

Technical note

Testicular development and body weight gain from birth to 1 year of age of Awassi and Redkaraman sheep and their reciprocal crosses

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Abstract

An experiment was conducted to compare testicular volume (TV), scrotal circumference (SC) and body weight (BW) gain of 10 Awassi (A), 10 Redkaraman (R) ram lambs with those of their reciprocal crosses: $R \times A$ (10 ram lambs) and $A \times R$ (10 ram lambs). Measurements were taken at birth, 90 (weaning), 180, 270 and 360 days of age. TV was similar in the purebred and crossbred lambs, while genotype effect was found significant ($P < 0.05$) for BW at birth, weaning and 180 days of age and SC at 270 days of age. In general, A lambs had lower BW than the other breeds of lambs. Highest estimates of heterosis were 20% and 12.3% in TV and SC, respectively, at 9 months of age, Redkaraman $\times$ Awassi lambs had larger SC than Awassi lambs. Age at puberty as determined by inflection point in SC growth was earliest in $R \times A$ (119 days) lambs, followed by $A \times R$ (139 days), R (140 days), whereas A lambs were the oldest to reach puberty (152 days).

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1. Introduction

The Middle Eastern fat-tailed Awassi (A), is a low fecundity breed well adapted to the eastern region of Turkey. Redkaraman (R) the dominant local breed, is the main source of income for most producers despite their low productivity. It was documented that the Awassi sheep are slightly more prolific than R sheep

(Emsen, 2002). On the other hand, R lambs grow more rapidly than A lambs.

Improvement of sheep productivity requires effective actions on its various components, with prolificacy being one of the most important. The biometrical analysis of testicular development is of great importance since it is significantly correlated with reproductive activity (El-Wishy and El-Sawaf, 1971). Land and Carr (1975) indicated that rate of testis growth was more rapid in lambs of a breed with high prolificacy such as the Finnish Landrace than a less prolific breed. Also,

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Louda et al. (1981), after examining testis growth, and finding small but consistent differences in the development of sexual activity and of sperm production, suggested that young rams of prolific breeds such as Romanov and Finnish Landrace, may differ, though slightly, in their potential reproductive performance.

As a result of the beneficial attributes and high heritability estimates (0.4–0.7) of testicular size (Coulter and Foote, 1979) measurements would be useful selection criteria for improvement of flock. Crossing, primarily a breeding system for commercial production, is often applied to take advantage, as far as possible, of superior qualities of two or more diverse genotypes (Rice et al., 1957). The present study was conducted to evaluate two testicular parameters and body weight gain of two breeds and their reciprocal crosses over a period extending from birth to one year of age.

2. Materials and methods

Measurements were taken on a total of 40 single born male lambs 10 from each of A, R, and the two reciprocal crosses, A × R and R × A. Rams were born between 1 and 15 February and kept together in one large pen with their ewes until weaning at 90 days of age. After weaning they were penned as a separate group. The animals grazed on natural pastures from 90 to 270 days of age. After grazing (270 days of age) each lamb was offered a daily ration consisting of 1.5 kg grass hay and 150 g barley. No hormonal growth stimulant or any other additives were administered.

Data were collected on rams over a period of 12 months beginning at birth. Measurements of body weight (BW) gain, scrotal circumference (SC) and testicular volume (TV) were taken at birth, weaning, 180, 270 and 360 days of age. SC was measured in centimeters using a flexible metal tape. Testicles were pushed deep into the scrotal sac of standing rams and measured at the area of greatest circumference. Testes volume was evaluated by the displacement of the physiologic solution in a graduate test tube.

Age at puberty was determined by inflection point of SC growth calculated by using the Tanaka non-linear growth model (Tanaka, 1982), a four-parameter indeterminate growth model having an initial period of growth and a period of exponential growth followed by an indefinite period of slow growth, which is reported

as the best fitted growth model to SC data in Awassi breed by Bilgin et al. (2003).

Estimated heterosis for mean body weight, scrotal circumference and testicular volume at birth, weaning, 180, 270, 360 days in purebred and crossbred lambs was estimated

$$\%EH = \frac{MV_{F_1} - MV_p}{MV_p} \times 100$$

where %EH = estimated heterosis; MV_{F_1} = mean value of F_1 crossbreds of AR and RA; MV_p = mean value of purebred of A and R.

General linear model procedures (MINITAB, 2000) were used to analyze the data at different stages of development. Means were tested for significant differences by Duncan multiple range test (Duncan, 1955). 't'-test was run on the absolute heterosis as

$$t = \frac{((RA + AR)/2) - ((RR + AA)/2)}{S.E.(\text{square root}(\text{Var A} + 0.25 \text{ Var AR} + 0.25 \text{ Var RA} + \text{Var R}))}$$

3. Results

Means and standard errors of BW, TV and SC over the time period investigated are shown in Table 1. Redkaraman lambs were significantly ($P < 0.05$) heavier at birth than A and A × R; however, at weaning A × R and R lambs had similar weights. Body weight was lowest in A rams throughout the study.

R × A lambs had significantly larger ($P < 0.05$) SC than A lambs at the end of the grazing period (270 days of age) whereas there was no difference in TV among genotypes. Crossbred lambs had relatively heavier TV at one year of age than purebreds. The Tanaka model described growth in SC remarkably well (R^2 ranged between 0.999 and 0.988) for the four genotypes. The inflection points given by the Tanaka model were as 152, 140, 119 and 139 days for A, R, R × A and A × R, respectively.

The increase of SC (215%) and TV (442%) between 1 and 360 days of age was twice and four times higher than that of body weight (114%). The estimates of heterosis ranged between −8.2% and 20.6% with the highest estimates for the three traits calculated at 270 days of age (Table 1). At 9 months of age, crossbred lambs were superior purebred rams in TV and SC by 20% and

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