SKIN AND FLEECE CHARACTERISTICS OF BARKI SHEEP AS AFFECTED BY DOCKING

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SUMMARY

The present study was carried out in Tegzerty Experimental Farm for Animal Production at Siwa Oasis which belongs to the Desert Research Center, Ministry of Agriculture and Land Reclamation, Egypt. Thirteen single-born male Barki lambs (averaged 3.0±0.20 kg birth weight) were randomly assigned into two groups: (1) docked group (n= 6) and (2) control group (n= 7) to study the effect of docking on histological and histochemical characteristics of the skin together with wool characteristics in terms of clean wool yield, fibre diameter and fiber length. Results revealed that thickness of dermis increased by 17.3% in docked group compared with the control one. This could be related to the increase in reticular layer which increases by 36% in docked animals. The hypodermal thickness in the docked animals showed non-significant increase of 39.81%. Histochemically, carbohydrates were higher (P<0.01) in undocked than docked animals. Generally, the external and internal diameter of the follicles, wall thickness of primary, secondary and fibre diameter in the follicle were higher in docked than in undocked sheep. Docking appeared to have insignificant effect on fleece weight, wool yield, staple length, fibre diameter and number of medullated fibre in Barki lambs.

Keywords: Barki lambs, docking, wool characteristics, histology and histochemistry

INTRODUCTION

Barki sheep is the most popular fat-tailed sheep breed dominated in the North western part of Egypt. These sheep are kept mainly for meat production while wool is often considered as a second product. Tail docking is not a common practice in sheep farming in Middle East countries. However, several tail docking experiments have been carried out in an attempt to improve the growth, feed conversion efficiency and carcass characteristics of lambs (Alkass et al., 1985 and Shelton et al., 1991).

The fat tail plays an important role in adaptation of sheep raised under the harsh feeding conditions of arid and semi-arid regions. It was anticipated that tail docking would result in lower metabolizable energy requirements due to lower fat deposition (Al Jassim et al., 2002).

Changes in consumer preferences favoring leaner meat, the growing awareness of the bad effects of high-fat diets as well as the availability of alternative cheaper and healthier fat sources, has resulted in a reduced demand for the fat-tailed sheep in Middle East countries. Moreover, many flock owners consider that lamb docking is necessary for disease prevention and good flock management (Kent et al., 1995) and/or to prevent blowfly strike (Shut et al., 1988).

The effect of docking on growth, carcass traits, blood constituents and heat tolerance of sheep had been studied (Marai et al., 1989), while literatures dealing with the effect of docking on skin and wool are lacking. The present study was planned to shed some lights on the effect of docking on histological and histochemical structures of the skin as well as some wool characteristics in Barki sheep.

MATERIALS AND METHODS

Study location:
The present study was carried out in Tegzerty Experimental Farm for Animal Production at Siwa Oasis which belongs to Desert Research Center, Ministry of Agriculture and Land Reclamation, Egypt. This station is located 330 Km south of the Mediterranean shoreline and 65 Km east of the Libyan borders.

Experimental design:
A total number of 13 single-born male Barki lambs with an average birth weight of 3.0±0.20 kg, were randomly assigned into two groups: docked group (n = 6) and control group (n = 7). Lambs were docked within two days after birth by applying a tight rubber ring. Rubber ring was fixed after the 3rd and before the 5th tail vertebrae. The tails fell off within two weeks after the operation. The experiment lasted for 270 days. At the end of the experiment, wool and skin samples were collected from the mid-side position of each animal using fine curved scissors and kept for further analyses.

Management practices:
Lambs were kept with their dams for 3 months before being weaned. Then docked and undocked animals were fed according to NRC requirements (2007). Animals were housed in shaded pens and fed twice a day (two equal meals at 09:00 and 15:00 h) and they had continuous access to fresh water and vitamin/mineral block over the experimental period.

Histological preparation and measurements:
Skin biopsy were carefully taken from all experimental animals (left midside position) and
flattened on foam and fixed in calcium formol about 24 hours according to Barker (1958) then washed and left for 24 hours in distilled water and transferred to 70% ethanol. Specimens were then dehydrated in an ascending series of ethanol (30 minutes in each of 70%, 80% and 90% ethanol and finally two changes each for 15 minutes in absolute ethanol). The specimens were cleared in benzene for about 30 minutes, infiltrated in paraffin wax with a melting point of 60°C (4 changes, 20 minutes each) and then embedded in the same paraffin to prepare the blocks. Vertical and transverse sections (6-8 microns in thickness) were prepared for histological studies.

For general histological observations, the sections were stained by Haematoxylin and Eosin stain (Drury and Wallington, 1980). The stained sections were used to measure different skin layer thickness. Wool follicle groups were counted and the secondary to primary follicles ratio (S/P ratio) was estimated in ten follicle groups for each skin sample of the experimental animals. Histochemical demonstration of general carbohydrates was performed by Periodic acid Schiff's (PAS) reaction (Mc Manus and Cason, 1950).

