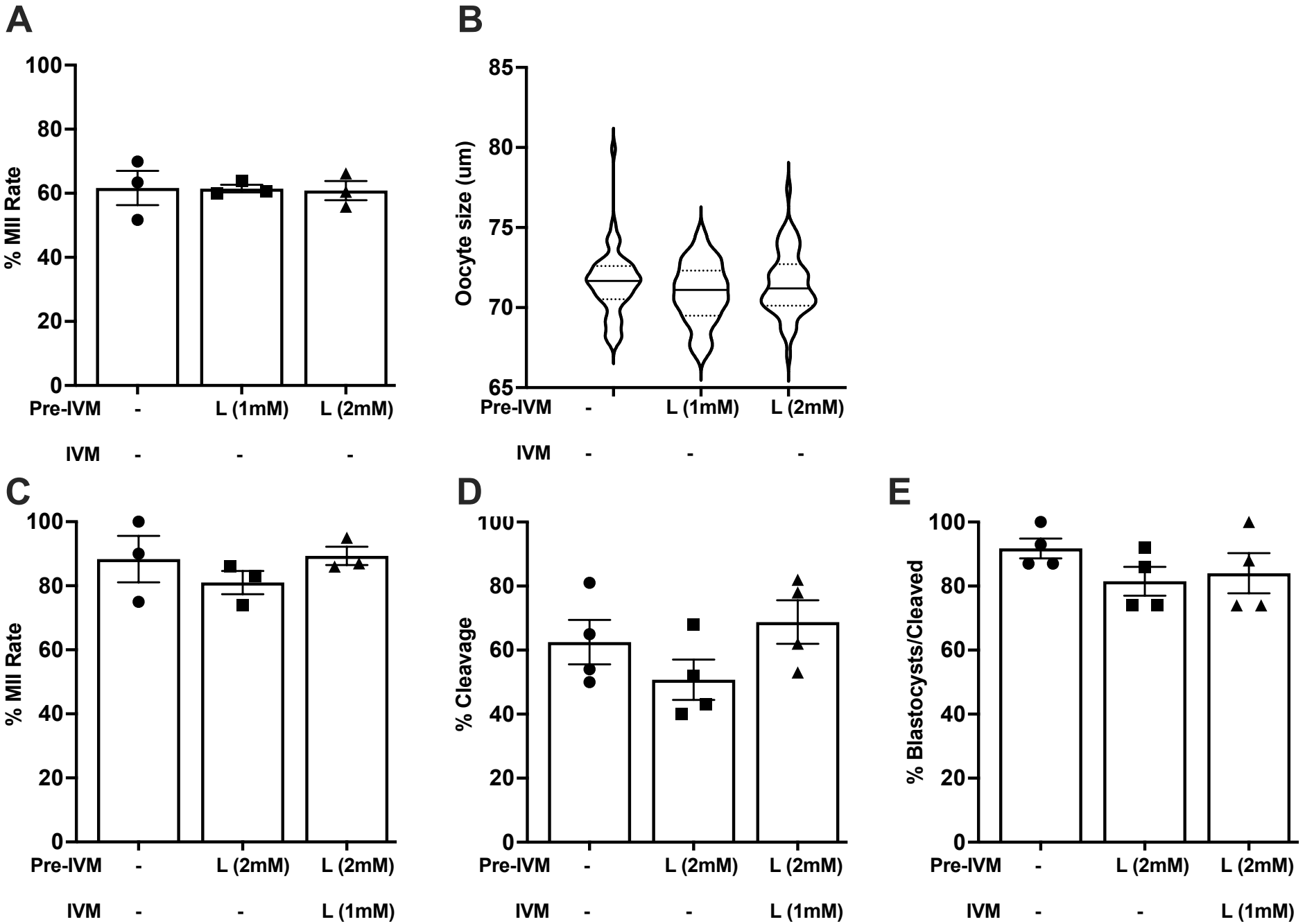
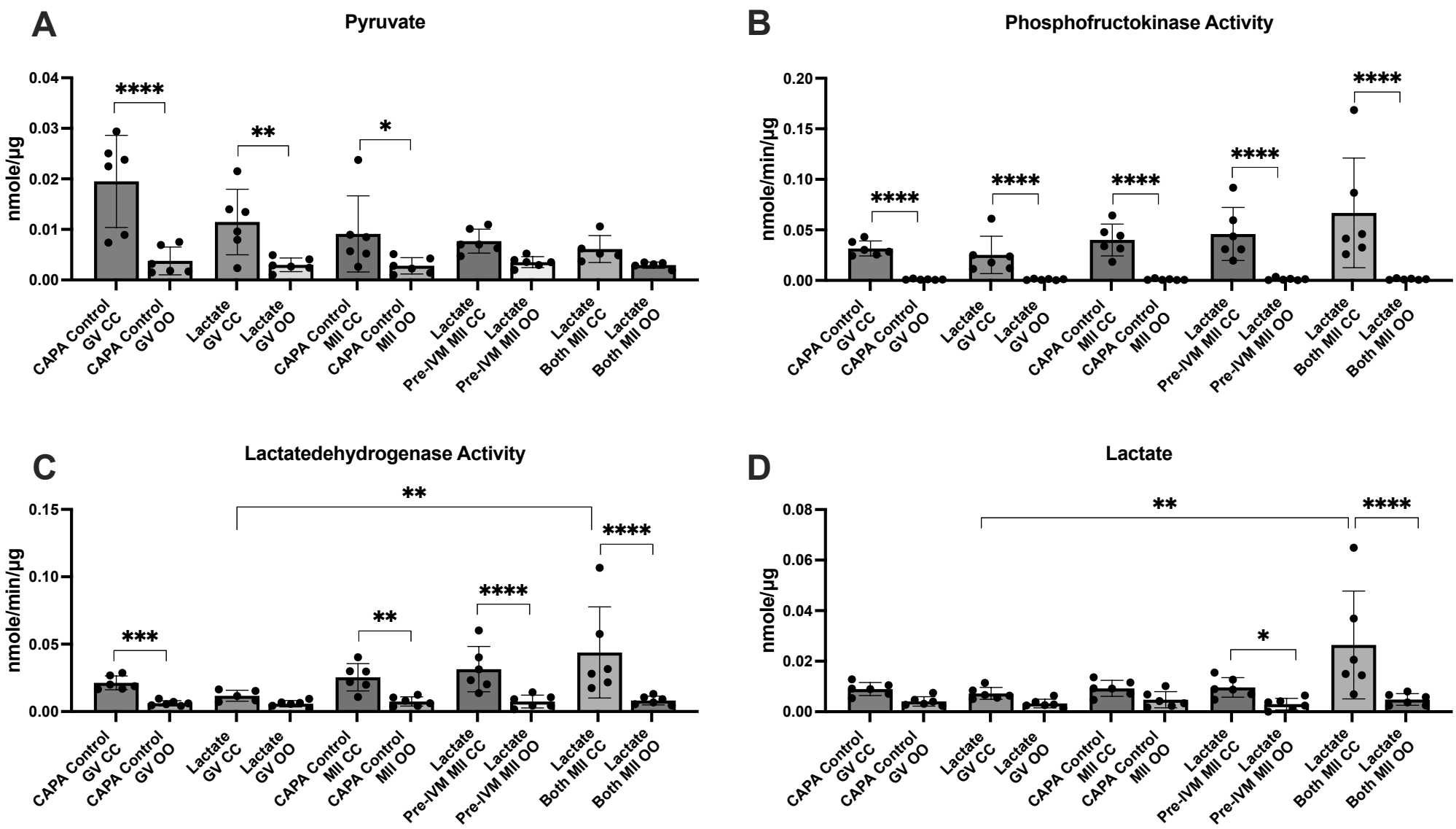
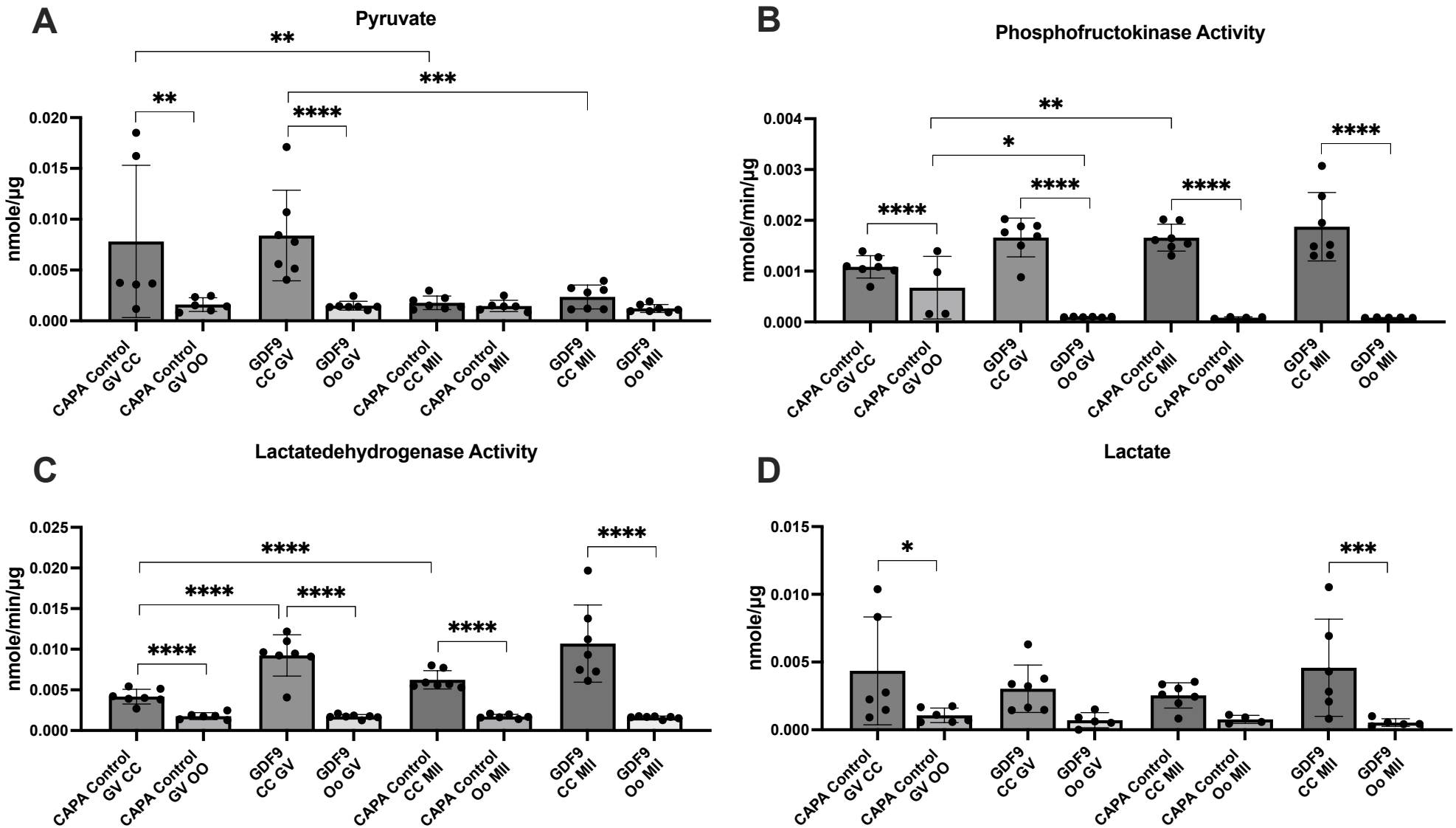


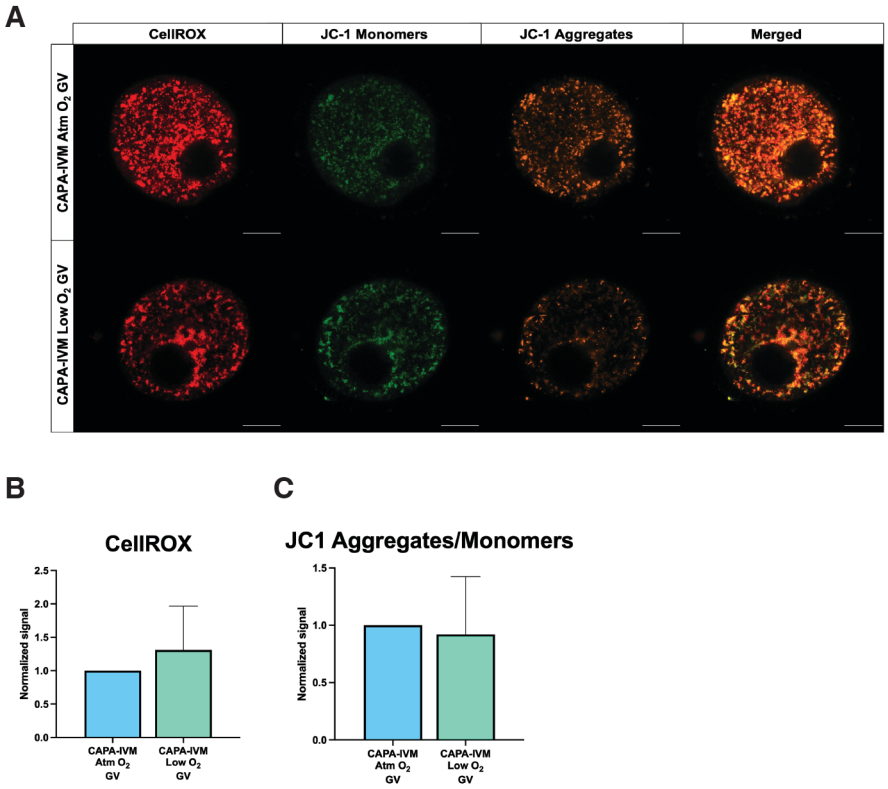
Supplementary Figure 1: (A and B) are showing the results of the dose finding study for lactate. Neither of the doses indicated any disruption. Considering the reports from literature, we decided to use 2 mM in our experiments. **(C-E)** are showing the mature oocyte rates and IVF results following the initial test of lactate supplementation to CAPA-IVM media. Given no significant differences were seen between experimental groups, we decided to supplement lactate both steps of CAPA-IVM as it is also present in the follicular fluid and reproductive tract throughout the menstrual cycle.



Supplementary Figure 2: Graphs showing individual effect of lactate supplementation both with CCs and oocytes. *: p<0.05, **: p<0.01, ***: p<0.001, ****: p<0.0001. Error bars indicate standard deviation.



Supplementary Figure 3: Graphs showing individual effect of super-GDF9 supplementation both with CCs and oocytes. *: p<0.05, **: p<0.01, ***: p<0.001, ****: p<0.0001. Error bars indicate standard deviation.



Supplementary Figure 4: ROS accumulation and mitochondrial membrane potential were compared within CAPA-IVM cultured GV oocytes under atmospheric (Atm) oxygen and 5% (low) oxygen. (A) Panel illustrates CellROX (red), JC-1 monomer (green) and JC-1 aggregate (orange) signals collected through imaging GV oocytes. Scale bar is 20 ⍰m. (B) shows average CellROX signal and (C) shows mitochondrial membrane potential, both data collected from three separate experiments.