Impact of Adding Rumen Protected Lysine or/and Methionine on Some Wool Characteristics in Barki Sheep

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ABSTRACT

Twenty four adult Barki ewes were used to investigate the effect of addition of rumen protected amino acids, lysine or/and methionine on some wool characteristics. This study was carried out from September 2016 to February 2017. Animals were divided into four groups (6ewes/group). The first group (Control): fed only the control diet, second group (LYS): fed the control diet and rumen protected lysine (6g Lysi pearl /kg concentrate, 3g/animal/day), third group (MET): fed the control diet and rumen protected methionine (14g Smartamin/kg concentrate, 7g /animal/day) and fourth group (LYS+MET): fed the control diet and mixture of (3g LYS and 7g MET/animal/day) for six months. Some wool measurements were investigated such as fiber length, fiber diameter, staple strength and wool growth per 10 cm² and clean wool yield. Results showed that supplementing methionine caused significant (P<0.05) increase in fiber length, fiber diameter, staple strength and clean wool yield. Lysine increased fiber length significantly (P<0.05), but did not affect clean wool yield and caused small increase in both staple strength and fiber diameter. Supplementing of (mixture of methionine and lysine) increased significantly fiber length, wool yield and staple strength, but caused insignificant increase in clean wool production per 10cm², but had no significant effect on fiber diameter. From these results, it can be concluded that addition of rumen protected methionine (7g Smartamin/animal/day) for six months enhanced significantly wool characteristics of Barki ewes (fiber length, fiber diameter, staple strength and clean wool yield).

Keywords: Sheep, lysine, methionine, wool characteristics, amino acids.

INTRODUCTION

It is known that fiber growth rate and its composition can be influenced by the availability of the amino acids which contain Sulphur to the follicle and a high proportion of the high-sulphur amino acids cysteine (Corbett 1979). In this respect, Graceva (1969) stated that wool growth increased by 17.9, 33.7 and 42.2% above basal when 3 g /animal / day of methionine was given orally, subcutaneously or infused into the abomasum, respectively. Bird and Moir (1972) observed an increasing the wool growth in sheep above the controls, when methionine was continuously infused ruminally or abomasally, respectively.

Lysine plays an important role for proteins synthesis in the inner root sheath, the area of the follicle of fiber where the growth of fiber is initiated (Rogers 1964). The importance of lysine for fiber growth may be related to its high content in its tone proteins which are active in cell division (Busch 2012). Recently, the increase of the population in Egypt and the expansion of Egyptian wool industry have led to increasing the demand for wool textile and hence the raw wool. This has created a great necessity to make studies for improving the wool produced locally to standardize the manufacturing needs to produce woolen textiles satisfying the consumer’s taste and decreasing the imported expensive wool.

Therefore, aim of this study was to investigate the effect of addition of rumen protected amino acids, lysine or/and methionine on some wool characteristics in Barki sheep.

MATERIALS AND METHODS

The present study was conducted at Maryout Research Station, belonging to Desert Research Center, Ministry of Agriculture and Land Reclamation (Latitude 31.02°N, longitude 29.80°E) located 35-km south-west of Alexandria. The experiment was carried out from September 2016 to February 2017.

Animals:

Total of 24 Barki adult ewes (non pregnant) were used in this study. Age of ewes ranged between 3 and 4 years and average live body weight was 28.95±1.37kg. The experimental animals were healthy and free from diseases. They were fed on Berseem hay (Trifoliumalexandrinum), offered ad. libitum plus concentrate feed mixture (14%CP and 60%TDN) at a rate of ½ kg/ewe/day, which was composed of cottonseed cake 50%, wheat bran 18%, yellow corn 15%, rice polish 11%, molasses 3%, limestone 2% and common salt, 1%. Drinking water was provided twice daily.

Experimental design:

The study included four groups of Barki adult ewes (6 ewes/group). The first group (Control): fed only the control diet, second group (LYS): fed the control diet and rumen protected lysine (6gLysi pearl /kg concentrate, 3g /animal/day), third group (MET): fed the control diet and rumen protected methionine (14g Smartamin / kg concentrate, 7g /animal/day) and fourth group (LYS+MET): fed the control diet and mixture of 3gLYS and 7gMET/animal/day). The rumen protected amino acids in this experiment were imported from United Biomed Egypt.

