

EFFECTS OF RESTRICTED NUTRITION DURING CALFHOOD ON SEXUAL DEVELOPMENT IN BEEF BULLS

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A previous study demonstrated that beef bulls raised by heifers have delayed sexual development when compared to bulls raised by cows, possibly due to differences in milk intake during calfhood (preweaning period). The present experiment used a model of bulls raised by heifers with the objective of elucidating the hormonal mechanisms involved in regulating sexual development when nutrition during calfhood was restricted. Thirty Angus and Angus x Charolais bull calves were weaned at 9 wk of age and allocated into 2 diet groups; from 10 to 26 wk of age bulls in the control group (CG) received ad lib barley silage with 8% barley grain, while bulls in the restricted-nutrition group (RG) received 75% of the amount supplied to the CG. From 26 to 50 wk of age, both groups received the same control diet. Body weight and scrotal circumference (SC) were determined at 4-wk intervals and intensive blood samplings followed by GnRH-challenge were performed (8 bulls/group; 14 to 26 wk of age). Serum concentrations of leptin, growth hormone (GH), luteinizing hormone (LH), and testosterone were determined by RIA and semen was collected for determination of age at puberty (ejaculate with >50 million sperm with >10% motile sperm). Age at puberty was compared with a *t*-test, while the remaining end points were analyzed by mixed-models analysis with Tukey's test. Overall, bulls in the RG weighed less and had smaller SC than bulls in the CG (group effect: $P < 0.05$; 399 vs. 437 kg and 27.6 vs. 29.8 cm at 50 wk, respectively). By 50 wk of age, 4 bulls in the RG had not reached puberty, while all bulls in the CG were pubertal (age at puberty 317.6 vs. 293.1 d, respectively; $P < 0.05$). Luteinizing hormone pulse frequency, mean concentration and total secretion in 10 h were lower in bulls in the RG (group effect: $P < 0.005$ to 0.07). Furthermore, mean, peak, and total LH secretion in 90 min after GnRH treatment, mean physiological testosterone concentration, and total testosterone secretion in 90 min after GnRH treatment were all lower in the RG (group effect: $P < 0.05$). Therefore, restricted nutrition suppressed LH secretion by suppressing the hypothalamic GnRH pulse-generator and by decreasing pituitary responsiveness to GnRH. Serum testosterone concentration in these bulls was decreased secondary to reduced LH concentrations and possibly due to direct effects on function and (or) number of Leydig cells. However, there were no differences between groups in serum concentrations of leptin or GH. In conclusion, restricted nutrition during calfhood delayed sexual development in beef bulls as result of inhibition of the hypothalamus-pituitary-gonads axis; restricted nutrition seemed to adversely affect every level of this axis. However, neither leptin nor GH seemed to be involved in translating nutritional status information to the hypothalamus-pituitary axis and regulating LH secretion. Strategies to improve nutrition for bull calves raised by heifers during the preweaning period may hasten sexual development and possibly improve fertility in yearling bulls.

Keywords: Bull; Nutrition; Puberty; Leptin; Growth hormone.