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Topic category: Basic science

Topics: Embryology (incl. IVF/ICSI, gamete and embryo selection, culture, cryopreservation, vitrification, developmental biology)

Abstract title: ATP contents in immature oocytes obtained from graafian follicles decreased compared with those from small follicles

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Study question: To assess the relationships among ATP contents in oocytes, ovarian stimulation procedures, donor age, oocyte cell cycle, and oocyte diameter, we measured ATP contents in immature oocytes obtained from graafian and small follicles.

Summary answer: ATP contents in immature oocytes obtained from small follicles (diameter: approx. 10-mm) followed by maturation culture was significantly higher than that in immature oocytes obtained from graafian follicles after ovarian stimulation and natural cycles (diameter: approx. 19-mm).

What is known already: ATP contents in oocytes have been suggested to be a marker of oocyte quality including maturity and developmental competence. On the other hand, it has been also reported that oocytes containing extremely

high ATP content had low developmental competence.

Study design, size, duration: This was an experimental study using 97 immature oocytes obtained from graafian follicles (diameter: approx. 19-mm) after ovarian stimulation or natural cycles and 79 immature oocytes obtained from small follicles (diameter: approx. 10-mm) followed by maturation culture between April 2012 and October 2012. The local IRB approved this study.

Participants/materials, setting, methods: Donated oocytes were used after informed consent. ATP contents in oocytes were measured individually after the measurement of their diameter and the removal of their cumulus cells. The ATP assay was performed individually based on the luminescence reaction. Luminescence was measured using a luminometer. Data were compared using student t-test.

Main results and the role of chance: There were no differences in the ATP contents between GV (6.7 pM, n: 110) and MI stage oocytes (6.2 pM, n: 66), and between stimulation (5.0 pM, n: 66) and natural cycles (4.4 pM, n: 32). Moreover, there were no relationships between the ATP contents and oocyte diameter (diameter: 107.5-135.0 μm , 120.5 μm , n: 147, $r^2 = 0.01$, $P = 0.2$), and between the ATP contents and donor age (age: 25-45 years old, n: 176, $r^2 = 0.02$, $P = 0.06$). However, the ATP content in oocytes obtained from small follicles (8.6 pM, n: 79) was significantly higher ($P < 0.05$) than that in oocytes obtained from graafian follicles (4.8 pM, n: 97).

Limitations, reasons for caution: Further studies are required to clarify the link between a decrease of ATP contents in immature oocytes obtained from large follicles compared with oocytes obtained from small follicles.

Wider implications of the findings: This study provided new insights on the implications of a decrease of ATP contents during follicle growth.

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Trial registration number : None.

Key words: oocyte maturation, ATP contents, oocyte diameter