Some aspects of reproduction in fat-tailed sheep in Subtropics

IV. Puberty and sexual maturity

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While numerous scientific publications are now available on the different aspects of puberty and development of sexual activity in improved sheep breeds, relevant information on fat-tailed breeds is still scanty. The age at which puberty and full reproductive capacity are attained and at which seminal fertility declines are of major importance in management of rams and in progeny tests.

This study sets out the age at which puberty and full sexual capacity are attained in Ausimi fat-tailed sheep. The latter breed is one of the most important and widespread of the native breeds.

Materials and methods

The investigation was carried out in Bahteen Agriculture Experiment Station. The usual practice of sheep breeding in this farm is to arrange the mating season in the summer so that lambing occurs when green fodder is available. Forty seven single-born ram lambs (14 born in November, 11 in December, 15 in January and 7 delivered in February) were used to study the age of puberty. The lambs were weaned at four months, when the same feeding regime for adult rams was adopted. Berseem (Trifolium alexandrinum) was given during the green season, whereas derris was offered ad lib. during the remaining part of the year (June to October). Pelleted concentrates of 0.5 kg. was given to each animal daily all the year round. The lambs were housed in large semi-open sheds where free exercise was possible.

Weekly observations were made on the separation of the processus urethrae from the penis and of the penis from the prepuce. In the meantime development of sexual activity was assessed by teasing the ram lambs using restrained anoestrous ewes and they were allowed to see the artificial vagina some weeks before ejaculation was attempted. The live body weight as well as length and breadth of testicles were recorded at the time of first ejaculation.

Moreover, a total of 177 ejaculates (55 ejaculates from seven yearling rams 15–18 months old; 52 ejaculates from six, two year old rams; 46 ejaculates from six, three year old rams and 24 ejaculates from four, four year old rams) were collected at weekly intervals by means of the artificial vagina during a period of two months (February and March) to study the development of seminal characteristics. Live weight and length and breadth of the testicles of the rams were recorded at the beginning of the experiment.

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Collected semen samples were examined for volume (ml.), motility and live sperm percentage, intensity of wave motion (0-5 score), sperm cell concentration per ml., total sperm per ejaculate and incidence of abnormal spermatozoa. Statistical analysis of the data was done according to SNEDECOR (1962).

Table 1

Average values of birth weight, body weight at 120 days, at first ejaculation, and age at separation of the penis and first ejaculation

<table>
<thead>
<tr>
<th>month of birth</th>
<th>birth wt. (kg)</th>
<th>live wt. at 120 days (kg)</th>
<th>age at seper. of penis (days)</th>
<th>age at 1st ejac. (days)</th>
<th>live wt. at 1st ejac. (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>4.33 (1.15)</td>
<td>17.73 (3.51)</td>
<td>236.78 (55.28)</td>
<td>267.14 (62.61)</td>
<td>30.06 (2.72)</td>
</tr>
<tr>
<td>December</td>
<td>3.99 (0.56)</td>
<td>13.73 (2.31)</td>
<td>303.81 (37.32)</td>
<td>335.00 (35.14)</td>
<td>26.55 (4.01)</td>
</tr>
<tr>
<td>January</td>
<td>3.76 (0.57)</td>
<td>15.64 (3.63)</td>
<td>289.43 (64.38)</td>
<td>310.29 (61.14)</td>
<td>28.93 (3.51)</td>
</tr>
<tr>
<td>February</td>
<td>3.61 (0.41)</td>
<td>13.43 (3.56)</td>
<td>339.44 (23.24)</td>
<td>368.91 (18.68)</td>
<td>25.73 (3.58)</td>
</tr>
<tr>
<td>Average</td>
<td>3.96</td>
<td>15.53</td>
<td>290.08 (23.24)</td>
<td>319.04 (18.68)</td>
<td>28.23</td>
</tr>
</tbody>
</table>

Figures between parentheses represent the standard deviation.

Results

The birth weight and live weight at 120 days for the lambs born early in the lambing season (November) was higher than that of those delivered later (December to February). Variation in these parameters for lambs born during the different months of the lambing season was statistically significant (Table 2).

