REGULATION OF BOVINE OOCYTE MEIOTIC AND DEVELOPMENTAL CAPACITY BY GLUCOSE AND GLUCOSAMINE

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Glucose is an important substrate for *in vitro* oocyte maturation (IVM) and is metabolised by cumulus oocyte complexes (COCs) via glycolysis or is used for extracellular matrix (ECM) synthesis. Follicular glucose concentration is significantly lower than commonly used IVM media (2.3 mM *v.* 5.6 mM in TCM199). Glucosamine is an alternative substrate for ECM and supplementation to IVM media reduces glucose uptake by COCs. The aim of this study was to determine the effect of glucose and glucosamine supplementation during IVM on bovine oocytes. First, bovine COCs ($n = 400$) were matured in TCM199 (containing pyruvate, BSA, hCG and FSH), or synthetic follicular fluid medium (SFFM; a defined medium based on bovine follicular fluid composition) with 2.3 mM or 5.6 mM glucose ± 5 mM glucosamine and nuclear maturation was assessed after 24 and 30 h. Significantly less COCs matured in 2.3 mM glucose completed nuclear maturation compared to COCs matured in 5.6 mM glucose ($P < 0.05$), whereas glucosamine had no effect on meiotic maturation. We then compared oocyte developmental capacity following IVM ($n = 600$) in TCM199 or SFFM + 5.6 mM glucose ± 5mM glucosamine. Blastocyst production was severely perturbed when COCs were matured in the presence of glucosamine (–glucosamine 32% *v.* +glucosamine 4%; $P < 0.001$). To determine the cause of this reduction in oocyte developmental competence, we investigated oocyte protein synthesis by maturing COCs ($n = 100$) in SFFM + 5.6 mM glucose ± 5mM glucosamine + 1 mM L-[2,3,4,5,6–^{3}H] phenylalanine. In the presence of glucosamine, oocyte protein synthesis was reduced 40% compared to oocytes matured in control medium ($P < 0.05$).

These results demonstrate that while glucosamine supplementation has no effect on oocyte nuclear maturation, cytoplasmic maturation is compromised, as demonstrated by perturbed oocyte protein synthesis and embryo development. In contrast, glucose concentration has a significant influence on meiotic progression. This provides a useful model to investigate the mechanisms of establishment of developmental competence in oocytes following maturation.

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