EFFECT OF REDUCING SUNFLOWER CAKE AND SEEDS DEGRADABILITY ON PUBERTY AND TESTICULAR MEASUREMENTS OF AWASSI LAMBS

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ABSTRACT

This study was conducted to elucidate the effect of lowering sunflower cake degradability or seeds on puberty, testicular and blood measurements of Awassi lambs. Thirty Awassi lambs with an average body weight of 25.93 ± 0.42 kg and 3-4 months old. Lambs were divided into three groups (10 lambs in each group) the first group was fed a diet contained 11% of sunflower cake (T1), the second group was fed a diet contained 11% of low degradable sunflower cake (T2), while the third group fed a diet that contained 11% of low degradable sunflower seeds (T3). The results indicated that reduce sunflower seeds degradability in (T3) led to a significant increase (p≤ 0.05) in the length of right and left testes (8.35 and 8.30 cm) respectively as compared to the T1 (7.84 and 7.77 cm) respectively and T2 (7.88 and 7.63 cm) respectively, scrotum volume increased significantly (p≤ 0.05) in the T3 165.72 cm³ as compared to the T2 151.86 cm³. Testosterone hormone concentration increased significantly (p≤ 0.01) in T3 2.81 ng/ml as compared to the T1 and T2 (1.455 and 1.75 ng/ml) respectively. Also, feeding lambs with low degradable sunflower cake (T2) and seeds (T3) enhance significantly (p≤ 0.05) seminiferous tubule diameter, germinal epithelium height, and Sertoli cells count as compared to lambs that fed sunflower cake (T1). The results indicate that reducing degradability of protein and fat sources rich in unsaturated fatty acids in the diets of lambs before puberty had a positive role in testicular development and testosterone hormone secretion at puberty.

keywords: protected protein, protected fat, puberty, testicular measurements.

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INTRODUCTION
Nutrition affects reproductive performance in two directions, the first by the hypothalamus-pituitary gland, the second by the development of the reproductive endocrine glands (5). This effect of nutrition is associated with increased body weight that determine puberty and maturity which is usually 50-70% of body weight (5,26,36). The balance of diet in its protein and energy content has a critical role in growth after weaning and weight gain (8,19), which leads to an increase in the growth testicular and testosterone secretion for the development of sexual characteristics and behavior and the production of sperm as the hormone secretion increases with the increase in growth until the age of puberty and sexual maturity (27). Moreover, the source of energy and protein affect reproductive performance, Kaur and Arora (18) and Scaramuzzi et al. (29) noticed that an increase in degradable protein feeding leads to increasing urea in the seminal plasma and negatively affects reproductive performance. Therefore, the use of the degradable protein within limits recommended NRC (23) necessary to reduce the negative impact on reproductive performance, both in males and females, (34). It was found that adding polyunsaturated fatty acids to diet subjected to processes of elongation and desaturation to produce fatty acid DHA (C22:6-3), increase phospholipids in seminal plasma, gonadotropin receptors and testosterone production (12,34). In addition, to improving semen quality because phospholipids are comprised 70% of the sperm plasma membrane composition, they can also be used as an energy source in the event of fructose deficiency, polyunsaturated fatty acids feeding also contribute to building insulin-like growth hormone (IGF-I) and increasing Ledig cell generators (5). polyunsaturated fatty acids effect on reproductive Performance is more significant when using low degradable sources like fish oil than oilseeds. This study was suggested to examine the role effect of feeding lambs with low degradable protein or fat rich in poly unsaturated fatty acid after weaning in testis development and testosterone hormone secretion at puberty.

MATERIALS AND METHODS
Thirty Awassi lambs with an average body weight 25.93 ± 0.42 kg and 3-4 months old were used in this study to clarify the effect of feeding low degradable sunflower seeds and cake in puberty, some blood parameters and histological structure of the testis lambs were allocated into three groups. the first group (T1) fed on a diet contained sunflower cake at 11%, the second group (T2) fed on a diet contained 11% low degradable sunflower cake, and the third group was fed a diet contained 11% of low degradable sunflower seeds (Table 1) lambs were fed using ad-libitum system in all groups. The degradability of sunflower cake and seeds was reduced by treatment with formaldehyde (17). Also, fresh water was provided freely during the period of study, the semen was collected from the lambs biweekly using the ejaculator method, and the age and weight at puberty were determined when the first sperm appeared in the semen. At puberty samples of blood was collected from the jugular vein, which was divided into two parts after separating the serum to estimate some blood biochemical measurements using commercial agent kits (Biolabo, French). testosterone hormone concentration was estimated using the Tosoh AiA 360, analysis technique. Testicular measurements were evaluated using a tap measurement, the circumference of the scrotum, according to Goijam et al. (15), the length and depth of the testicles using Vernia as reported Toe et al. (33), Schoeman and Combrink (30), and scrotum size according to as reported Elmaz et al. (13) using the equation. Testes volume (cm$^3$) = 0.0396x (average testis length) x (scrotal circumference)$^2$. Histological sections were prepared, as described by Luna (20). The results were analyzed statistically by using the complete random design (CRD) by the computer using the program (SAS 28), and the significance between mean was determined by the analysis of polynomial variance Duncan (9).