Wool characteristics:

Wool samples were harvested from patch (10 cm2) located in the left mid-side position of each ewe at December (after 3 months) and from right side position at February (after 6 months, end of treatments) to record wool measurements as the following:

Fiber length (FL):

Average lengths of ten fibers taken randomly from each greasy sample were estimated by using a rule to the nearest 0.5 cm. The length was taken as the distance between the beginning and the end of each fiber.

Fiber diameter (FD):

Short sections of approximately 400 fibers were prepared and put in paraffin oil on glass slides and covered with glass cover. Fiber diameter was measured by using a microscope and image captured by image analysis software (Zen, 2012, Blue edition) and (device Carl-Zeiss)
RESULTS AND DISCUSSION

Fiber length of wool:

Results presented in Figure (1) showed that fiber length significantly (P<0.05) increased by supplementing methionine, lysine and mixture of methionine and lysine compared with control. Furthermore, the fiber length was higher in all treatments after 6 months compared with 3 months of experiment. Our results are in agreement with several authors (Reis and Tunks, 1978; Reis et al., 1991), who found that the omission of methionine from a mixture of amino acids reduced wool growth and decreased length growth rate. Methionine has specific effects on wool growth, it may be related to the formation of S-adenosyl-L-methionine. This compound is a methyl donor for many important reactions which may influence wool growth (Reis 1982). It is also an intermediate in the biosynthesis of the polyamines, spermidine and spermine, which appear to have a role in nucleic acid and protein synthesis, especially in actively dividing tissues (Tabor and Tabor 1976; Williams-Ashman and Canellakis 1979).

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In the same way, Reis (1991) also indicated a large effect of lysine intake on the rate of wool growth of pre-ruminant lambs receiving all their nutrients via the abomasum. Sahlu and Fernandez (1992) found that there was a large increase in fiber length with infusion of 2 g of lysine per day. Lysine plays an important role for wool growth, this role may be partly related to the high content of lysine in histone proteins, which are important for cell division, and inner root sheath proteins (Reis, 1989). On the other hand, Reis and Tunks (1978) observed that wool fiber length decreased when lysine was added to a lysine deficient diet. While, Sahlu and Fernandez (1992) stated that average growth rate of wool fiber length decreased significantly when infused lysine and methionine together than the average of each amino acid infused individually. Infusion of both methionine and lysine into the abomasum resulted in increasing wool growth rate, suggesting that methionine may be the first (Doyle and Bird, 1975) and lysine the second limiting amino acid (Storm and Orskov, 1984) in wool growth.
Wool fiber diameter:

Addition of rumen protected amino acids tended to make a slight increase in fiber diameter especially with lysine and lysine with methionine compared with control group (31.07 µm, 31.93 µm and 29.34 µm, respectively). Data in Figure, (2) showed that supplementation with methionine leads to significant increase in fiber diameter (37.39 µm) compared with other groups. Our results are in agreement with Sahlu and Fernandez (1992), who reported that infusion of methionine increased fiber diameter and mixture of lysine and methionine had no significant effect on fiber diameter. Galbraith (2000) stated that the increased diameter of Mohair fibers following methionine supplementation is due to the suggested role of an increased intermediate filament-associated protein fraction in producing a greater volume of cells of the hair cortex. In addition, methionine performed some specific function, perhaps in wool protein synthesis or cell division according to Reis et al. (1990). In this line, Reis and Tunks (1978) and Reis et al. (1990) also stated that the omission of methionine from a mixture of amino acids decreased fiber diameter.

Clean wool production per 10 cm² and yield %:

Data in Table (1) revealed that addition of methionine resulted significantly (P<0.05) in higher clean wool production per 10 cm² compared with the other groups, whereas addition of lysine and both methionine and lysine groups had an increase compared with control group. Increase in fiber diameter and fiber length are the reason for the increase happened by methionine supplementation. Stephenson et al., (1991) found that methionine tended to increase wool productivity. Moreover, Infusion of methionine tended to increase wool production by 20 % compared with the control group (Helal, 2004). Clean wool yield takes the same trend of clean wool per studied area. In the same way, Galbraith (2000) reported that methionine stimulated raw fiber yields of both Angora and Cashmere goats. Sahlu and Fernandez (1992) revealed that grease and clean mohair yields were increased with methionine infusion. The same results conducted with sheep were reported by many authors (Reis, 1967; Williams, et al., 1972; Reis et al., 1973).

