

Scrotal Circumference of beef bulls, Rio Grande do Sul, Brazil

Brazil, like Australia, is a large land area subject to harsh climatic extremes. From tropical Amazon in the north, baking hot tropical summer rainfall climate in central regions to more temperate regions of the state of Rio Grande do Sul along the southern border. Long dry periods and extreme heat periods impact on cattle herd fertility, the most important factor in profitability of cow-calf operations.

Maintaining high fertility in bulls is crucial to high calving percentages.

The variability of scrotal circumference and the effects of age and breed as well as the relationship between testicular weight (TW), scrotal circumference (SC), and live weight (BW) were investigated in bulls. Devon, Poll Hereford and Red Angus breeds showed higher SC values than the other British, Continental, Synthetic (Composed), and Zebu (Brahman) breeds studied. The percentage of culled bulls because of low SC ranged from 7.01 to 24.25%. The increase of SC was proportional to the increase in TW and they were highly correlated ($r=0.90$). The results suggest that SC in young bulls is the best way to predict TW and, therefore, a useful tool for their selection.

The reproductive process in beef cattle, even with the improvements in reproduction techniques, has not shown significant advancements in its efficiency parameters, as it is quite difficult to implement them. Additional gains regarding the cow-calf system, mainly in terms of genetics and fertility, have strongly limited this process; and taking good advantage of these gains, such as male and female precocity, is crucial in increasing productivity.

Bulls play a key role in cow-calf production and represent an important source of bioeconomic capital in this activity. However, 15% to 20% of bulls can have fertility problems due to various causes (physical condition, testicles, foreskin, musculoskeletal system, penis, etc).

Lunsta in 1988 selected bulls with larger testicles and found a heritability of 41% for age at puberty in their daughters and for scrotal circumference in half-brothers, while Van Melis (2010) found 53% and 42% for these characteristics. Therefore, increased precocity based on the selection of bulls for larger scrotal circumference may enhance the precocity of their progeny (Gressler 2000).

Scrotal circumference is one of the parameters assessed during clinical examination, which is part of a reproductive evaluation of a bull. Measurement of scrotal circumference is important because it assesses testicular volume and is highly correlated with sperm output. Considering that this measurement is easy to perform and accurate, it can be used for the selection of young bulls.

The aims of this study were to quantify the variability of scrotal circumference in bulls by establishing minimum values for this characteristic, and to investigate the relationship between testicular weight and scrotal circumference.

Two experiments were carried out.

In **Experiment 1**, scrotal circumference was measured in 9664 bulls, aged from 2 to 3 years old, belonging to British, Synthetic composed, European and Zebu breeds.

The assessments were performed on farms throughout the state of Rio Grande do Sul in southern Brazil, during breeding soundness examinations, for sales, or during on-farm evaluations in the Bull Evaluation Program in Julio de Castilhos in 1988. This program was continued by the Brazilian Institution SENAR until taken over by Casa Rural RS in 2008. The purpose of the program being to evaluate bulls on farms because (according to the literature) around 25% of mature bulls are deemed unsuitable for reproduction. During the years of the program 120 veterinarians attended courses in anatomy, physiology and reproductive diseases developing standardised culling criteria for bull soundness.

In **Experiment 2**, 70 grass-fed Charolais cross bulls, aged 11 to 12 months from the Plateau region of Rio Grande do Sul, were evaluated for live weight, scrotal circumference and testicular weight. The young bulls were managed during the suckling period on pearl millet pastures until weaning (6 to 7 months) and later fed on black oats and ryegrass. At the end of the experiment testicles were measured for circumference then removed and weighed.

In **Experiment 1**, the mean SC obtained for bulls of all breeds was 35.15cm at 2 years and 36.47cm at 3 years. Within the British breeds at 2 years Poll Herefords (37.86cm), Red Angus (36.83cm) and Devon (36.69) bulls had the largest SC measurements. At 3 years Devon, Red Angus and Poll Hereford had the highest SC values 38.06, 37.88 and 37.86cm respectively, whereas Shorthorn had the lowest SC values 33.38 and 35.05cm at 2 and 3 years old. This variation in SC values among British breeds possibly demonstrates a greater or lesser selection for this trait.

In European breeds, Charolais bulls had larger SC than Limousin ones, regardless of age.