Table 2

Analysis of variance of birth weight, weight at 120 days, weight at first ejaculation and age at separation of the penis and first ejaculation in different months of the lambing season

<table>
<thead>
<tr>
<th>source of variation</th>
<th>birth weight</th>
<th>weight at 120 days</th>
<th>age at Sep. of penis</th>
<th>age at 1st ejac.</th>
<th>body weight at 1st ejac.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MS</td>
<td>FV</td>
<td>MS</td>
<td>FV</td>
<td>MS</td>
</tr>
<tr>
<td>bet. months</td>
<td>43</td>
<td>1.14</td>
<td>46.59</td>
<td>23201.54</td>
<td>23139.95</td>
</tr>
<tr>
<td>with. months</td>
<td>3</td>
<td>0.402</td>
<td>11.024</td>
<td>2734.96</td>
<td>2656.97</td>
</tr>
</tbody>
</table>

The average age at which separation of the penis was achieved in the ram lambs is smallest in those born in November and largest in those delivered in December. Difference in such criterion due to month of birth was statistically very significant (P < 0.01). A gradual breakdown in the adhesions takes place, the urethral process is freed first, then the glans penis and at puberty the penis is freely movable in the sheath. Detachment of the glans penis from the wall of the prepuce usually takes place...
more rapidly than separation of the processus urethrae from the glans. By the time of separation of the penis an appreciable change in the size of the testes from that of a bean to that comparable to the size of hen's egg was noticeable.

The age at first ejaculation was shortest in ram lambs born during November and longest in those delivered in February. Statistical analysis revealed a highly significant difference (P < 0.01) in age at first ejaculation of the lambs born during different months.

As a function of body development rather than chronological age, the average body weight at first ejaculation was nearly the same in ram lambs born during the different months. Analysis of variance failed to reveal any significant difference in average weight of the lambs at first ejaculation.

The live body weight at first ejaculation was significantly correlated with birth weight of the lambs (r = + 0.911). The same parameter was also significantly correlated with live weight at the time of weaning (r = + 0.804). Negative but highly significant correlations of 0.492 and 0.505 were calculated between the live weight at first ejaculation on one hand and age of separation of the penis and age of first ejaculation on the other hand respectively (Table 3).

Table 3

Simple coefficients of correlation

<table>
<thead>
<tr>
<th>parameters studied</th>
<th>body wt. at 1st ejacul.</th>
<th>age at 1st ejacul.</th>
<th>age at sep. of the penis</th>
<th>body wt. at 120 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>birth weight</td>
<td>+ 0.911**</td>
<td>-0.320*</td>
<td>-0.352*</td>
<td>+ 0.254</td>
</tr>
<tr>
<td>body wt. at 120 days</td>
<td>+ 0.804**</td>
<td>-0.402**</td>
<td>-0.192</td>
<td></td>
</tr>
<tr>
<td>age at sep. of the penis</td>
<td>-0.492**</td>
<td>+ 0.494**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>age at 1st ejacul.</td>
<td>-0.505**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = P < 0.05; ** = P < 0.01

The age at first ejaculation was significantly correlated with each of birth weight (r = -0.320), body weight at 120 days (r = -0.402), and age at separation of the penis (r = + 0.494). A negative yet statistically significant correlation (r = -0.352) was obtained between weight and age at separation of the penis in the rams studied.

Clear signs of libido indicated by sniffing the female’s urine, nosing the external genitalia, pawing the ground and rear of the female with the forelimbs, rubbing along the side of the female, curling of the upper lip with the head held horizontally and the neck extended and even mounting with or without protrusion of the penis were observed before ejaculation was successful.

However, even by the time of first ejaculation reluctance to mount the teaser was clear in most of the rams leading to a high average reaction time (5.44 minutes) and number of mounts per ejaculation (3.05). Steady development of sexual expressions occurs as age advances. In two year old rams the average reaction time and number of mounts per ejaculation were at a minimum (0.74 minutes and 1.18 mounts per ejaculation).

The development of seminal features with advancing age of the rams is shown in Table 4. Both the quality and quantity were poor in the early ejaculates from pubescent rams lambs but rapid improvement occurred after puberty was attained.

The average volume of the ejaculate, sperm cell concentration and total sperm per ejaculate increased with advancing age up to 4 years. The incidence of motile and living sperms increased up to the age of 2 years but with very slight fluctuation thereafter. As a function of both motility and sperm cell concentration, wave motion
reached its maximum value in 2-year-old rams and was maintained at that level in older rams.

