PUBERAL DEVELOPMENT IN THE NIGERIAN DWARF SHEEP

II. Absolute and relative organ growth in the ram lambs

By

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SUMMARY

Eleven ram lambs, all born between June and July (rainy season) were slaughtered at four age groups — 75, 100, 125 and 150 days. The body weights of animals prior to slaughter, the weights of the testes, the epididymis, the vesicular glands, the ampullae, the adrenals, the thyroids and the pituitary glands were determined and subjected to a step-wise multiple regression analysis using age or body weight as the independent variable. The weights of the reproductive organs — testes, epididymides, ampullae, vesicular glands — showed significantly higher correlation with the body weight than with the age, thus emphasizing the greater importance of the physiological age over the chronological age in the development of the body organs. The highest growth rate of the organs of the reproductive tract occurred during puberty and thus coincided with the enhanced endocrine function observed in ram lambs at this stage.

INTRODUCTION

It is known that the proportions of the various organs of the body change as an animal develops because of the differential growth rate of the organs and the body weight. The time rate of change in these proportional dimensions is not the same for all organs because the different growth centres of the body are active at different times (Hafez & Dyer, 1969). Literature reports (Bernadis & Skelton, 1964; Ray, 1964; Skinner *et al,* 1968) suggest that organs primarily associated with reproduction attain their most rapid growth rate at time of puberty while organs of the brain tissues complete their growth very early in life. However, gland size, especially in the case of the endocrine glands does not necessarily indicate the degree of activity nor the extent of the hormone storage (Schultze and Turner 1948 cited by Ray 1964).

There is however no published literature on the puberal growth of the organs and glands in the Nigerian Dwarf Sheep. The proper functioning and intergrity of these organs and glands is very vital for optimum productivity of the animals. This study was therefore aimed at establishing the absolute and relative growth rates of the various organs and glands associated with reproduction in the ram lambs around puberty.

MATERIALS AND METHODS

11 ram lambs of the Nigerian Dwarf Sheep born between June and July 1976 and fed on roughages and concentrate ration *ad libitum* were used for this study. The ram lambs were randomly assigned and slaughtered at four age groups — 75, 100, 125 and 150 days. Puberty had been earlier reported in these animals around 4 months of age (Orji 1976).

Each group had 2 animals. The extra 3 animals were slaughtered in between the groups, at 85, 115 and 135 days.

Collection of the samples:

The liveweight of the ram lambs were taken just before their slaughter at the University of Ibadan abattoir. The entire genital tract, adrenal, thyroid and pituitary glands were collected at slaughter and taken to the laboratory

under ice blocks. The pituitary gland was obtained by breaking the skull, lifting the brain carefully and removing the gland within the sella turcica.

Processing of the samples:

The testes, epididymis, vesicular glands, ampullae, thyroid glands, pituitary and adrenal glands were striped of any adhering connective tissue and weighed. Samples of each of these sections were taken for histological evaluation.

Statistical analysis:

Least squares polynomial curve fitting and analysis were done stepwise, using the age or body weight of the ram lambs before slaughter as independent variable while the testes, the epididymides, the vesicular glands and the adrenal gland weights were used as dependent variables (computer analysis). Log-log growth constants were calculated on the absolute basis (on age) and on the relative basis (on the body weight).

Pairwise correlation coefficients of the variables were also calculated with the computer. In all cases the total weight of paired organs and glands were used for the statistical analysis.

RESULTS

The means and the variance ratio (F) for the effect of the age on the weight of

TABLE 1

Means ± SE and Variance ratios for the effect of the different ages on the weights of the organs

	Age (days)				
	75	100	125	150	*Variance ratio (F)*
Body weight (kg)	9.25 ± 0.75	11.00 ± 1.04	12.00 ± 0.01	11.50 ± 0.5	3.49
Pituitary (g)	0.16	0.14 ± 0.09	0.31 ± 0.05	0.31 ± 0.01	2.1
Adrenal (g)	1.48 ± 0.09	1.33 ± 0.06	2.08 ± 0.58	1.85 ± 0.30	1.51
Thyroid (g)	0.83	0.59 ± 0.25	0.89 ± 0.01	0.98 ± 0.04	0.76
Ampulla (g)	0.16	0.82 ± 0.37	0.84 ± 0.16	1.07 ± 0.16	0.81
Vesicular gland (g)	0.80 ± 0.33	1.57 ± 0.92	1.82 ± 0.23	1.61 ± 0.06	0.38
Testes (g)	7.46 ± 5.01	25.92 ± 9.95	68.32 ± 2.47	71.73 ± 4.5	5.51
Epididymis(g)	3.15 ± 1.71	6.47 ± 2.41	9.95 ± 0.45	9.70 ± 0.29	3.51

