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Title of Ph.D. Thesis:
Correlation of vertical velocity of spermatozoa with fertility potential and evaluation of physiological significance of sperm motility regulatory factors

Abstract:
Male factors are responsible for about 50% of the infertility. All the available techniques for sperm motility analysis consider ‘horizontal’ movement only and not a single instrument available for analyzing ‘vertical’ movement. Our lab in recent past developed a sperm vertical velocity measuring instrument (SPERMA). Undertaking upward movement against the gravity is much tougher as compared to horizontal progression. Thus, vertical velocity is a better index for sperm sample gradation. In the present study the SPERMA was upgraded to a portable, low price, multiple-sample (four) analyzer with upgraded softwares for user interface, instrument control, data acquisition and data analysis to make it more user friendly for clinical and research purposes. This was accomplished by modifying the electromechanical system. All the motility parameters given by the present instruments including CASA (Computer-Aided-Semen-Analyzer) are not yet well correlated with fertilizing efficacy of spermatozoa. Here, we have revealed that sperm cells with higher vertical velocity showed increased rates of capaciation and acrosome reaction. Thus, upgraded SPERMA can be used more effectively for sperm quality evaluation.

One of the major causes of male infertility is due to lack of sperm motility (asthenospermia). The present research elucidates the purification, specific localization, function and inhibitory pathway of the motility inhibiting factor (MIF-II) isolated from caprine epididymal plasma (EP). MIF-II antibody enhanced cauda sperm motility at higher dilution and caused agglutination at lower dilutions. It also induced caput sperm motility in in-vitro initiation media. Surface localization of MIF-II was confirmed by agglutination and indirect immunofluorescence studies. Increase in MIF-II in epididymal plasma during maturation may be related to the maintenance of quiescence of spermatozoa until ejaculation. It was found that MIF-II acts through decreasing cAMP via elevating the level of nitric oxide (NO). Treatment with MIF-II neither altered the cell surface morphology nor showed apoptosis or cell damage. MIF-II and its antibody may be used in fertility management effectively.

The upgraded “SPERMA” together with the sperm motility regulatory factors may form the basis for new approaches towards cattle breeding, conservation of endangered species and treatment of male infertility: a social problem of immense dimension all over the world.