

Fertility Markers in Dairy Bulls: Implications for Improving Cattle Productivity

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Dairy bull semen often has wide variations in fertility, despite meeting minimum standards for quality. The objectives of this study were to compare following physical characteristics of the bulls and sperm characteristics to identify fertility markers: 1) scrotal surface temperature patterns; 2) ultrasonographic characteristics of the testes; 3) sperm motion characteristics; and 4) sperm viability. 10 mature Holstein breeding bulls (4-5 y old) were classified as either low- or high-fertility (n=5 each), based on adjusted 56-d non-return rates (NRR). Scrotal measurements and testicular dimensions, scrotal thermograms and testicular ultrasonographic data were recorded. Four ejaculates were collected and frozen stored for the evaluation of sperm viability and motility.

There was no difference in the testicular physical characteristics between low-versus high-fertility bulls. However, these fertility groups differed ($P < 0.05$) in mean viable sperm, both after thawing (49.49 ± 8.01 vs $60.62 \pm 9.72\%$) and after swim up (63.05 ± 1.17 vs $70.92 \pm 1.42\%$). The proportion of moribund sperm was significantly higher (9.47 ± 1.16 vs $8.49 \pm 1.6\%$; $P < 0.05$) in sperm from low- vs. high-fertility bulls. Furthermore, higher proportion of moribund sperm (16.35 ± 3.1 vs $12.63 \pm 3.3\%$), expressed as a percentage of viable sperm in low-versus high-fertility bulls suggest that rate of conversion of viable sperm to moribund state is higher in low-fertility bulls. These results suggest that viability of sperm from low-fertility bulls was inherently compromised. Several sperm kinematic parameters (straightness, linearity, curvilinear distance, curvilinear velocity, and amplitude of lateral head displacement) were correlated with NRR.

Implications: These studies suggest that testicular physical characteristics may not predict subtle changes in the fertility of bulls maintained in commercial artificial insemination centers. However, proportions of viable sperm and moribund sperm, rate of conversion of viable sperm to moribund state and sperm kinematic parameters may have potential applications in fertility predictions.

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