF were not affected significantly (P>0.05) by increasing levels of FS. There is a slight decrease (P>0.05) in NDF and ADF digestibility as levels of FS increased in the diet.

Table 3. Nutrient digestibility of Awassi lambs fed graded levels of FS (Means±SE)

<table>
<thead>
<tr>
<th>Digestibility %</th>
<th>Fenugreek seeds dose (g/head/day)</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS&lt;sub&gt;0&lt;/sub&gt;(0)</td>
<td>FS&lt;sub&gt;1&lt;/sub&gt;(2.5)</td>
</tr>
<tr>
<td>DM</td>
<td>70.69±2.92</td>
<td>70.92±2.02</td>
</tr>
<tr>
<td>OM</td>
<td>73.50±3.03</td>
<td>72.85±1.79</td>
</tr>
<tr>
<td>CP</td>
<td>76.36±2.22</td>
<td>76.10±1.42</td>
</tr>
<tr>
<td>NDF</td>
<td>66.66±0.98</td>
<td>64.23±1.50</td>
</tr>
<tr>
<td>ADF</td>
<td>45.23±2.38</td>
<td>43.48±1.76</td>
</tr>
</tbody>
</table>
None of the difference reached significant levels NS = non-significant; SE=Standard error; DM=Dry matter, OM=Organic matter; CP=Crude protein; NDF= Neutral detergent fiber; ADF= Acid detergent fiber.
FS0=Fenugreek seeds 0 g/head/day, FS1=Fenugreek seeds 2.5 g/head/day, FS2=Fenugreek seeds 5 g/head/day, FS3=Fenugreek seeds 7.5 g/head/day

Rumen fermentation characteristics
Mean value of Ruminal pH, NH3-N and TVFA’s concentrations in the rumen liquor of Awassi lambs fed graded levels of FS are shown in Table 4 and Figures 1, 2, and 3. The lowest pH value and peak TVFA’s concentrations were recorded at 3h post-feeding ,while NH3-N concentrations reached peak at 3h post-feeding and then decreased at 6h post feeding for all diets. Regards effect of graded levels of FS supplementation, the concentrations of NH3-N, TVFA’s and ruminal liquor pH were similar among treatments (P>0.05). Data also showed that NH3-N and TVFA’s concentrations were tended (P>0.05) to decrease as levels of FS increased.

<table>
<thead>
<tr>
<th>Rumen fermentation</th>
<th>Fenugreek seeds dose (g/head/day)</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS0(0)</td>
<td>FS1(2.5)</td>
</tr>
<tr>
<td>Ruminal pH</td>
<td>6.23±0.17</td>
<td>6.29±0.20</td>
</tr>
<tr>
<td>NH3-N (mg/100ml)</td>
<td>18.88±0.40</td>
<td>18.52±2.19</td>
</tr>
<tr>
<td>TVFA’s (Mm)</td>
<td>117.74±0.53</td>
<td>117.59±1.41</td>
</tr>
</tbody>
</table>

SE=standard error; NS=No-significant; NH3-N= Ammonia nitrogen; TVFA’s= Total volatile fatty acids.

FS0=Fenugreek seeds 0 g/head/day, FS1=Fenugreek seeds 2.5 g/head/day, FS2=Fenugreek seeds 5 g/head/day, FS3=Fenugreek seeds 7.5 g/head/day

Figure 1. Diurnal pattern of Ruminal pH
Serum metabolites

Serum metabolites such as SG, STP and SUN concentrations of Awassi lambs fed graded levels of FS are illustrated in Table 5. Results showed no significant difference (P>0.05) among these constitutions except for SUN concentrations.

Table 5. Serum metabolites of Awassi lambs fed graded levels of fenugreek seeds (Means±SE)

<table>
<thead>
<tr>
<th>Serum metabolites</th>
<th>Fenugreek seeds dose (g/head/day)</th>
<th>Sign.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS₀(0)</td>
<td>FS₁(2.5)</td>
</tr>
<tr>
<td>SG(mg/100ml)</td>
<td>67.32±5.33</td>
<td>66.49±2.10</td>
</tr>
<tr>
<td>STP (g/100ml)</td>
<td>6.95 ±0.12</td>
<td>7.18±0.20</td>
</tr>
<tr>
<td>SUN(mg/100ml)</td>
<td>42.35±0.78</td>
<td>41.05±0.80</td>
</tr>
</tbody>
</table>

SE = standard error; NS= non-significant;
SG= serum glucose; STP= serum total protein; SUN= serum urea nitrogen;
FS₀=Fenugreek seeds 0 g/head/day, FS₁=Fenugreek seeds 2.5 g/head/day, FS₂=Fenugreek seeds 5 g/head/day, FS₃=Fenugreek seeds 7.5 g/head/day.
Discussion