TABLE 2

Means and the correlation coefficients of the age, body weight and the organs

Variable	*Mean + SE*	*Correlation Coefficients* 1	2	3	4	5	6	7	8
1. Age (days)	112.0 ± 9.28								
2. Body weight	10.73 ± 0.7	0.55							
3. Pituitary	0.19 ± 0.04	0.51	0.21						
4. Adrenal	1.61 ± 0.13	0.35	0.26	0.41					
5. Thyroid	0.76 ± 0.08	0.37	0.24	0.68	0.25				
6. Ampulla	0.93 ± 0.17	0.56	0.92	0.08	0.23	0.14			
7. Vesicular glands	1.65 ± 0.31	0.36	0.89	0.04	0.13	0.26	0.91		
8. Testes	45.91 ± 9.69	0.75	0.81	0.47	0.67	0.37	0.81	0.71	
9. Epididymis	7.85 ± 1.06	0.67	0.95	0.36	0.36	0.47	0.88	0.89	0.

For P = 0.05, r = 0.58
P = 0.01, r = 0.71

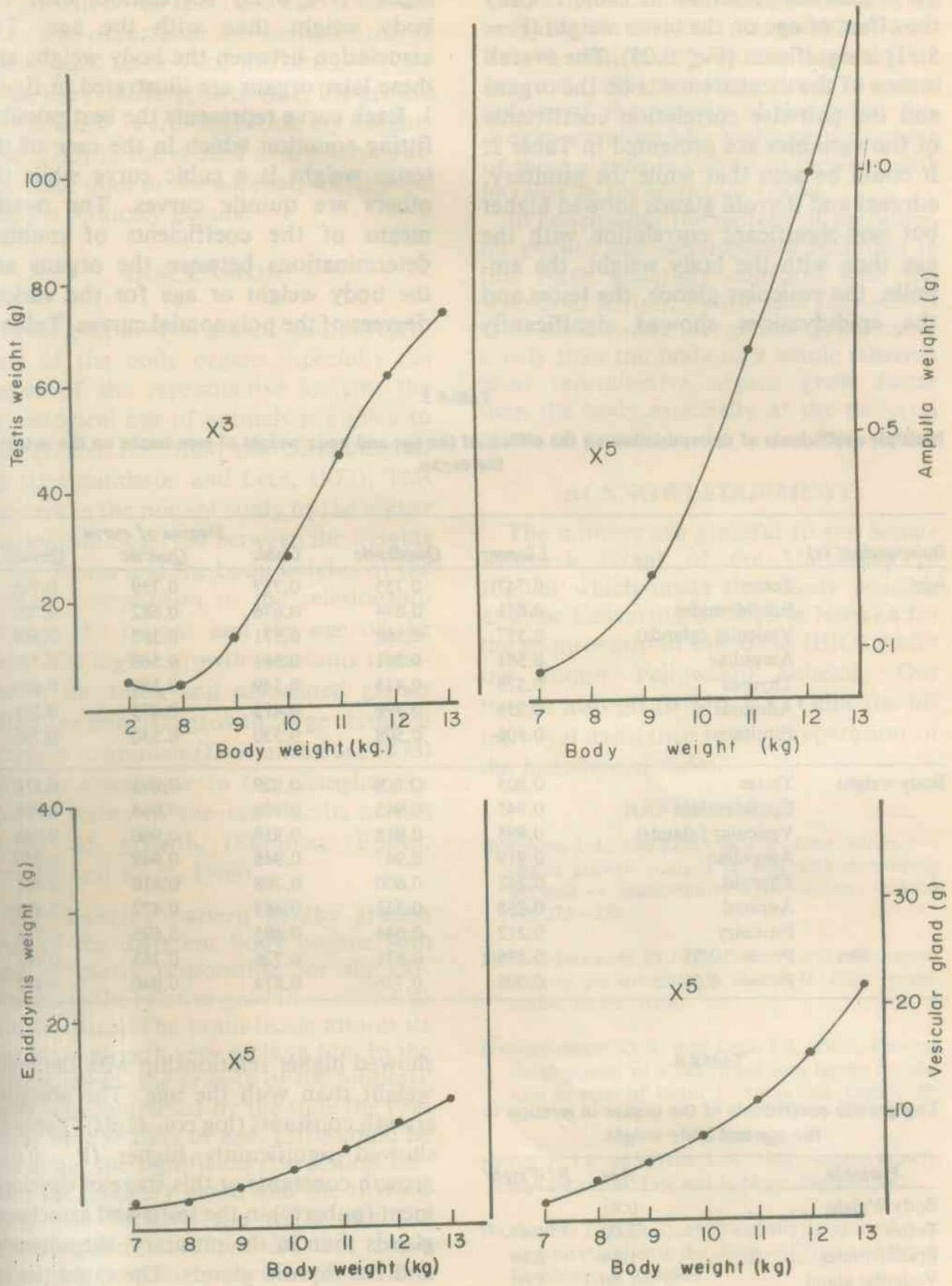

Fig. 1: Allometric growth of the testis, epididymis, ampulla and Vesicular glands of the Nigerian Dwarf Sheep.

