The use of ceftiofur sodium in the extension and cooled storage of equine semen: its effects on motion characteristics, pH, and osmolality

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The purpose of the current study was to determine and compare the effect of varying antimicrobial concentrations in a semen extender on equine spermatozoal motion characteristics, semen osmolality, and semen pH. A total of 13 ejaculates from three stallions were examined. Each ejaculate was divided and extended in a skim milk-glucose based semen extender (Har-Vet TM Semen Extender, Har-Vet TM, Spring Valley, WI) without antibiotic (control) or that contained one of seven different antimicrobial drugs: ceftiofur sodium (Naxcel®, Pfizer Inc., New York, NY) at 250 µg/mL; 500 µg/mL; 1,000 µg/mL; 2,500 µg/mL (CEFT2500); combination of amikacin sulfate (1,000 µg/mL) and potassium penicillin G (1,000 IU/mL) (AMKPCN); gentamicin sulfate at 1,000 µg/mL (GENT); and ticarcillin disodium at 1,000 µg/mL (TICAR). Extended semen was cooled and stored at approximately 5°C. Motility measures using computer-assisted semen analysis (Sperm Vision® CASA, Minitube®, Verona, WI), pH measurements (Accumet AB15, Fisher Scientific Inc., Hanover Park, IL), and osmolality measurements (5010 Osmette III TM, Precision Systems Inc., Natick, MA) were performed at 0, 24, and 48 h after collection. A statistical software program (SAS 9.1, SAS Inc., Cary, NC) was used for all statistical analyses. A mixed model analysis of variance was used to determine the main effect of antimicrobial group on measured parameters. Ceftiofur sodium had a dose-dependent effect on curvilinear distance, curvilinear velocity, and the amplitude of lateral head displacement, with higher concentrations of ceftiofur (1,000 and 2,500 µg/mL) increasing these spermatozoal motility measures in comparison to control (F test, P<0.05; post-test comparison, P<0.0071). There was also an effect of antimicrobial group on straightness of motility (F test, P<0.05) with higher concentrations of ceftiofur decreasing values in comparison to control (post-test comparison, P<0.028). Stepwise multivariable regression analysis revealed pH was the strongest indicator for the increased motion characteristics, but it was only a minor predictor (R^2 ≤ 4.0%). There was also a significant effect of antimicrobial group on extender pH, with pH being decreased in the CEFT2500, AMKPCN, and TICAR groups, and increased in the GENT group compared to control. There was no significant effect of antimicrobial group on extender osmolality. The changes in motion characteristics associated with higher extender concentrations of ceftiofur are consistent with a dose-dependent tendency toward spermatozoal hyperactivation by ceftiofur through an unidentified mechanism. Additional studies appear indicated to evaluate the efficacy of ceftiofur sodium in the extension and cooled storage of stallion semen and its relationship to hyperactivation of equine spermatozoa.

Keywords: Spermatozoa, ceftiofur sodium, motility, pH, osmolality

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