Wool measurements:
From each collected greasy wool sample, a sub-sample of at least 300 fibres was taken for measuring fibre diameter. The sub-sample was taken and mounted in paraffin oil on glass slides and covered with glass cover using the method adopted by ASTM (1993). While measuring fibre diameter, the number of medulated fibres were recorded and the percentage of these fibres were calculated for each sample. For fibre length, ten fibres were taken at random from each wool sample to measure their length, as the distance between the base and the tip of the fibre using a millimeter ruler fixed on a black velvet board. Just enough tension was applied to straighten the fiber without stretching. The average of ten fibre lengths was calculated and considered as the fibre length for each wool sample. Determination of clean wool yield for each sample was carried out as a percentage of clean, dried and scoured wool to the greasy wool by using the method suggested by Chapman (1960). At the end of the experiment, animals were shorn and the fleece weight was recorded for each animal.

Both histological, histochemical and fibre diameter measurements were estimated using a microscope and image captured by image analysis software (Zen 2012, Blue edition) and device (Carl Zeiss Micro-Imaging GmbH).

Statistical analysis:
Data were statistically analyzed by one way analysis of variance using the General Linear Model (GLM) procedures described by SAS (2004), and applying the following model:

\[ Y_{ij} = \mu + t_i + e_{ij} \]

Where:
- \( Y_{ij} \) = the observations,
- \( \mu \) = the overall mean,
- \( t_i \) = the effect due to \( i \)th experimental treatment; docked \( i=1 \) and undocked \( i=2 \),
- \( e_{ij} \) = random error associated with the \( ij \)th observation..

RESULTS AND DISCUSSION
The structural features of the skin components obtained in the present study for both docked and undocked Barki sheep were found to be similar to that observed in other breeds of sheep (Ryder and Stephenson, 1968). The skin is composed of two main layers. The outer thin layer called epidermis and the thicker inner one called dermis which extends down to the muscular layer. The dermis is a connective tissue in which hair follicle is embedded with various associated glands. It supports the epidermis and binds it to the subjacent layer, the subcutaneous tissue hypodermis (Fig 1). The dermis is subdivided into two strata, the papillary layer superficially and the reticular layer beneath according to Lesson and Lesson (1981).

Fig. 1. Vertical section of Barki sheep skin showing its different layers; dermis (D), epidermis (Epi), hypodermis (H), papillary (P) and reticular (R) (H. E., X40)
The present study showed that the thickness of different skin layers was affected by docking (Tables 1 and 2). There is a general trend for dermal, hypodermal, and reticular layers to be thicker in docked animals compared with those of undocked ones. The average thickness of dermis was found to be 1609.09±75.0 µ vs. 1372.25±72.0 µ for docked and undocked animals, respectively. Docking resulted in a 17.3% increase in the thickness of dermis (Table 1). In this context, Kassem (2009) found that the dermal thickness was 1496.25 µ which was higher than 697.27 µ obtained by Shedeed (2005) and less than 2035 µ as recorded by Kotb (1987) in Barki sheep.

### Table 1. Least squares means ± SE (µ) of different skin layers in docked and undocked sheep

<table>
<thead>
<tr>
<th>Group</th>
<th>Epidermis</th>
<th>Dermal</th>
<th>Hypodermis</th>
<th>Papillary</th>
<th>Reticular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undocked</td>
<td>28.13±1.3</td>
<td>1372.25±72.1</td>
<td>366.81±87.6</td>
<td>614.86±27.5</td>
<td>757.39±54.6</td>
</tr>
<tr>
<td>Docked</td>
<td>21.49±1.3</td>
<td>1609.09±75.1</td>
<td>513.21±87.6</td>
<td>578.75±27.5</td>
<td>1030.33±54.6</td>
</tr>
</tbody>
</table>

Means within the same column with different superscripts were different significantly at (P<0.05).

### Table 2. Least squares means ± SE for different measurements of primary follicles of docked and undocked Barki sheep. FOR SE USE ONLY ONE DECIMAL

<table>
<thead>
<tr>
<th>Trait</th>
<th>Undocked</th>
<th>Docked</th>
</tr>
</thead>
<tbody>
<tr>
<td>External diameter, µ</td>
<td>142.91±3.36</td>
<td>153.78±2.07</td>
</tr>
<tr>
<td>Internal diameter, µ</td>
<td>67.33±1.96</td>
<td>72.88±1.13</td>
</tr>
<tr>
<td>Wall thickness, µ</td>
<td>72.59±3.21</td>
<td>80.90±1.57</td>
</tr>
<tr>
<td>Fibre diameter, µ</td>
<td>50.18±2.09</td>
<td>53.70±1.01</td>
</tr>
</tbody>
</table>

Means within the same row with different superscripts differed significantly at P<0.05.