$Y_{ij} = \mu + t_i + e_{ij}$
$Y_{ij} = $ observation from treatment.
$T_i = $ any treatment (diet).
$E_{ij} = $ value of standard error.
RESULTS AND DISCUSSION

Results in table (2) revealed non-significant differences in the mean of initial weight between the groups being 26.15, 25.63, and 26.05 kg respectively, also, the differences were non-significant in age at puberty 179.78, 175.91, 180.00 days and weight at puberty 33.33, 33.20, and 32.81 kg respectively. The scrotal circumference was no significant in age at puberty 179.78, 175.91, 180.00 days and weight at puberty 33.33, 33.20, and 32.81 kg respectively, also, the differences between the groups being 26.15, 25.63, and 26.05 kg respectively, also, the differences in the mean of initial weight kg/day between the treatments being 22.25, 21.90, and 22.38 cm, respectively. The length of the right and left testes increased significantly (p≤ 0.05) in the third treatment (165.73 cm) compared to those fed on low-degradable seeds in the third treatment (151.86 cm). The increase of testes length and scrotum size in the third treatment may be due to the increase in energy intake from sunflower seeds (10.75 Mj/day) as compared to other treatments (9.95, 9.96 Mj/day), respectively. Moghaddam et al. (21) indicated that feeding lambs at a high level of energy led to an increase in the size of the seminiferous tubules and an increase in the proliferation of germ cells in the testis as a result to the increase in testosterone hormone concentration.

Table 2. Effect of treatments on puberty and some testis measurements.

<table>
<thead>
<tr>
<th>Traits</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight / Kg</td>
<td>26.1</td>
<td>25.6</td>
<td>26.0</td>
</tr>
<tr>
<td>Dry matter intake kg/day</td>
<td>0.980</td>
<td>0.981</td>
<td>0.950</td>
</tr>
<tr>
<td>Age at puberty / day</td>
<td>179.78</td>
<td>175.91</td>
<td>180.00</td>
</tr>
<tr>
<td>Weight at puberty / kg</td>
<td>33.33</td>
<td>33.20</td>
<td>32.81</td>
</tr>
<tr>
<td>Scrotum circumference / cm</td>
<td>22.38</td>
<td>21.90</td>
<td>22.25</td>
</tr>
<tr>
<td>Right testis length / cm</td>
<td>7.84</td>
<td>7.88</td>
<td>8.35</td>
</tr>
<tr>
<td>Left testis length / cm</td>
<td>7.77</td>
<td>7.63</td>
<td>8.30</td>
</tr>
<tr>
<td>Right testis depth / cm</td>
<td>0.13</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Left testis depth / cm</td>
<td>0.16</td>
<td>0.09</td>
<td>0.08</td>
</tr>
<tr>
<td>Scrotum volume / cm³</td>
<td>163.00</td>
<td>151.86</td>
<td>165.73</td>
</tr>
</tbody>
</table>

* a,b, Mean values within a row with different superscripts differed (P ≤ 0.05).

This was confirmed from the results in a Table 4. Which indicates that the best development of the testis in the third treatment, which was fed on fat. Boulanouer et al. (7), EL-Madawy et al. (12), Saaed and Zain (27) stated that energy has an essential role in sexual puberty and testis development in sheep. The effect of unsaturated fatty acids intake increment is related to regulating hypothalamus secretion (GnRH) of LH hormones, insulin, and leptin, which enhance testes development. (32), this result was consistent with those reported by EL-Badawy et al. (11) and EL-Madawy et al., (12) that feeding on oils high in unsaturated fatty acids led to a significant increase in the
It also agreed with El-Zelaky et al. (10) that feeding lambs on a low degradable jatropha cake led to a significant increase in scrotum size, while Dantas et al. (8) observed that the age or weight at puberty was not affected by the increased protein and energy intake (1).

Results of blood biochemical measurements in Table (3) showed that the reduction in the degradation of the sunflower cake and seeds did not lead to significant differences in total protein concentrations (6.82, 6.61, 6.89 g/dl), albumin (3.50, 3.57, 3.72 g/dl), and globulin (3.31, 3.03, 3.16 g/dl) and blood glucose concentration (66.26, 65.45, 66.64 mg/dl) respectively, urea concentration decreased significantly (p≤0.05) in the second treatment (24.94 mg/dl) compared with the highest concentration in third treatment, (29.97 mg/dl). Lowering degradability of sunflower seeds led to a significant increase (p≤ 0.01) in cholesterol concentration (89.39 mg/100ml) compared to the first 80.68 mg /dl and second treatments (62.18 mg /dl), also significant differences were recorded between the first and second treatments, a significant (p≤ 0.01) increased was noted in blood triglyceride in the third treatment (59.94 mg/dl) compared to the first and second treatments (44.60 and 48.11 mg/dl) respectively, testosterone hormone concentration in the third treatment was highest (p≤ 0.01) as compared to the first and second treatments. It is well known that feeding undegradable protein is associated with a decrease in blood urea (22), this may relate to the improved efficiency of protein utilization (25). On the other hand, it is noticed that lower sunflower seeds degradability caused an increase in blood urea, the reason for that may correlate with increasing urea percentage in the diet components of the third treatment (Table 1) Yixuan et al.(37) explained that increase urea in the diet causes an increase in blood urea, as well Umar et al. (35) explained that an increase in energy or fat in the diet leads to an increase in blood urea, which is consistent with this study.

