Scrotal Circumference at Puberty and its Relationship to Testes Mass in Three Genotypes of Beef Cattle

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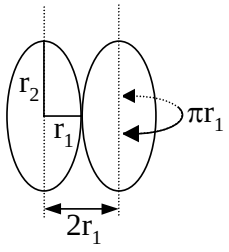
Scrotal circumference (SC) is a simple, non-invasive measurement commonly used to evaluate bull breeding potential although its validity as a predictor of fertility is questionable (Holroyd, 1998). SC is highly heritable but varies with breed and animal factors such as condition, live weight and age. As an indicator of fertility, recommended SC values range broadly from 30cm to 38cm (Miller, 1992). It is assumed that SC accurately reflects testes mass (TM) which may be related to direct measures of fertility such as spermatogenesis (Entwistle, 1992). The SC measurements made here test the assumption that SC, used to estimate testes volume (TV), is directly related to TM. Miller (1992) reported a value of 261mm as the SC threshold for puberty. We have studied serial SC measurements so as to devise a more accurate means of using SC to determine puberty.

This study utilised data, recorded monthly, from 107 pasture-fed bulls from 13mo of age (BW=349.5±3.9kg) until surgically castrated under sedation at about 18mo of age. Genotypes were *Bos indicus* (BI, n=36), F_1 cross (BX, n=36) and *Bos taurus* (BT, n=35). SC was recorded 1d (SC_c), 1mo (SC_{-1}), 2mo (SC_{-2}), 3mo (SC_{-3}) and 5mo (SC_{-5}) before castration. TM was measured at castration. The effect of genotype group on SC and TM was determined by analysis of variance with the corresponding BW included as a covariate. The relationship between TM and SC_c was investigated using various models. To provide a physically meaningful model, testes were modelled as prolate spheroids with an axis ratio (r_2/r_1) of 2 (Entwistle, 1992) giving the relationship; $TV=0.015409\ SC^3$. **Figure A.** Puberty status was determined by considering changes in the ratio of SC to BW. It was assumed that this ratio decreased prior to puberty, increased rapidly during puberty and decreased again following puberty. The SC and age in days (AGE) at the inflection point correspond to the pubertal values (SC_p and AGE_p).



Genotype group differences in SC (corrected for BW) were identified in young bulls but differences reduced with age so that at castration there were no genotype differences in SC or TM (Table 1). Combining various breeds into genotype groups may have obscured differences between breeds (eg. Brahman and Boran) or fertility lines. A linear relationship between TV and TM was observed (Figure 1; $TM = 41.1 + 0.9068\ TV$; $R^2=0.878$). This implies a cubic (volume and density) relationship between SC and TM thus confirming that SC is a valid measure of the amount of spermatogenic tissue in bovine testes.

Table 1. Effect of genotype group on means of TM (g) and SC (mm) with BW as covariate.

	TM	SC_{-5}	SC_{-3}	SC_{-2}	SC_{-1}	SC_c
	ns	***	***	*	#	ns
BI	465	242 [b]	265 [b]	283 [b]	299	307
BX	496	262 [a]	283 [a]	298 [a]	310	315
BT	479	266 [a]	289 [a]	301 [a]	313	315

ns p>0.1, *** p<0.001, * p<0.05, # p=0.068

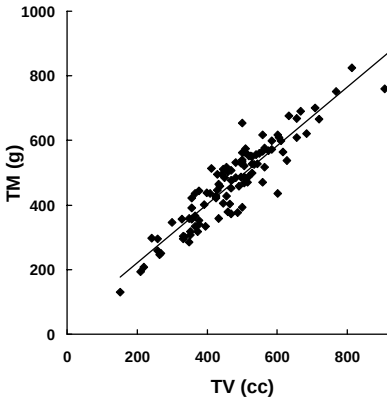


Figure 1. Relationship of testes mass to testes volume calculated from scrotal circumference

Forty animals (37%) were identified as going through puberty during the study period by a clear inflection point in their SC/BW ratio. The remaining animals did not display a transition so were either post-puberty at SC_{-5} or had failed to reach puberty at castration. The average SC_p for all genotypes was 286 ± 6mm and the average AGE_p was 427 ± 5d. Uncertainty about the remaining animals made it difficult to sensibly investigate genotype differences for these attributes. This simple transition method can effectively utilise SC measurements and body weight ratios to identify puberty in bulls.

Entwistle, K. 1992. A brief update on male reproductive physiology. In: Bull Fertility. R. G. Holroyd, Ed. Queensland Gov., Brisbane. p. 1.

Holroyd, R. G. 1998. No single bull trait relates to calf output. NAP News. Meat and Livestock Australia. 10:3.

Miller, R. 1992. Overconditioning of bulls. In: Bull Fertility. R. G. Holroyd, Ed. Queensland Gov., Brisbane. p. 44.

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