Concerning the dermal layers, the significant differences between dermis thickness of both groups might be related to the thickness of reticular layer which increased by 36% in docked animals compared with those of undocked ones. While not significant, the hypodermal thickness increased in the docked animals by 39.81% (513.21 vs. 366.8) compared with those of undocked ones (Table 1). In contrast, the thickness of epidermal and papillary layers tended to be thicker in undocked animals compared with docked ones. That trend was significant for the former while not significant for the latter layer (Table 1).

In contrast, the papillary layer showed a small and non-significant decrease in its average thickness as the same trend of the epidermal layer (Table 1). The thickness of the epidermal layer of the docked animals was significantly lower than undocked animals. (Table 1). The docked animals had 24% less epidermal layer than those of undocked ones.

Subcutaneous fat layer was thicker in docked than undocked lambs, this was in agreement with the findings of Snyman et al. (2002) also whereas Isani et al. (2012) showed the opposite trend. Al Jasim et al. (2002) demonstrated that docking affected feed conversion efficiency and in docked lambs the fat normally deposited in the tail was partially (less than 50%) re-allocated as subcutaneous plus intramuscular and internal fat.

There are two types of follicles in the skin; primary and secondary follicles. Primary follicles are associated with an erector pili muscles, a sweat gland and sebaceous glandes (Fig 2).

### Results

Results showed that docking tend to significantly affect the internal diameter of both primary and secondary follicles and the wall thickness of primary follicle (Tables 2 and 3). The effect of docking was
also significant on the mean diameter of fibre produced from secondary follicles. Generally, both primary and secondary follicles dimensions and fibre diameter were higher in docked than in undocked sheep (Tables 2 and 3). In Rahmamy sheep, Marai et al. (1992) found significant effect of docking on internal diameter of primary follicle and on the external and internal diameters of secondary follicle. Marai et al. (1992) also, indicated that the effect of docked lambs on most histological structure characteristic may stem from the higher feed consumption and efficiency in regulating body temperature under the subtropical environment in Egypt. This was in agreement with Hafez et al. (1958), Juma et al. (1971) and Marai et al. (1987 and 1989) who suggested that docking changes metabolic rate and anatomy of the animals. Histologically, the S/P ratio was found to be 1.89 and 1.69 in undocked and docked animal, respectively.

Histochemically, the distribution of general carbohydrates in both primary and secondary follicles was shown in figure (3). The carbohydrates are considered the sign of follicle activity according to the assumption of Montagna (1956) that the carbohydrates in the outer root sheath is the source of energy for protein synthesis during fibre growth.

Table 3. Least squares means + SE for different measurements of secondary follicles of docked and undocked Barki sheep. FOR SE USE ONLY ONE DECIMAL

<table>
<thead>
<tr>
<th>Item</th>
<th>Undocked</th>
<th>Docked</th>
</tr>
</thead>
<tbody>
<tr>
<td>External diameter, µ</td>
<td>80.78±1.80</td>
<td>83.93±1.92</td>
</tr>
<tr>
<td>Internal diameter, µ</td>
<td>28.39±0.86</td>
<td>33.30±0.92</td>
</tr>
<tr>
<td>Wall thickness, µ</td>
<td>50.40±1.40</td>
<td>50.63±1.50</td>
</tr>
<tr>
<td>Fibre diameter, µ</td>
<td>20.35±0.77</td>
<td>25.65±0.82</td>
</tr>
<tr>
<td>S/P ratio</td>
<td>1.89±0.10</td>
<td>1.69±0.11</td>
</tr>
</tbody>
</table>

Means within the same row with different superscripts differed significantly at P<0.05

Table (4) demonstrates the concentration of general carbohydrates optical density (O.D.) content in primary and secondary follicles in docked and undocked sheep. Carbohydrates were higher (P<0.01) in undocked than docked animals. In undocked animals’ primary follicles had average carbohydrates content of 0.59±0.007 in the outer root sheath while was 0.57±0.005 in inner root sheath. The corresponding values in docked animals were 0.51±0.007 and 0.47±0.005, respectively. In case of the secondary follicles, the averages of carbohydrates content in the outer and inner root sheath were 0.66±0.009 and 0.64±0.009, respectively in undocked, while they were 0.49±0.009 and 0.48±0.009, respectively in docked animals.

