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Dielectrophoretic Behaviour of MII Bovine Oocytes and Zygotes and its Relation to the Embryonic Developmental Competence and mRNA Expression Pattern

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Abstract

This study was aimed at investigating the dielectrophoretic behaviour of oocytes and zygotes in relation to the developmental competence and transcriptional abundance. Metaphase II (MII) bovine oocytes with (PB+) and without (PB-) first polar body and zygotes were subjected to dielectrophoresis procedure designed as 4 MHz AC, 5 v, 450 μm electrode distance and medium conductivity 80 μs/cm. The PB+, PB- and zygotes were classified into very fast, fast, slow and very slow depending on their speed in the electric field. Parthenogenetic activation was used to assess the rate of embryonic development of dielectrophoretically separated of oocytes. The result shows that,in PB+ oocytes the blastocyst rate at 7 (days post activation) dpa was higher ($p < 0.05$) in very fast than in very slow. In PB- oocytes, the blastocyst rate at 6 and 7 dpa was higher ($p < 0.05$) in the very fast and fast compared to the slow and very slow. Similarly, the total blastocyst rate at 7 days post insemination was higher ($p < 0.05$) in the very fast compared to very slow and slow dielectrophoretic categories of zygotes. Moreover, cDNA microarray experiments were performed between very fast and very slow dielectrophoretic PB+ oocytes and zygotes for transcriptional analysis. The result reveals that 31 and 5 genes were up and down regulated respectively in very fast compared to the very slow dielectrophoretic categories of oocytes. Among the up-regulated genes, DNMT1 and ANXA2 are believed to involve in ion binding. RPLP2 and RPLPO involve in protein biosynthesis and RNA binding. Others including NUSAP1 and CDC91L1 are involving in cell cycle regulation. Similarly, 25 and 17 genes were up and down regulated respectively in the very fast dielectrophoretic categories of zygotes relative to the very slow. Among the up-regulated genes, NANOS1, ZNF85 and IQGAP1 are involved in ion binding and STK6, SMARCA5 and NASP are needed for cell cycle regulation. In conclusion dielectrophoretic separated oocytes and zygotes showed difference in the rate blastocyst development accompanied by difference in transcriptional abundances.

Keywords: Developmental rate , dielectrophoresis, oocyte, zygote

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