PUBERAL DEVELOPMENT IN THE NIGERIAN DWARF SHEEP
III. Testicular biometry in the ram lambs

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SUMMARY

Testicular measurements were made on the testis of 47 ram lambs aged between 2 and 36 weeks and 4 to 14kg body weight in situ and after excision, with a view to assessing both the growth and development of the testis and how closely the actual measurements on the excised testis could be approximated by those made on the testis of live rams. The results showed that the measurements made on the live animals were very closely related to the actual measurements on the excised testis but that the precision in this improved with increase in size of the testis. Testis growth could be adequately monitored by linear measurements of the circumference, width and length of the testis.

INTRODUCTION

Reports about the existence of a strong relationship between the linear measurements on the testis and the weight of the testis of young ram lambs using regression equations, have been made on the Clun forest rams (Colyer 1971), and on the live bulls (Willet and Ohms 1957). There is, however, little available information on the use of the testicular biometry in the assessment of the growth and development of the testis of the Nigerian Dwarf Sheep. This investigation was therefore aimed at:-

(i) establishing the relationship between the linear measurements and the testis weight of Nigerian Dwarf ram lambs using linear regression equations;

(ii) establishing the relationship between the linear measurements made on the testis of the live animals (in situ) and the actual testis measurements in different age groups.

MATERIALS AND METHODS

Animals: 47 ram lambs between 2 and 36 weeks of age and 4 to 14kg body weight from the breeding flock of the University of Ibadan Farm were used for this study.

Measurements: The body weight of the rams were taken just before castration. The following dimensional measurements were made on the testis of each animal in sitting position:-

i. The circumference of the testis was measured with a cloth tape at the place of maximum circumference;
ii. the length of each testis was measured with a tesumeter (Podany, 1969) from the distal end of the testis to the proximal end exclusing the epididymis;
iii. the width or diameter of the widest area of each testis was also measured with the testimeter.
iv. the skin-fold thickness was measured with calipers.

The means of two measurements were taken in each case. The animal were then castrated and the measurements repeated on the actual testis. The volume of each testis was determined by water displacement in a measuring cylinder. Samples were taken from the equatorial region of each testis for histological evaluation.

Statistical Analysis: All the analysis were computer generated. The skin-fold thickness was subtracted from the measurements of the length and the width of each testis in the live animals before computations.

RESULTS

The summary of the length and width measurements on the testis of the ram lamb is presented in Table 1. There was no significant difference ($P > 0.05$) between the measurements made on the left testis and the right testis of the ram lambs. However, within age groups, the growth of the testis was not uniform as could be seen by the differences in the standard errors shown in the Table.

The measurements made on the live animals were very closely related to the actual measurements on the excised testis. However, the precision in the estimation of the actual dimensions of the testis from the measurements on the live animals increased, as the testes grew bigger. The regression equations relating the measurements on the testis of the live animals (X) after subtracting the Skin-fold thickness, and the measurements on the actual excised testis (Y) are shown in

TABLE 1

Summary of the means and t-values for the in-situ and actual length and width measurements on the testis of the rams

Age (weeks)	*Variable*	*n*	*Means (cm)*	*Computed t-value*
	length of testis:			
2—16	in situ	24	2.04 ± 0.15	0.13
	actual	24	2.02 ± 0.11	
17—36	in situ	23	5.23 ± 0.33	0.50
	actual	23	5.01 ± 0.29	
	width of testis:			
2—16	in situ	24	0.91 ± 0.13	3.04*
	actual	24	1.39 ± 0.09	
17—36	in situ	23	3.17 ± 0.23	1.11
	actual	23	3.48 ± 0.18	

P = 0.05

TABLE 2

Regression equations relating the measurements on the testis in *situ* and after excision

Age of ram (months)	*Testis side*	*Regression equation*	*SE*	*R*
A. Length of testis:				
Below 4.	left	Y = 0.79 ± 0.60 X	0.35	0.62
	Right	Y = 0.61 ± 0.68 X	0.33	0.72
Above 4.	left	Y = 0.49 + 0.86 X	0.41	0.92
	Right	Y = 0.65 + 0.82 X	O.44	0.91
b. Width of testis:				
Below 4.	left	Y = 0.83 + 0.61 X	0.22	0.76
	Right	Y = 0.70 + 0.73 X	0.27	0.75
Above 4.	left	Y = 1.16 + 0.72 X	0.26	0.91
	Right	Y = 0.96 + 0.78 X	0.36	0.87

