Embryo morphokinetic and metabolomics evident in videos of bovine embryos

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Introduction

Current methods to evaluate embryo health have not changed in 4 decades. These methods rely on the International Embryo Transfer Society morphological grading system and are insufficient to distinguish morphokinetic and metabolomic characteristics, which are known factors pertaining to an embryo's developmental potential. The objective of this research aimed to utilize graphic image processing to evaluate embryo morphokinetic changes present in 30s video data of bovine embryos to study real-time embryo morphokinetics and infer information pertaining to embryo metabolic activity.

Materials and methods

Thirty-second videos were obtained of 550 in vitro produced Grade 1 bovine morulas and blastocysts at Texas A&M Reproductive Services Laboratory and Texas Tech University School of Veterinary Medicine. Embryos were cultured for an additional 24-48 h and assessed for continued development or hatching. Videos were processed with background subtraction, contrast boosting and compared frame-by-frame. Any differences in subsequent frames depicting the embryo proper would appear as white pixels on the screen. Regions without changes appear as black pixels. Four regions without live matter, exterior to the embryo, were used as quality control zones. The standard deviation of the pixel changes was plotted for all regions of interest and comparisons were made between embryos which demonstrated continued development versus embryos which did not develop further.

Results

All regions of the embryo mass demonstrated different activity and pixel changes than in quality control regions, demonstrating motion detected is unique and individual to the embryo. Embryos which demonstrated competency by hatching demonstrated less variance in standard deviation than embryos which stalled in development ($P < 0.05$). Additionally, embryos which stalled in development demonstrated a lower normalized average standard deviation than embryos with continued development ($P < 0.05$).

Significance

This data suggests short videos of embryos in culture can capture measurable morphokinetic activity which can result in an enhanced understanding of embryo health and developmental potential, as morphokinetic could reflect the embryo's real time metabolic activity. This assessment can be used select the healthiest embryos for transfer and improve pregnancy outcomes of embryo transfer.