Table 3. Effect of treatments on some blood parameters.

<table>
<thead>
<tr>
<th>parameter</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (g/dl)</td>
<td>6.8 ± 0.18</td>
<td>6.61 ± 0.07</td>
<td>6.89 ± 0.29</td>
</tr>
<tr>
<td>Albumin (g/dl)</td>
<td>3.50 ± 0.15</td>
<td>3.57 ± 0.05</td>
<td>3.72 ± 0.05</td>
</tr>
<tr>
<td>Globulin (g/dl)</td>
<td>3.31 ± 0.08</td>
<td>3.03 ± 0.12</td>
<td>3.16 ± 0.24</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>66.2 ± 2.55</td>
<td>65.4 ± 1.56</td>
<td>66.6 ± 0.21</td>
</tr>
<tr>
<td>Urea (mg / dl) *</td>
<td>27.4 ± 1.03</td>
<td>24.9 ± 0.97</td>
<td>29.9 ± 0.58</td>
</tr>
<tr>
<td>Cholesterol (mg /dl **)</td>
<td>80.6 ± 2.12</td>
<td>62.1 ± 1.10</td>
<td>89.3 ± 1.10</td>
</tr>
<tr>
<td>Triglycerides (mg/dl **)</td>
<td>4.46 ± 1.34</td>
<td>48.1 ± 1.03</td>
<td>59.9 ± 1.42</td>
</tr>
<tr>
<td>Testosterone concentration (ng / ml **)</td>
<td>1.45 ± 0.06</td>
<td>1.74 ± 0.03</td>
<td>2.81 ± 0.26</td>
</tr>
</tbody>
</table>

* a,b, Mean values within a row with different superscripts differed (P ≤ 0.05).
* a,b,c Mean values within a row with different superscripts differed (P ≤ 0.01).

In general, despite the differences between the treatments in the concentration of urea but it is close was close to the normal range in the blood 26.6-45.6 mg/100 ml. Nudda et al. (24) found that low degradable flaxseed did not lead to significant differences in blood urea and proteins. El-Badawy et al. (11) mentioned that the different levels of rocket oil rich in linoleic acid in lambs diets caused a significant increase in blood urea and proteins. In our study, the increased intake of polyunsaturated fatty acids from sunflower seed was associated with increased blood cholesterol, triglycerides, and enhancing blood testosterone secretion in the third treatment, this led to an increase in a ledge cell number and the development of the size of the testicles (6,36). The results are agreed with what obtained by (4,12,14) they indicated that adding oil to the diet led to an increase in blood cholesterol and triglycerides. Esmaeili et al. (14), Behery et al. (4), El-Madawy et al. (12) found that low degradable oils such as fish oil led to a significant increase in the testosterone hormone concentration. El-Zelaky et al. (10) noticed that feeding lambs a low degradable jatropha cake led to a significant increase in testosterone concentration during 115-275 days of old, this
may be due to changes in testicular size resulting from an increased protein supply, which is positively correlated with changes in gonadotrophin and testosterone secretion (31). On other hand the results did not agree with

Table 4. Effect of treatments on histological structures of testis.

<table>
<thead>
<tr>
<th>properties</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminiferous Tubule diameter (µm)</td>
<td>172.78 ± 2.19 b</td>
<td>189.98 ± 3.69 a</td>
<td>198.50 ± 3.78 a</td>
</tr>
<tr>
<td>Germinal epithelium height (µm)</td>
<td>38.8 ± 1.51 b</td>
<td>47.4 ± 1.40 a</td>
<td>52.7 ± 2.36 a</td>
</tr>
<tr>
<td>No. of Sertoli cells/ tubule*</td>
<td>8.16 ± 0.47 b</td>
<td>9.16 ± 0.65 ab</td>
<td>10.1 ± 0.47 a</td>
</tr>
</tbody>
</table>

* a,b. Mean values within a row with different superscripts differed (P ≤ 0.05).

The results were agreed with Moghaddam et al. (21) who showed that feeding lambs on a diet high in polyunsaturated fatty acids stimulate the growth and development of the seminiferous tubules, increases germ cell proliferation, and in Sertoli cells count. Contrary to what Ahmad and others (1) stated that feeding lambs on low degradable palm oil did not lead to significant differences in the diameter of the seminiferous tubules.

Conclusion

The results show that feeding low degradable sunflower cake and seeds enrich in polyunsaturated fatty acids (PUFA) in the diet of lambs before puberty led to an increase in testes development as a result of the increase in the seminiferous tubule diameter and sertoli cells count in addition to increase testosterone hormone secretion.
ACKNOWLEDGEMENT
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REFERENCES