Table 1. Effect of addition rumen protected amino acids on some wool characteristics of Barki ewes (LSM ± SE) at the end of treatment.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Control</th>
<th>LYS</th>
<th>MET</th>
<th>LYS+MET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean wool production</td>
<td>5.86±0.59</td>
<td>7.29±0.54</td>
<td>8.31±0.54</td>
<td>7.13±0.54</td>
</tr>
<tr>
<td>per 10 cm²</td>
<td>55.48±2.15</td>
<td>54.66±2.15</td>
<td>64.25±2.15</td>
<td>58.53±2.15</td>
</tr>
<tr>
<td>Wool yield (%)</td>
<td>30.98±1.91</td>
<td>34.24±1.91</td>
<td>42.67±1.91</td>
<td>36.66±1.91</td>
</tr>
<tr>
<td>Staple strength N/Ktex</td>
<td></td>
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</tr>
</tbody>
</table>

Mean values with similar superscripts within the same row are not significantly different.

Stable strength:

Data in Table (1) show that the staple strength increased significantly (P<0.05) by adding methionine or lysine and methionine compared with control. Whereas, addition of lysine did not cause significant effect on staple strength. Likewise, the supplementation of low and high methionine by intraperitoneal injection increased staple strength significantly as reported by Bray et al, (1993). Moreover, Hynd et al (2015) revealed that the omission of methionine from the mixture consistently reduced staple strength.

Wool content of amino acids:

Data presented in table (2) showed that adding rumen protected amino acids lysine or/and methionine caused a significant (P<0.05) increase in lysine, serine, glutamic acid and tyrosine, while it caused significant (P<0.05) decrease in methionine, glycine, valine, leucine, proline and ammonia compared to the control group.

This modification seems to be due entirely to an alteration in the overall composition of the high-sulfur proteins and to an increase in their proportion in the fiber. These variations are not the result of a change in the composition of individual proteins, but are due to alterations in their relative proportions and to the initiation of the synthesis of new proteins, many of which are extremely rich in cystine. It is suggested that the heterogeneity of the high-sulfur proteins may be due, in part, to similar changes in composition caused by natural variations in the nutrition of sheep. This is agreement with Gilespie et al. (1969), who stated that when the diet of sheep is supplemented by the infusion of sulfur-containing amino acids into the abomasum, there were changes in amino acid composition of wool, with significant increases in cystine, histidine, threonine, serine and proline. There were decreases in the contents of aspartic acid, leucine and phenylalanine. These differences would be consistent with a simple increase in the proportion of high sulphur proteins in wool after sulphur-enrichment, for high-sulphur proteins, compared with low sulphur proteins, show variations in composition of the same kind, namely a higher content of S-carboxymethylcysteine, histidine, threonine, serine and...
proline and a lower content of aspartic acid, leucine and phenylalanine. In the present study, it was observed that proline decreased significantly. Responses could differ with environmental conditions, the basal diets, doses of amino acids and the methods of giving amino acids for the animal. The difference in responses needs further studies.