The results obtained in the current study were agreed with results reported by Sahin et al. (10) who found that feed intake, body weight gain, daily gain weight and FCR were not affected when inclusion FS at 0, 2, 4 and 8% in the diet of growing Awassi lambs. Al-Isawi (11) and Dosky and Taher (12) also observed similar results in Hamadani and Karadi lambs with no different in feed intake, total gain, average daily gain and feed conversion ratio. However, some studies reported increasing gain due to the addition of FS to diet of lambs (13, 23, 24) male kids (25). In addition, Hassan et al. (26) reported that oral administration of 2.5 g FS/kg BW led to increases in body weight gain, while 5 g FS/kg BW did not change body weight gain of Sudanese ewes. Atta Elmnan et al. (27) reported that the intake of DM and CP were increased in Nubian goats fed on diet supplemented with 5, 10 and 15% of FS as compered with those fed control diet without FS. Al-Sherwany (9) reported that DMI were significantly increased in Awassi ewes fed 1.2gFS/Kg BW as compered with those fed 0 and 0.6gFS/kg BW, they attributed this improvement in feed intake due to the presence of saponins in FS which stimulate eating center in hypothalamus similar like in non ruminant animal (28). Moreover, Saleh (23) found that DM intake of Barki rams (52.6 kg) increased with 20g FS/head/day and decrease with 40g FS/head/day. However, Mir and Kumar (29) also reported that DMI and CPI were not affected by supplementation 3% FS in goats diet. Similar results reported diary goats (30). The inconsistency of these results may be due to diet composition, levels of FS in the diet, level of feeding and plan of nutrition. Feed intake could not largely be affected by dietary inclusion of saponins as reviewed by Patra and Saxena (31). In addition, Aazami et al. (32) found that DMI and growth performance of small ruminants did not improve by graded levels of saponins in the diets.

The available literatures on the effect of FS supplementation on nutrients digestibility are also variable. Results of the current study revealed insignificant difference in the digestibility of DM and other nutrient (OM, CP, NDF and ADF) among diets. These results were agreed with results obtained in calves steer (33), lambs (13), and goats (30). In contrast, others reported significant increase in the digestibility of DM, OM and CP in goats (25, 27, 29). In the current study, NDF and ADF digestibility were numerically decreased as levels of FS increased in the diet of Awassi lambs. Saleh (22) noted a linear decrease of CF digestibility in sheep receiving FS (20-40gFS/head /day). Atta Elmnan et al. (27) obtained similar results in goats. In contrast, Abbas et al. (13) and Mir and Kumar (29) reported increase NDF and ADF digestibility in the diet of sheep and goats. In calves steer the administration of FS has no effect on NDF and ADF digestibility (33). A number of studies have demonstrated that saponins containing plants or saponins extracts did not affect digestibility (3, 32, 34) and the digestibility response of saponins seems to be dose dependent (31). The inconsistency of these results may be due to diet composition, levels of FS in the diet.

The finding obtained in the current study on rumen fermentations are supported by Abo-Donia et al. (33)who found that ruminal pH value, NH₃-N and TVFA’s concentration were in beef steers fed 3% FS were similar to the value of control group. Mir and Kumar (29) also noted that FS supplementation did not affect on ruminal pH in goats. In contact, Atta Elmnan et al. (27) and Salama et al. (25) reported that increasing levels of FS in the diet of goats lead to significant increase in NH₃-N and TVFA’s concentrations. Saponins, contained
in fenugreek seeds, have antimicrobial properties, and suppress the growth of ciliate protozoa, peptidase-producing bacteria, and cellulolytic bacteria in the rumen (36). The non significant reduction in NH$_3$-N concentration obtained in the current study may be due to antiprotozoal effect of saponins in FS at their high dose (37). According to Makkar et al. (35) saponins alter rumen fermentation by increasing digestibility (either increase or not affect) and increase the microbial protein synthesis. In the current study the addition of FS did not affect the apparent digestibility of lambs, which might be due that FS in the current study not alert rumen fermentation.

The results concerning SG concentrations obtained in the current study are in accordance with results previously reported by several authors (8, 9, 11, 13, 22) who reported that increasing levels of FS in the diet did not affect on SG concentrations in sheep and goats. Similar results reported by Abo-Donia et al. (33) in calves steer. Others reported that supplemented FS led to decrease SG concentration in ruminant animal (7, 38), they attributed that to hypoglycemia effect of FS and stimulate pancreatic insulin or may be that FS stimulate pancreatic insulin secretion. The insignificant differences in STP concentrations obtained in the current study are in accordance with results reported by (9, 13, 22). Others reported that FS increased STP concentrations in ruminant (38).The non significant difference in SUN concentration in the current study are in accordance with results previously reported by several authors (13, 22), kids (29, 30) who reported that increasing levels of FS in the diet did not affect on SUN concentrations in lambs and kids. The SUN concentrations could be useful as an indicator of protein status within a group of sheep and could help to point out potential problem with a feeding regime (39). In addition, Aazami et al. (32) found that SG and SUN concentration of sheep and goats did not alerted by graded levels of saponins in the diets. Moreover, most serum metabolites values estimated in the present study are within the normal ranges of healthy Awassi male lambs published by (40).

It can be concluded; supplementation of fenugreek seeds in the diets of fattening Awassi lambs did not improve growth performance, nutrient digestibility and ruminal fermentation without adverse effects on blood metabolites.

References