In the group of Synthetic Composed breeds, Montana bulls at 2 years showed the largest SC (36.18cm), whereas Santa Gertrudis and Braford bulls had the lowest values (34.98cm and 34.93cm) respectively. At 3 years Montana and Brangus bulls had the highest SC values, (37.47 and 37.13cm).

Among the Zebu breeds, those of the Nelore breed had larger SC than Tabapua bulls.

The differences in SC values among British, Euro, Composed and Zebu bulls can be explained by breed differences, year and location of measure, and differences in testicular development between *Bos taurus* and *Bos indicus*.

Puberty is characterised by factors such as body weight, scrotal circumference, hormone concentration, sexual aggressiveness, and semen production. In addition to puberty, anatomical characteristics of the testicles should be also considered.

The results obtained for Nelore bulls indicated a predominance of testicles with elongated shapes at 17-24 months. For this reason, testicular volume is a better predictor of testicular development. These differences are noticed by the increase in SC between 2 and 3 years of life.

These differences are noticed by an increase in SC between the second and third years of life. British bulls increased in SC by 0.97cm from the two to three years of age, whereas SC increased 1.62cm for Euro, 1.40cm for Composed and 1.86cm for Zebu breeds respectively. In a former study, Coulter (1987) when comparing 7918 bulls as 2-year-olds, found the mean SC was 37.2cm for Angus, 36.3cm for Charolais, 36.1cm for Hereford, 35.6cm Poll Hereford, 34.9cm Shorthorn and 32.2cm for Limousin. These means, except for the one obtained for Poll Hereford, were similar to observations in this study.

In Experiment 2, the mean live weight of the Charolais cross bulls in the present study was 306.8kg with an average Scrotal Circumference of 28.8cm and testicular weight of 363.9g. The relationship between testicular weight and scrotal circumference was 12.63g/cm.

In young bulls, SC measurements are influenced by breed, body condition scores, age at onset of puberty, and breeding system. Testicles show a maximum growth rate during puberty and the nutritional status of developing young bulls plays a major role in the age at which puberty begins. There is a direct correlation between SC and testicular weight and a relative correlation between scrotal circumference and testicular weight as a function of live weight. The increase in live weight leads to a linear increase in SC within the age at puberty. As SC indicates potential fertility, SC measurements and the selection of young bulls provide greater possibilities for sperm output.

Table1: Mean and standard deviation of scrotal circumference for bulls of the assessed breeds at the ages of two and three years old.

Breed Group	Breed	2-year-old			3-year-old		
		Number	Mean	SD	Number	Mean	SD
British	Angus	1681	36.45 b	2.79	1439	37.53 ab	2.76
	Devon	364	36.69 ab	3.05	280	38.06 a	2.73
	Hereford	600	36.43 b	3.19	535	37.08 b	3.08
	P Hereford	1376	37.86 a	3.30	966	37.86 a	2.92
	Red Angus	1705	36.83 ab	2.99	1485	37.88 a	2.82
	Shorthorn	12	33.38 c	2.48	51	35.05 c	2.13
	Total	5738	36.27 A	3.09	4756	37.24 A	3.03
European	Charolais	516	36.19	3.11	346	37.52	3.11
	Limousin	69	32.98	3.31	36	36.62	3.41
	Total	585	35.45 AB	3.22	382	37.07 A	3.04
Synthetic Composed	Braford	1210	34.93 b	2.91	1162	35.99 b	2.99
	Brangus	1312	35.71 ab	3.29	1401	37.13 a	3.05
	Montana	310	36.18 a	2.64	59	37.47 a	2.47
	Santa Gertrudis	77	34.98 b	2.95	46	36.84 ab	3.10
	Total	2909	35.45 AB	3.36	2668	36.85 A	3.08
Zebu	Nelore	344	32.45	3.29	261	34.17	2.79
	Tabapua	88	32.13	3.43	168	34.13	2.89
	Total	432	32.29 B	3.57	429	34.15 B	3.14
	Overall total Mean	9664	35.15	3.31	8235	36.47	3.07

Different letters (lower case and capital) in the same column indicate statistical difference (P<0.05)

Reference: Measurement of scrotal circumference of beef bull in Rio Grande do Sul, SRO Menegassi, JOJ Barcellos, V Peripolli, PRRX Pereira, JBS Borges, VN Lampert. Universidade Federal do Rio Grande do Sul.

The research paper mentioned has been edited and adapted by Vic Edwards.