Table 2. All the regressions were highly significant ($P < 0.01$). The testis weight was very closely related to the testis volume ($r = 0.996$). The overall density of the testis in all the animals studied was 1.04gm per ml. There was no significant difference in the testis density within the various age groups. However a slight drop to a mean value of 0.93 between 10 and 13 weeks of age was observed and this coincided with the age at which canalisation started in most of the seminiferous tubules of the testis. The circumference of the testes measured on the live animals was significantly correlated to the testis weight ($r = 0.44$ and $r = 0.93$) for rams, below and above 4 months of age respectively. The difference between the two correlation coefficients was very highly significant ($P < 0.001$). The regression equations relating the testis weight (Y) to the testis circumference (X) were as follows:

Rams below 4 months.

$Y = -15.43 + 2.97X$

$SE = 15.7$

$R = 0.19$

Rams from 5 to 9 months.

$Y = -132.52 + 11.69X$

$SE = 19.69$

$R = 0.86$

Both regressions are significant ($P < 0.05$).

The histological evaluation showed that canalisation of the seminiferous tubules started at about 12 weeks of age. Primary spermatocytes, spermatids and spermatozoa were seen in at least 50 per cent of the seminiferous tubules of the investigated animals as from 10, 18 and 23 weeks of age respectively.

The actual testis circumference is slightly more closely related to the testis width ($r = 0.99$) than to the testis length ($r = 0.98$). The growth coefficients of the testicular dimensions is shown in Table 3. It could be seen from the table that as the testis weight increased both the testis width and circumference increased significantly more than the length ($P < 0.05$).

DISCUSSION

It is the normal practice when choosing replacement males in a livestock programme to place a great deal of additional emphasis on the development of the testis as this would reinforce other judgments on the age, body weight and health of the animals. The close relationship recorded in the present study between the measurements on the live animals and those on the actual excised testis therefore shows that the development of the testis could be accurately assessed in the live animals especially in older rams by external measurements. However, it would appear as shown by Dyrmundsson and Lees

TABLE 3

Growth coefficients of the length, width and circumference of the testis

Age (days)	*N*	*Testis Weight (g)*	*Testis Length k*	*Testis Width k*	*Testis Circumference k*
21 (14 — 28)	6	1.71	0.49	0.39	0.39
49 (42 — 56)	6	4.33	0.30	0.39	0.36
77 (70 — 84)	6	7.95	0.29	0.37	0.33
105 (98 — 112)	6	8.35	0.16	0.31	0.39
133 (126 — 140)	6	42.58	0.36	0.32	0.34
161 (154 — 168)	6	58.49	0.36	0,36	0.29
190 (184 — 196)	5	109.60	0.47	0.38	0.28
224 (224 — 224)	3	54.46	0.36	0.58	0.28
243 (243 — 251)	3	156.62	0.09	0.74	0.42

(1972) that testicular growth alone cannot accurately determine the time of the appearance of spermatozoa in epididymis of the rams, since there is a significant interaction between the body weight (which directly affects the testis growth rate) and the chronological age.

A high degree of symmetry has also been reported (Carmon and Green, 1952; Colyer, 1971; Dyrmundsson and Lees, 1972) in the growth and development of the left and right testis of ram lambs. The present results are in agreement with this. However, since during sexual development, the body weight of the rams has greater influence on the growth of the sexual organs than the chronological age, there is therefore, as seen from the results of this study, great variability in the extent of growth and development and hence the measurements within the various age groups of the rams.

On the relationship between the testis circumference and the testis weight, the large negative regression constants in the large testis and the difference between the regression coefficients may be indications that the relationship between the testis weight and the testis circumference is not linear. However, the highly significant correlation between the testis circumference measured on the live animals and the actual testis weight are in conformity with earlier reports (Colyer, 1971; Foote, 1969; Willets and Ohms, 1957) that the testis circumference measured on the live animals has a direct relationship with the testis weight.

Our data indicate that the circumference and the width of the mature testis are better indices of the testis weight than the length of the testis. The testicular weight estimates made using the testicular circumference were within 86 per cent of the actual testis weight and the testis width accounted for up to 98 per cent of the total variation in the testis circumference as against 96 per cent for the testis length.

The times of appearance of the difference types of germ cells are in agreement with those obtained by other authors for the time of appearance of primary spermatocytes (11 weeks), spermatids (18 weeks) and spermatozoa (21 weeks) in the seminiferous tubules of temperate breeds of sheep (Skinner *et al*, 1968).

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