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Measurement of bovine sperm nuclear shape using Fourier harmonic amplitudes

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An objective method for measuring bovine sperm nuclear shape was developed. Digital images of bovine sperm stained with propidium iodide were collected and Fourier functions used to describe the perimeters of individual sperm nuclei. Harmonic amplitudes from Fourier functions were first shown to be independent of sperm orientation during digitization. Sperm from 12 different bulls were used, and 6 harmonic amplitudes per sperm were found to adequately describe sperm nuclear shape. Based on harmonic amplitudes 0 to 5, cluster analysis was used to generate 20 different groups. Sperm within groups had similar morphologies and groups were distinguished by statistically unique shape characteristics. Harmonic amplitudes 0 to 5 can be used to distinguish previously reported abnormalities such as tapered, pyriform, macrocephalic, and microcephalic, as well as gradations in between. Furthermore, differences were detected among bull harmonic amplitude centroids ($P < .05$), indicating that bulls differ in mean sperm nuclear shape.

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