A Better Approach to the Estimation of Testicular Size in Live Boars

By

G. N. EGBUNIKE* and J. STEINBACH

Department of Animal Science,
University of Ibadan,
Ibadan.

SUMMARY

A MODIFIED approach in testicular biometry in boars is described. Twelve mature Large White pigs were used for this study. Half the major axis of the testis [a] and the square of half the minor axis [b²] were highly significantly correlated with both testicular weight and testicular volume. The multiple correlations between a and b² and the testis weight and testis volume were respectively 0.94 and 0.96 and equally highly significant.

The testicular weights and volumes calculated with the multiple regression equations obtained in this study accounted for 99% and 97% of the actual values respectively.

INTRODUCTION

THE importance of accurately estimating testis size in live animals cannot be over-emphasized since it appears to be the most variable component in the equations that have been used in the calculations of sperm production rates (Swierstral 1966). A reliable method will also provide a means of detecting all forms of hypogonadism in young male animals and thus facilitate the identification and selection of sires with such hereditary defects.

That there is a highly positive correlation between testicular dimensions, especially scrotal circumference, and testicular weights in bulls has already been demonstrated (Willett and Ohms, 1957; and Hahn Foote and Seidel, 1969). A similar relationship exists between the two axes

of the testis and testis weight in boars (Podany, 1969) and in rabbits (Paufler, Van Vleck and Foote, 1969).

Unfortunately, the use of the regression formulae devised by Willett and Ohms (1957) and Hahn *et al* (1969) for estimating the weights of Angoni bull testes resulted in over-estimation and under-estimation respectively (Igboeli and Rakha, 1971).

In view of this situation, a brief study was undertaken to provide a better means of estimating the testicular size in live boars.

MATERIALS AND METHODS

Animals

The 12 Large White boars used in this study were raised in an open-air University pig-barn where they had water and feed *ad libitum*. They ranged in age from 9 months to 27 months and were all healthy.

Biometrical Procedures

Just before the animals were slaughtered, they were isolated and allowed enough time to calm down. When they had become familiar with the operators and were more relaxed, the major and minor axes of each testis were measured using a testimeter (Podany, 1969). The scrotal

* Present address: Department of Animal Science,
College of Science and Technology,
Port Harcourt.

skin-fold was then measured with a pair of calipers (Fig. 1).

The formula for calculating the volume of an ellipsoidal body (Rottmann, 1960) was used taking the testis to be ellipsoidal (Fig. 2). Since *b* and *c* are equal being radii of the same circle, the formula becomes:

$$\text{Volume} = \frac{3}{4} \pi ab^2$$

The two variables in the formula, half the major axis, *a*, and half the minor axis, *b*, were obtained after subtracting the skin-fold from both the major and minor axes. Some preliminary measurements had to be taken by two technicians, using the same instruments, until they were able to obtain highly repeatable measurements as had earlier been reported (Hahn *et al*, 1969).

Immediately after the boars had been sacrificed, their testes were excised, trimmed free of the epididymides and weighed. The volume of each testis was determined

by water displacement. All measurements were done to the nearest 0.1.

With the four variables, weight, volume, *a*, and *b*², multiple regression analyses were done. The resultant equations were then used to calculate the weight and volume of each testis. These calculated values were compared with the real values and then subjected to statistical analyses (Steel and Torrie, 1960).

RESULTS

The calculated and real weights and volumes of the 24 testes from the experimental animals are shown in Table 1. The calculated weights represented 99% of the real values while the corresponding figure for volume was 97%. Although, there were slight variations on both sides, analyses of variance failed to show any significant differences between the two groups (Table 2).

TABLE 1
Means and Standard errors of Calculated and Actual Values of Testicular Weight and Volume

	Weight (g)	Volume (ml)
Calculated	271.06 + 11.43	250.12 + 10.69
(Range)	(175.45 — 380.03)	(146.90 — 354.52)
Actual	274.57 + 11.37	258.47 + 10.38
(Range)	(203.6 — 371.5)	(191.0 — 355.0)
Calculated/Actual (%)	98.72	96.77

TABLE 2
Summary of Analyses of Variance on the differences between the Calculated Weights and Volumes and the Real Ones

Source of Variation	Degree of Freedom	Mean Sum of Squares			
		Weight	Volume	Weight	Volume
Calculated vs. Real	1	147.74	835.42	0.77	2.74
Between Animals	23	5684.77	5384.76	29.73**	17.67***
Error	23	191.21	304.66		

***P < 0.005

The correlation coefficients between the testicular dimensions and the testis weights and volumes are shown in Table 3. The two axes were highly correlated with the testis weight and volume. Also, the multiple correlation coefficients, R , between a and b^2 and testis weight and volume of 0.94 and 0.96 respectively were highly significant ($P < 0.01$) (Table 3)

The multiple regression equations obtained for calculating the weight and volume of testes from a and b^2 are as follows:

$$\text{Volume: } Y_v = 53.6X_a + 5.6X_{b^2} - 185.3$$

$$\text{Weight: } Y_w = 34.1X_a + 11.5X_{b^2} - 102.1$$

TABLE 3

Correlations Between Various Testicular Measurements

Dependent Variables	Independent Variables		
	major axis (a) (r)	minor axis (b2) (r)	(a) and (b2) (R)
Weight	0.89**	0.90**	0.94**
Volume	0.99**	0.99**	0.96**
Major axis	—	0.81**	—

** $P < 0.01$

Figure 1. A: Posterior view of a boar, showing the testes with major (a) and minor (b) axis.

B: Section through the scrotum, showing the measurement of the skin-fold thickness.

Figure 2. Rotational ellipsoid, showing half the major axis (a), half the minor axis (b) and the radius of the equatorial plane (c). The volume of the rotational ellipsoid is equal to $\frac{3}{4} (a \times b \times c)$.

DISCUSSION

The highly significant correlation between the testicular measurements and the testicular weight and volume confirm the findings of earlier workers (Willett and Ohms, 1957; Hahn *et al*, 1969 and Podany, 1969). Similarly, the multiple correlations between a and b^2 and testis weight and volume confirm the views held by Carson and Amann (1972) that two or three dimensions are more accurate in estimating testicular weights than just one linear measurement.

In a similar study by Paufler *et al* (1969), the testicular sizes obtained by the

use of the formula for an ellipsoidal body were over-estimated. Part of this over-estimate was attributed to the inclusion of the thickness of the scrotal skin or skin fold.

In the present study, however, the skin-fold was excluded from all the linear measurements. On the other hand, some of the animals had more subcutaneous fat around the testes which prevented the proper flushing of the testes in the posterior quarters of the animals and may have been partly responsible for the slight differences between the actual and calculated values reported herein.

These variations, notwithstanding, the 99% of the weight and 97% of the volume accounted for by the calculated values are reasonably high. However, these results indicate that accurate measurements are essential. It will therefore be necessary to at least take measurements in duplicates and use the mean values.

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