

Fractal analysis of microCT images of the oviduct during the estrous cycle

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It is well known that the oviduct plays a key role in several events deeply related with reproduction, such as sperm storage and capacitation, gametes interactions, fertilization and early embryo development, among others. To better understand some of the interactions and process occurring within this organ, the study of its morphological modifications is of primordial importance. To that, we adopted a microtomography (MicroTC) modelling system and the fractal analysis that allow to explore the 3D oviductal functional anatomy, by using eight swine oviducts at different stages of the estrous cycle.

MicroCT datasets were acquired by using the high-resolution 3D-imaging system Skyscan 1172G (Bruker, Kontich – Belgium). CT images were analyzed using plugin on ImageJ software (NIH, Bethesda, MD), a box-counting method was applied to calculate the Fractal dimension of the oviduct. Focusing our attention on the utero-tubal junction (involved in sperm selection) and the isthmo-ampullar junction (the fertilization site).

We found that by using PCA analysis it was possible to clearly differentiate the oviduct at different cycle stage on the basis of their values for: Db for grid, lacunarity for grid, R2 for Db, Media Db, lacunarity, σ for D for Db, Max for D, Min for D. Lacunarity, Media and Max for Db have a greater influence on the analysis. The results showed that 2 principal components were associated with the morphological changes.

This information, is obtained by a fast nondestructive method, and could be very useful because this innovative approach enables the achievement a 3D model and suggest that using fractal analysis techniques can aid to better understand the modifications of oviduct anatomy that depends on the neuroendocrine axis.

This innovative approach could be a start point to design 3D cell culture systems, that could be applied in human and animal assisted reproductive techniques, improving the IVF outcomes.