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JOURNAL ARTICLE

# Relationship of bull fertility to sperm nuclear shape

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The relationship between sperm nuclear shape and bull fertility was determined. Two groups of bulls, 3 per group, were selected. Bulls differed in fertility based on lifetime nonreturn rates. Digital images of propidium iodide-stained sperm from each bull were collected and shape-evaluated by Fourier harmonic amplitudes 0 to 5. A discriminant function (P < .05) was constructed based on harmonic amplitudes and the 2 fertility groups. When individual sperm were

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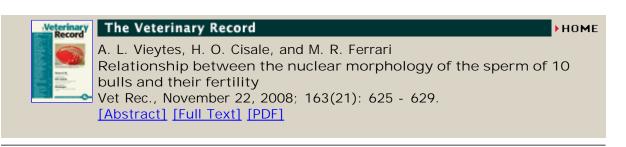
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classified as being of high or lower fertility, the percentage of each bull's sperm placed in the high-fertility group had a linear relationship (r = .89, P < .05) with fertility. To construct a plot of mean sperm shapes, a novel technique to automatically orient and identify the anterior tip of the sperm head was developed. The mean nuclear shape of high-fertility sperm was more elongated and tapered than those of lower fertility. A discriminant function (P < .05) was also constructed that separated the 6 bulls into 2 groups based only on the harmonic amplitudes or sperm nuclear shape. The bulls were correctly classified into the 2 fertility groups. A comparison of sperm chromatin structure analysis (SCSA) and harmonic amplitudes found that overall size variance, anterior roundness, and posterior taperedness of sperm nuclei were related to chromatin stability (P < .05). Some of the differences observed in sperm nuclear shape between the high- and lower-fertility bulls may be explained by varying levels of chromatin stability. However, sperm nuclear shape appears to contain additional information from chromatin stability alone. In this particular study, with 6 bulls, all with good chromatin quality, sperm nuclear shape was a better predictor of bull fertility.

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