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JOURNAL ARTICLE

Morphologically distinct sperm subpopulations defined by Fourier shape descriptors in fresh ejaculates correlate with variation in boar semen quality following cryopreservation

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This study investigated two hypotheses: 1) that consistent between-boar variation in frozen semen quality exists and is genetically determined, and 2) that morphologically distinct subpopulations of spermatozoa exist within fresh boar ejaculates and that the incidence of these subpopulations is correlated with semen quality following cryopreservation. Five ejaculates were collected from each of 15 boars (5 boars from each of 3 breeds). An objective sperm morphology analyzer used Fourier shape descriptors to describe variation in the morphology of 300 spermatozoa per ejaculate before freezing. Semen was diluted into a commercial freezing buffer (700 mOsm/kg, 3% glycerol) and 5 straws (0.5 mL) per ejaculate were cryopreserved (to -5 degrees C at 6 degrees C/min, then -5 degrees C to -80 degrees C at 40 degrees C/min). Semen was assessed for percentage of motile cells and motility characteristics (with computer-aided sperm analysis), plasma membrane integrity (SYBR-14 positive), and acrosome integrity (fluorescein-labeled peanut agglutinin positive). Consistent between-boar variability was detected for post-thaw sperm motility ($P < .01$), membrane integrity ($P < .01$), acrosome integrity ($P < .01$), curvilinear velocity ($P < .01$), straight-line velocity ($P < .05$), beat cross-frequency ($P < .05$), and amplitude of lateral head displacement ($P < .01$). Three morphologically distinct subpopulations of spermatozoa, defined by Fourier descriptors, were detected. The proportion of these subpopulations within the fresh ejaculate correlated with semen quality assessments made following cryopreservation. These findings support the hypothesis that consistent interindividual variation in sperm freezability is genetically determined and may relate to processes that occur during spermatogenesis. Subsequent characterization of these genetic differences between "good" and "poor" freezers may ultimately identify biophysical components of the spermatozoa that are essential for successful cryopreservation.

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