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DEVELOPMENTAL CHARACTERISTICS OF TESTICULAR AND EPIDIDYMAL FUNCTION OF BRAHMAN BULLS

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Background. Several studies have shown that Brahman bulls attain puberty at older ages than *Bos taurus* bulls. Endocrine events preceding puberty have been studied. However, information on peripuberal testicular and epididymal function of Brahman bulls is lacking. Supplementation of undegradable intake protein (UIP) in mature Bos indicus cross bulls has been shown to increase epididymal size and epididymal sperm reserves. In peripuberal Brahman bulls, supplementation with undegradable intake protein had a positive effect on growth, but did not affect testicular size or testosterone concentrations. The objectives of this study were to study testicular and epididymal function of peripuberal Brahman bulls, and to determine the effects of UIP and sire on those traits.

Research Findings. Thirty-nine Brahman bulls (age = 302 d; BW = 450 lb) were allotted to one of two treatment groups. The high UIP group (H) received a supplement containing 72% UIP, and the low UIP group (L) received a supplement with 47% UIP. Both feed supplements were isonitrogenous (16% CP) and isocaloric (3.2 Mcal/kg of metabolizable energy). For an 84-d period the supplements were fed at 1% of average body weight. Bermudagrass hay, minerals and water were available free choice. After the initial 84-d period, bulls were fed the appropriate concentrate ration at 1.25% of average body weight. In a randomly predetermined order, bulls were castrated when the first ejaculate with first sperm cell (Stage 1), 10 to 25 x 10^6 sperm cells (Stage 2) or $\geq$ 50 x 10^6 sperm cells (Stage 3 - puberty) were obtained. Daily sperm production, daily sperm production per gram of parenchyma, and epididymal sperm reserves were calculated for one testicle and one epididymis/bull using a homogenization technique. The bulls used were the progeny of 4 different sires. There were no differences ($P>0.05$) between treatments for daily sperm production or daily sperm production per gram of parenchyma for any of the stages. Bulls in Stage 2 had heavier testicles, higher daily sperm production and higher daily sperm production per gram of parenchyma ($P<0.05$) than bulls in Stage 1. Despite similar testicular weight, bulls in Stage 3 had higher ($P<0.05$) daily sperm production than bulls in Stage 2 of sperm output, due to a sharp increase ($P<0.05$) in daily sperm production per gram of parenchyma (6.4 vs 3.2 million, respectively). Therefore, the first ejaculate with 50 x 10^6 or more sperm cells does indeed represent a specific stage of sexual development, and may be appropriate as a definition for puberty in the Brahman bull. Bulls fed high UIP supplement had heavier epididymis than bulls assigned to the low UIP group (Table 1). However, increased epididymal weight was not accompanied by an increase in epididymal sperm reserves (ESR). Epididymal tail sperm reserves are the only epididymal source of spermatozoa available for ejaculation. Bulls assigned to the low UIP supplement had higher ($P<0.05$) proportions of epididymal sperm reserves in the tail of the epididymis (0.78) at puberty, than bulls on the high UIP diet (0.54). Sire also affected epididymal sperm distribution, with progeny from one sire having a higher ($P<0.05$) proportion of epididymal tail sperm reserves (0.72) than the progeny of the other three sires (0.33 to 0.48).

Table 1. Epididymal weights and epididymal sperm reserves (ESR).

Treatment	Stage 1 (g)	Stage 2 (g)	Stage 3 (g)	Total (g)	ESR ($x10^6$)
High	6.8 ± 0.9^a	7.4 ± 0.9^a	5.6 ± 0.9^a	6.6 ± 1.0^a	249 ± 53^a
Low	2.5 ± 0.8^b	5.3 ± 1.1^a	3.8 ± 0.9^a	3.9 ± 0.6^b	253 ± 57^a

Mean in the same column with different superscripts differ ($P<0.05$).

Epididymal tail sperm reserves for puberal bulls in this study (368×10^6 sperm cells) were much lower than reported for 1.5 yr old Bos indicus and 14 to 18-mo-old Bos taurus bulls (Table 2). With an average ejaculation of 211×10^6 sperm cells at puberty, the tail epididymal sperm reserves were not enough for two ejaculates.

Table 2. Sperm reserves of the cauda epididymis in bulls of different breeds*.

Breed	Brahman	Brahman crosses[1]	Bos taurus[2]
Age	16 mo	18 mo	16 mo
ESR	368×10^6	3120×10^6	4700×10^6

*Values for a single epididymis.

Adapted from [1]Wildeus and Entwistle (1982) Theriogenology 17:655.
[2]McMillan *et al.* (1972) New Zealand Journal Agr. Res. 15:255

Application. Low cauda epididymis sperm reserves preclude the use of Brahman bulls which have just reached puberty for breeding. Further studies are needed to clarify the development of sperm reserves available for ejaculation in young postpuberal Brahman bulls. The growth improvements obtained in Brahman bulls with supplements high in UIP are not accompanied by increased sperm production or increased extra gonadal sperm reserves.