

The Potential Role of Inflammation in Oocyte Health and Developmental Potential

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This research investigated the relationship between inflammation and the developmental potential of bovine oocytes. Cumulus granulosa cells play a critical role in supporting the developing oocyte during its development. Cumulus granulosa cells have previously been shown to have a pro-inflammatory immune response signaling through Toll-like receptor-4 (TLR-4). In order to investigate potential inflammatory effects on oocyte development, we utilized a single cumulus-oocyte-complex (COC) *in vitro* maturation, fertilization and culture system. This system allowed us to collect cumulus granulosa cell samples and retrospectively separate them into low developmental potential (LDP) or high developmental potential (HDP) groups. Samples were labeled as LDP if they stalled at the 2-cell stage and HDP if they reached the blastocyst stage, following fertilization and development. We then compared the expression of proinflammatory cytokines, including tumor necrosis factor alpha (TNF α), interleukin 6 (IL-6), C-X-C chemokine 5 (CXC-5), and monocyte chemoattractant protein 1 (MCP1). Also, in order to investigate the ability of granulosa cells to respond to pathogens, we isolated granulosa cells and treated them with various concentrations of lipopolysaccharide (LPS). LPS is known to trigger an immune response in responsive cells through upregulating the expression of pro-inflammatory cytokines. We found cumulus cells in the HDP group had lower expression levels of IL-6 (0.52 ± 0.45 vs. 6.68 ± 3.80) and TNF α (0.84 ± 0.18 vs 2.58 ± 0.37) when compared to the LDP group. Furthermore, LPS treatment of granulosa cells tended to increase the expression of IL-6, TNF α , and MCP1.

This research is currently ongoing to confirm the observed response. These results support the hypothesis that granulosa cells can respond to LPS, via the upregulation of pro-inflammatory cytokines, causing a potentially negative effect on bovine oocyte developmental competence. A limited number of samples were run concerning the LPS treated cells, thus making the results suggestive, not conclusive. Further research into the specific mechanisms continue.

Statement of Research Advisor:

Inflammation has long been known to negatively affect fertility outcomes, though the mechanism remains unexplained. Sara's work helped solidify a potential relationship between oocyte developmental competence and cumulus granulosa inflammatory cytokine expression.

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