Follicular Waves and Hormonal Profiles during the Estrous Cycle of Carriers and Non-Carriers of the Trio Allele, a Major Bovine Gene for High Ovulation and Fecundity

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A high fecundity bovine genotype has recently been mapped to bovine chromosome 10. Cattle carrying the high fecundity allele, referred to as the Trio allele, have multiple ovulations while half-sibling, non-carriers generally have single ovulations. The present study was designed to evaluate follicle wave patterns and associated circulating hormones during the estrous cycle of Trio allele carrier (n=7) and non-carrier half-sib controls (n=5). We hypothesized that Trio allele carriers would exhibit multiple smaller dominant follicles and greater circulating FSH than non-carrier controls. All animals had their estrous cycle synchronized as follows: two doses of prostaglandin F2α (PGF) were administered 24 h apart on days 0 and 1, and on day 3 GnRH was administered. On day 10 (7 d after previous GnRH), another GnRH treatment was administered and two doses of PGF were administered on day 15 and 16. Ultrasound examinations of the ovaries and blood sample collection were performed every 24 h starting on the day of estrus until the completion of an interovulatory interval. Examinations were done using a B-mode ultrasound scanner with a 7.5 MHz transducer and recorded in a 20 second cine-loop. The proportion of Trio carrier and non-carrier cows with 2 or 3-wave patterns was not different between genotypes with the majority (>70%) exhibiting 3-wave patterns. Trio carriers had greater ($P<0.01$) number of ovulations (4.0±0.4 vs 1.0±0.0 ovulations) and smaller preovulatory follicles (8.9±0.4 vs. 14.9±0.4 mm; $P<0.01$) than non-carrier controls. However, total luteal tissue volume and circulating progesterone, normalized to the initial ovulation or to the onset of luteolysis, were not different between genotypes ($P>0.10$). Follicular waves were found to be associated with an FSH surge in both genotypes. Evaluation of circulating FSH and follicle growth patterns was evaluated in 3-wave animals due to insufficient number of animals with 2-wave patterns. Peak FSH concentration at each follicular wave (3-wave patterns) was not different ($P > 0.05$) between genotypes, but circulating FSH during the decline and nadir, encompassing the day of deviation, was greater ($P<0.05$) in Trio carriers. Despite a difference in the length of the estrous cycle (23.0±0.6 vs. 25.2±0.8 d; $P=0.03$), the pattern of follicle growth, such as day of wave emergence, day of follicle deviation, and day of maximum diameter of the dominant follicle, when normalized to the FSH surge of each follicular wave were similar ($P>0.05$) in Trio carriers compared to non-carriers. However, mean dominant follicle diameter at wave emergence, at deviation and mean dominant follicle maximal diameter were smaller ($P<0.05$) in Trio carriers than non-carrier controls in every wave. For example, during the first follicular wave mean dominant follicle diameter at first detection, at deviation and at their maximum were 3.0±0.2mm, 5.1±0.3mm, and 7.0±0.4mm for Trio carriers and 4.9±0.6, 8.9±0.9mm, and 14.7±1.7mm for non-carrier controls. Circulating estradiol normalized to the day of ovulation was not different ($P=0.49$) between Trio carriers and non-carriers. Thus, decreased follicle size and greater circulating FSH are key components of the mechanism that produces multiple ovulations in cattle that are carriers of the Trio high fecundity allele.