Table 2. Effect of addition of rumen protected amino acids on wool content of amino acids (%) in Barki ewes (LSM ± SE).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Control</th>
<th>LYS</th>
<th>MET</th>
<th>LYS+MET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysine</td>
<td>3.20±0.04&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.30±0.25&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.10±0.29&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.80±0.28&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cysteine</td>
<td>6.13±0.21</td>
<td>6.84±0.39</td>
<td>6.60±0.38</td>
<td>6.14±0.35</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.37±0.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.34±0.02&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.30±0.02&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.28±0.02&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Asparagine</td>
<td>7.41±0.11</td>
<td>7.23±0.42</td>
<td>7.20±0.42</td>
<td>7.10±0.41</td>
</tr>
<tr>
<td>Threonine</td>
<td>5.95±0.07</td>
<td>5.82±0.33</td>
<td>5.70±0.33</td>
<td>5.60±0.32</td>
</tr>
<tr>
<td>Serine</td>
<td>9.04±0.04&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.46±0.61&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.12±0.58&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>10.62±0.61&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Glutamic</td>
<td>15.02±0.16&lt;sup&gt;b&lt;/sup&gt;</td>
<td>19.73±1.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.26±1.11&lt;sup&gt;a&lt;/sup&gt;</td>
<td>19.40±1.12&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Glycine</td>
<td>5.65±0.12&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.10±0.29&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.82±0.28&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.80±0.28&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Alanine</td>
<td>4.55±0.06</td>
<td>5.20±0.30</td>
<td>4.73±0.27</td>
<td>4.90±0.28</td>
</tr>
<tr>
<td>Valine</td>
<td>4.44±0.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.60±0.21&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.60±0.21&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.40±0.20&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Isoleucine</td>
<td>2.76±0.10</td>
<td>2.90±0.17</td>
<td>3.12±0.18</td>
<td>2.70±0.16</td>
</tr>
<tr>
<td>Leucine</td>
<td>8.05±0.10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.94±0.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.32±0.42&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.10±0.41&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tyrosine</td>
<td>4.62±0.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.10±0.35&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.30±0.31&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.60±0.38&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>3.01±0.09</td>
<td>2.86±0.17</td>
<td>3.20±0.18</td>
<td>2.90±0.17</td>
</tr>
<tr>
<td>Histidine</td>
<td>2.81±0.14</td>
<td>2.80±0.16</td>
<td>2.60±0.15</td>
<td>2.40±0.14</td>
</tr>
<tr>
<td>Arginine</td>
<td>5.69±0.63</td>
<td>5.20±0.30</td>
<td>5.10±0.29</td>
<td>5.30±0.31</td>
</tr>
<tr>
<td>Proline</td>
<td>6.57±0.11&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.30±0.19&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.88±0.23&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.21±0.24&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ammonia</td>
<td>4.75±0.08&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.28±0.08&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.05±0.12&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.75±0.10&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Mean values with similar superscripts within the same row are not significantly different.

CONCLUSION

In conclusion, addition of rumen protected methionine (7g Smartamin /head /day) for 6 months enhanced significantly wool characteristics of Barki ewes (fiber length, fiber diameter, staple strength and clean wool yield).

REFERENCES


**Tأثير اضافة اللينسين او الميثيونين المحمي على بعض صفات الصوف في الإغاث البرقي**

والان احمد رمضان، مصطفى عبد الحليم الحرازي، وانار أحمد خليل، وآنا حميدة يوسف

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قسم النباتات والكيمياء - جامعة المنصورة

تم استخدام أربعة عشرون من نحام البرقي البالغ عبارة إختيار تأثير اضافة الأمينات الأساسية المحمية اللينسين او الميثيونين على بعض صفات الصوف. تم إجراء الدراسة خلال الفترة من شهر فبراير لسنة 2017 حتى شهر فبراير لسنة 2018. تم تقسيم الحوادث إلى أربع مجالي (١١ نبطة). تم تغذية النبطة الأولى فقط على العقلية بدون أي إضافات (المجموعة القاسية). تم تغذية النبطة الثانية على العقلية مضافة إليها اللينسين المحمي (اسيبريل) بجرعة ١٧٠ جم/كم*١٥٠ جم لكل حيوان يوميا. تم تغذية النبطة الثالثة على العقلية مضافة إليها الميثيونين المحمي (سيماتر أفين) بجرعة ١٦٤ جم/كم*١٥٠ جم لكل حيوان يوميا بينما تم تغذية النبطة الرابعة على العقلية معضفة إليها كل من اللينسين والميثيونين وذلك لمدة سنة أمه. تم اختيار بعض صفات الصوف مثل طول اللينة، قطر اللينة، قوة شد الخصيلة نحو الصوف، مساحة ١٠ سم ونسبة الصوف الطيفية. تحدد أن إضافة الميثيونين أدت إلى زيادة معنوية في قطر اللينة، طول اللينة، قوة شد الخصيلة ونسبة الصوف الطيفية. أدت إضافة اللينسين إلى زيادة طول اللينة ولكن تم تأثر على نسبة الصوف الطيفية. أيضا سببت زيادة بسيطة في كل من قوة شد الخصيلة وقطر اللينة. إضافة ميثيونين ولينسين أدت زيادة معنوية في طول اللينة، نسبة الصوف الطيفية وقوة شد الخصيلة، ولكن سبب زيادة معنوية في محسوع الصوف الطيفي، نتائج قد تكون ممكنة أن تؤثر في الميثيونين أو لينسين، ولكن يمكن أن تؤثر في مساحة ١٠ سم. كلاً، إضافة ميثيونين ولينسين لم تؤثر معنويًا على قطر اللينة، طول اللينة، قوة شد الخصيلة ونسبة الصوف الطيفية.

*محصول الصوف الطيف، وقعة شد الخصيلة.*