the organs are presented in Table 1. Only the effect of age on the testes weight (F = 5.51) is significant (P< 0.05). The overall means of the measurements on the organs and the pairwise correlation coefficients of the variables are presented in Table 2. It could be seen that while the pituitary, adrenal and thyroid glands showed higher but non-significant correlation with the age than with the body weight, the ampulla, the vesicular glands, the testes and the epididymides showed significantly higher (P< 0.05) correlation with the body weight than with the age. The association between the body weight and these later organs are illustrated in figure 1. Each curve represents the best possible fitting equation which in the case of the testes weight is a cubic curve while the others are quintic curves. The overall means of the coefficients of multiple determinations between the organs and the body weight or age for the various degrees of the polynomial curves (Table 3)

TABLE 3

Multiple coefficients of determination on the effects of the age and body weight of ram lambs on the weight of the organ.

Independent (x)		*Degree of curve*				
		Linear	*Quadratic*	*Cubic*	*Quartic*	*Quintic*
Age	Testes	0.747	0.755	0.757	0.759	0.766
	Epididymides	0.671	0.674	0.676	0.682	0.705
	Vesicular (glands)	0.357	0.368	0.371	0.387	0.564
	Ampullae	0.561	0.561	0.561	0.569	0.777
	Thyroid	0.373	0.415	0.549	0.550	0.880
	Adrenals	0.355	0.398	0.472	0.473	0.561
	Pituitary	0.506	0.508	0.530	0.530	0.780
Body weight	Testes	0.805	O.806	0.829	0.845	0.878
	Epididymides	0.945	0.945	0.968	0.968	0.968
	Vesicular (glands)	0.895	0.918	0.918	0.960	0.966
	Ampullae	0.919	0.947	0.948	0.949	0.950
	Thyroid	0.242	0.600	0.788	0.810	0.852
	Adrenal	0.258	0.322	0.463	0.472	0.688
	Pituitary	0.212	0.644	0.685	0.695	0.724
For	P = 0.05 r =	0.576	0.671	0.726	0.763	0.763
	P = 0.01 r =	0.708	0.776	0.814	0.840	0.840

TABLE 4

Log growth coefficients of the organs in relation to the age and body weight.

Variable	*Age*	*B/Weight*
Body Weight	0.41	
Testes	3.02	4.61
Epididymides	1.64	2.89
Vesicular gland	1.36	3.07
Ampullae	1.96	3.76
Thyroid	0.70	1.17
Adrenal	0.25	0.26
Pituitary	0.22	0.57

showed higher relationship with the body weight than with the age. The absolute growth constants (log constants) (Table 4) showed significantly higher (P 0.05) growth constants at this stage of development (puberty) in the testis and associated glands than in the pituitary, the adrenals and the thyroid glands. The rapid rise in the weights of the ampulla and the vesicular glands at about 125 days of age and 10 — 11kg body weight though not significant (Table 1) was consistent with

the growth of the testis and also coincided with the occurrence of spermatozoa in histological sections of the testis.

On the relative growth rate, the growth coefficients were significantly higher ($P < 0.05$) in the organs of the reproductive tract than in the adrenal, the thyroid and the pituitary glands.

DISCUSSION

In the prepubertal growth and development of the body organs especially the organs of the reproductive system, the physiological age of animals is known to play greater role than the chronological age (Dyrmundsson and Lees, 1972). This is shown in the present study by the higher relationship observed between the weights of the organs and the body weights of the rams in comparison to the relationship between the organs and the age of the rams. The higher growth constants recorded in the testis and associated glands reflect the pubertal growth surge recorded generally in animals (Dyrmundsson, 1973) which is a response to the changing endocrine status of the ram lambs at this period of growth (Skinner, Booth, Rowson and Karg, 1968).

The changing pattern of the growth rates of the different body organs with time, is partly responsible for the differences in the relative growth coefficients of the organs. The brain tissue attains its maximum growth very early in life. In the Suffolk sheep, the growth of the pituitary gland was completed by the time the ram lambs were 98 days of age. Little could be said about the significant correlation between the pituitary gland and the tnyroid gland also between the testes and the adrenal gland since we did not come across any previous report on these. It is possible that these glands were just growing in response to the general body growth at this period or that the thyroid gland, just like the pituitary gland also complete its growth early in life.

The significant correlations between the ampulla, the vesicular gland and the testis weight seem to confirm the report (Skinner *et al,* 1968) that these glands are good indices of the activity of the testes. Androgen secretion which affects the growth of these glands is known to increase with increase in the testicular tissue.

In conclusion, the pattern of prepubertal growth and development recorded in this study generally conform with the reports of Kirton, Fourie and Jury (1972) that most endocrine glands grow more slowly than the body as a whole whereas most reproductive organs grow faster than the body especially at the pubertal phase of growth.

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