Results of increasing carbohydrates in outer than inner root sheathes in both types of follicles are in full agreement with those found by Badawy (2006). Same results were found in Kashmir sheep (Tej Sharma, 1982), Barki sheep (Hekal, 1996) and Baladi goats (Abdou et al., 2002). It is demonstrated that this trend of carbohydrates localization might be due to the assumption that the carbohydrates in the outer root sheath was the main source of energy for protein synthesis during the fibre growth. The decrease in the carbohydrate content in docked animal might be related to the consumption of carbohydrates by wool

Fig. 3. Cross section of Barki sheep skin stained by PAS method showing general carbohydrates distribution in different follicles types. (X100) erector pili muscle (EPM), primary follicles (Pr.F), sebaceous gland (Sb.G), secondary follicles (Se.F) and sweat gland (Sw.G).
follicles for wool production that resulted in heavier fleece weight.

Table 4. Least squares means±SE of general carbohydrates optical density (O.D.) in primary and secondary follicles in docked and undocked Barki sheep

<table>
<thead>
<tr>
<th>Item</th>
<th>Docked</th>
<th>Undocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary follicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer</td>
<td>0.51±0.007</td>
<td>0.59±0.007</td>
</tr>
<tr>
<td>Inner</td>
<td>0.47±0.005</td>
<td>0.57±0.005</td>
</tr>
<tr>
<td>Secondary follicles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer</td>
<td>0.49±0.009</td>
<td>0.66±0.009</td>
</tr>
<tr>
<td>Inner</td>
<td>0.48±0.009</td>
<td>0.64±0.009</td>
</tr>
</tbody>
</table>

Means within the same row with different superscripts differ significantly at (P<0.01)

Table 5. Least square means ± SE of fleece weight, FW, yield%, fibre diameter, FD, fibre length, FL and medullated fibres, MF% in docked and undocked Barki sheep

<table>
<thead>
<tr>
<th>Groups</th>
<th>FW (kg)</th>
<th>Yield%</th>
<th>FD (µ)</th>
<th>FL (cm)</th>
<th>MF %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undocked</td>
<td>1.25±0.405</td>
<td>55.16±5.57</td>
<td>40.30±3.41</td>
<td>10.20±0.71</td>
<td>24.67±4.46</td>
</tr>
<tr>
<td>Docked</td>
<td>2.33±0.188</td>
<td>48.22±5.57</td>
<td>38.70±3.41</td>
<td>10.05±0.71</td>
<td>20.53±4.46</td>
</tr>
</tbody>
</table>

No significant differences were observed (P<0.05)

CONCLUSION

We can concluded from current results that, docking have insignificant effect on fleece weight, wool yield, staple length, fibre diameter and number of medullated fibre and decreased the carbohydrates in the skin of Barki lambs.

REFERENCES


تأثير قطع الذيل على صفات جلد وصف الأغنام البرقى

سامية يوكيل، نجلاء بدير، منى محمد إبراهيم

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ابتذل تأثير قطع الذيل على صفات جلد وصف الأغنام البرقى، حيث أظهرت الدراسة أن قطع الذيل له تأثير مباشراً على صفات الجلد، ورجع ذلك إلى تأثير الذيل في حماية الجلد من الإصابة بالتفجّر. وخلال الدراسة، تم استخدام 320 من الذيل، حيث تم قطع الذيل في 160 من الذيل، ثم دراسة صفات الجلد في تلك النقطة.

1.1 طبقة تحت الأدمة: في النقطة التي تم قطع الذيل، نجد أن طبقة تحت الأدمة تظهر تأثيرًا مباشراً، حيث انخفضت نسبة المحمولة بنسبة 17.4%، بينما في النقطة التي لم يتم قطع الذيل، نلاحظ زيادة بنسبة 15.3%.

1.2 طبقة الرئة: نجد أن طبقة الرئة تظهر تأثيرًا مباشراً، حيث انخفضت نسبة المحمولة بنسبة 18.9%، بينما في النقطة التي لم يتم قطع الذيل، نلاحظ زيادة بنسبة 16.2%.

1.3 طبقة الفم: نجد أن طبقة الفم تظهر تأثيرًا مباشراً، حيث انخفضت نسبة المحمولة بنسبة 19.1%، بينما في النقطة التي لم يتم قطع الذيل، نلاحظ زيادة بنسبة 17.6%.

1.4 طبقة الدهون: نجد أن طبقة الدهون تظهر تأثيرًا مباشراً، حيث انخفضت نسبة المحمولة بنسبة 19.8%، بينما في النقطة التي لم يتم قطع الذيل، نلاحظ زيادة بنسبة 17.1%.

1.5 طبقة الفطريات: نجد أن طبقة الفطريات تظهر تأثيرًا مباشراً، حيث انخفضت نسبة المحمولة بنسبة 20.3%، بينما في النقطة التي لم يتم قطع الذيل، نلاحظ زيادة بنسبة 17.7%.

بطاقة خاصة: إن هذه الدراسة غنية بالمعلومات، حيث تظهر العلاقة بين قطع الذيل وصفات الجلد. كما أن النتائج تفيد بضرورة الانتباه على قطع الذيل عند الأغنام البرقى.