

Upgradation of the sperm vertical velocity analyzer and uncovering the correlation between vertical velocity and fertility potential

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The present study enhances the sperm motility analyzer (SPERMA) computer-based instrumental system, correlating sperm 'vertical velocity' with fertility potential. The upgraded SPERMA allows simultaneous analysis of four samples at different heights, a substantial improvement over the previous designs. Two prototypes with diverse actuators, lead screws and gears were developed. Vertical velocity data, using goat sperm model, showed a direct correlation with fertilization parameters. The upgraded SPERMA proves valuable in assessing human and mammalian fertility, applicable in infertility clinics, animal breeding and species conservation. Its versatility enables enhanced fertility evaluation and reproductive research and may extend to other basic sciences.

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direction. Only a few spermatozoa successfully reach the ovum. The process of moving upward is energy-consuming, as it is against gravity. In IVF programs, the swim-up technique is employed to select the healthiest spermatozoa for enhancing fertilization¹². Spermatozoa with a higher degree of vertical velocity are considered healthier for fertilization. Thus, it is reasonable to expect that average vertical velocity would be a more effective parameter for grading semen samples.

Among the mentioned techniques, only the turbidimetric method analyses vertical sperm movement^{7,8}, but there was a lack of standard analyzer. To address this, the sperm motility analyzer (SPERMA) was developed¹³, capturing multiple datasets by exposing samples to different heights. This study upgrades SPERMA for multi-sample analysis with improved software for user interface, instrument control, data acquisition and analysis. Additionally, it explores the correlation between vertical velocity data and sperm