The decrease in incidence of abnormal sperm cells was dramatic just after puberty but much less obvious thereafter. Most of the abnormalities met with in the early ejaculates from pubescent rams were in the form of protoplasmic droplets, decapitated sperm, bent and coiled tails. Primary abnormalities in the shape and size of the head constituted a small percentage of the total deformities.

Discussion

The literature available shows that there are great differences in pubertal age between ram lambs of the various breeds (112.0 days for Dorper in South Africa; Skinner 1971, to 250.0 days for mutton Merino in Rhodesia; Symington 1971). However these figures are much lower than the average age of puberty of rams in the current study indicated by the appearance of spermatozoa in the ejaculate. The average age of puberty in creep fed and control Rahmani fat-tailed rams bred at the same latitude was 216 and 396 days respectively (Ragab et al. 1966). The criterion of puberty used by the latter authors was the expression of clear signs of libido which appear sometime before successful ejaculation and appearance of spermatozoa in the ejaculates. Breed, management and latitude differences as well as criteria on which definition of puberty is based may account for variation in age of puberty in the different studies.

The older age at first ejaculation for ram lambs delivered late in the lambing season compared with the age of those born earlier may be
due to the lower growth rate related to difference in birth weight, level of nutrition and other environmental and managerial factors available. It has been stated that attainment of puberty is dependent on inherent and environmental factors (Wiggins and Terrill 1953). The highly significant variation in weight at birth and at 120 days for lambs born during different months of the lambing season lends further support. The nonsignificant variation in live weight at puberty could be accounted for by the wide age range. In the mean time it indicates that the age is of less importance than live weight in determining puberty. This is in accordance with the findings of Dunn (1955), Watson et al. (1956); Symington (1961), Pretorius and Marincowitz (1968), Ortvavant et al. (1969) and Dyrumdsson and Lees (1972).

In Ausimi rams used in the present study, the penis had separated from the prepuce much later than in the other breeds studied by Johnston (1948); Wiggins and Terrill (1953), Dunn (1955) and Belonje (1965). This might again be due to the lower growth rate and testes development in the indigenous breeds as separation of the penis is dependent on general rate of growth (Skinner and Rowson 1968) and weight of the testicular tissue (Watson et al. 1956).

In accordance with the findings of Symington (1961), Low and Joubert (1964) and ElWishy and ElSawaf (1971) clear signs of sexual desire are displayed before the ability to ejaculate. Testosterone secretion prior to the onset of active spermatogenesis is responsible for this phenomenon (Davies and Mann 1947; Rowson 1959; Skinner et al. 1968; Skinner 1970, 1971). However, sexual dexterity indicated by the least reaction time and number of mounts per ejaculation is attained in two year old rams.

The poor quality of semen ejaculated by pubescent rams in the present work is substantiated by previous observations of Dunn (1955), Symington (1961), Louw and Joubert (1964) and ElWishy and ElSawaf (1971). The high incidence of morphologically abnormal spermatozoa is accounted for mainly by immature forms with protoplasmic droplets and coiled tails (William and Savage 1925; Starke 1959).

In the postpubertal period an obvious increase in the percentage of actively motile, morphologically normal and live spermatozoa was observed up to the second year with no substantial change thereafter. This indicates that such parameters are not normally influenced by further body development. Nevertheless, ejaculate volume, concentration of spermatozoa and consequently total sperm per ejaculate increased at a steady rate up to the fourth year. As Terrill (1938) and Symington (1961) observed that maximum sperm concentration was attained in 2 year old rams, it could be concluded that in the slow maturing fat-tailed sheep full sexual maturity is not attained before the fourth year of life. Hence it could be recommended that fewer number of ewes should be allocated to younger rams if high conception were to be achieved.

Acknowledgement

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Summary

The average age of separation of the penis and first ejaculation in 47 fat-tailed Ausimi ram lambs was 290.08 and 319.04 days respectively. These parameters were significantly influenced by the month of lambing. Lambs born early in the lambing season attained puberty at younger age than those born later. The quality and quantity of the ejaculates collected from pubescent rams were poor with high incidence of dead and deformed spermatozoa. The percentage of morphologically normal, live and motile spermatozoa reached their highest values at the age of two years, whereas a steady increase in ejaculate volume, number of spermatozoa per unit volume and total number of spermatozoa per ejaculate was observed up to the age of 4 years.
Zusammenfassung

Einige Aspekte zur Fruchtbarkeit bei Fettzwanzigeschafen in den Subtropen. IV. Pubertät und Geschlechtsreife


References


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