Multiple Dominant Follicles are required for Complete Suppression of Circulating FSH in a High Fecundity Bovine Genotype as demonstrated with a One-Follicle Model

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A novel high fecundity bovine allele, Trio, was recently discovered. Cattle carrying the Trio allele have multiple ovulations of smaller-sized follicles while half-sibling non-carriers have single ovulations. Our hypothesis is that maintenance of inhibition of FSH to basal concentrations after follicle deviation (selection) is dependent on only a single dominant follicle in non-carriers but requires multiple dominant follicles in Trio carriers. A synchronized follicular wave was induced in Trio carrier (n=19) and non-carrier (n=20) heifers, by follicular ablation with follicle growth in a controlled progesterone (P4) environment (no CL, one intravaginal P4 implant). Five days after synchronization, intravaginal P4 was removed, and heifers within each genotype were randomized to one of two treatments: 1) One-follicle model: removal of all follicles except largest dominant follicle (F1), or 2) Sham-aspiration control. Thus, four groups were analyzed: Trio carrier, one-follicle (TC-OF; n=11); Trio carrier, control (TC-C, n=8); Non-carrier, one-follicle (NC-OF, n=12); and Non-carrier, control (NC-C, n=8). Heifers in OF groups had all follicles ≥4 mm in diameter, except F1, removed by ultrasound-guided transvaginal follicle aspiration with re-aspiration of any visible, previously-aspirated follicles 12 h later. Heifers in control group underwent a sham aspiration in which no follicles were removed. Blood samples were collected by coccygeal venipuncture every 12h starting 24h before treatment and FSH concentrations were determined by radioimmunoassay. Diameter of F1 at time of treatment was greater (282% greater volume; $P<0.001$) in Non-carriers (10.6±0.3 mm) than Trio carriers (7.5±0.3 mm), whereas, circulating FSH was greater ($P<0.05$) in Trio carriers (0.46±0.03 ng/ml) than Non-carriers (0.31±0.01 ng/ml), regardless of subsequent treatment. Analysis of circulating FSH indicated effects of group, time, and group by time interaction ($P<0.03$). Circulating FSH increased ($P<0.05$) immediately after treatment in TC-OF heifers and was greater ($P<0.05$) than any other group at hours 12 and 24. At hour 24, circulating FSH was 0.68±0.05 ng/ml for TC-OF, 0.44±0.07 ng/ml for TC-C, 0.29±0.04 ng/ml for NC-C, and 0.33±0.03 ng/ml for NC-OF. Analysis of percentage change in FSH from pre-treatment concentrations indicated significant effects of group, time, and group by time interaction ($P<0.03$). Prior to treatment (hour -24 to 0), there were no differences in percentage change in FSH between groups ($P>0.10$). Removal of all but the F1 follicle in Trio carrier heifers (TC-OF) resulted in increased ($P<0.01$) circulating FSH to 143% and 154% of pretreatment values, at hours 12 and 24 respectively. Conversely, the percentage change in circulating FSH was not different ($P>0.20$) from pre-treatment values for heifers in NC-C (89%), NC-OF (108%) and TC-C (91%). Percentage change in FSH at hours 12 and 24 was greater in the TC-OF group than in any of the other groups ($P<0.02$). Thus our hypothesis was supported. After selection of the dominant follicle(s), non-carrier controls require only a single dominant follicle to achieve complete suppression of FSH, whereas, Trio carriers require multiple dominant follicles to maintain FSH inhibition, probably due to the differences in F1 size (282% greater volume in non-carriers than Trio carriers) and correspondingly lower secretion of FSH suppressors.