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Characterization of individual differences in the efficiency of superovulation in the Gyr breed

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Most of the previous studies aiming to improve superovulation evaluated only differences in the number of corpora lutea (CL) observed and of embryos recovered. Therefore, differences in total follicular population before hormonal stimulation and in response parameters associated to follicle growth were frequently neglected, causing bias in the conclusion. The aim of the present study was to characterize individual variation in both relative and absolute efficiency of superovulation, based on ovarian follicular population. Non-lactating Gyr breed cows (n=2) and heifers (n=15), kept under the same management, were used. Follicle growth was synchronized (D0) using an intravaginal progesterone device and an injection of estradiol benzoate. Superovulations started on D5 with the injection of 200 UI FSHp, following a conventional protocol. The number and diameter of the follicles present before (D4) and during superovulation (D5 to D8), as well as the number of CL at flushing (D16), were evaluated by ultrasonography. Follicular population was ranked according to size (≤ 4 mm, 5-7 mm, ≥ 8 mm), and changes in the percentage of follicles in each size class were used to calculate relative efficiency. The absolute efficiency was determined by the ratio number of embryos recovered: number of follicles ≤ 4 mm on D5. Results are shown as mean \pm SEM. As expected, there was a great individual variation in the superovulation outcomes, both considering the number of CL (0 to 28, mean 12.6 ± 2.1 ; CV=68.2%) and embryos collected (0 to 15, mean 5.1 ± 1.1 ; CV=92.4%). There was no increase ($P>0.05$) in total follicular population during treatment, and the correlation between the number of follicles during superovulation and the further number of CL or embryos remained relatively constant between D5 and D8 ($r=0.56$ to 0.65 and $r=0.70$ to 0.79 , respectively; $P<0.01$). FSH treatment induced a progressive ($P<0.05$) but partial mobilization of small follicles to larger size classes. The relative efficiency of the follicle growth stimulation was $41.9\pm 5.5\%$ (0 to 75.6%), and this was the endpoint with the largest correlation ($R=0.80$; $P<0.0001$) with the absolute efficiency of the process ($12.2\pm 2.1\%$, ranging from 0.0 to 25.0%). Retrospective analysis demonstrated that donors with relative efficiency $>50\%$ had a number of follicles ≤ 4 mm on D1 similar to those with efficiency $<50\%$ (41.6 ± 6.8 vs 42.1 ± 3.1 ; $P<0.001$), but produced more CL and embryos (17.8 ± 2.5 and 7.6 ± 1.7 vs 6.9 ± 2.1 and 2.4 ± 0.9 ; respectively, $P<0.001$). In conclusion, individual differences in follicular population and in the follicle response to FSH are important sources of variation in superovulation results, and shall be taken into account for experimental design.

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