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Rapid Communication

Discovering a Potential Treatment to Improve Egg Quality and Reproductive Success, Especially in Older Women

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INTRODUCTION

As a woman gets older, her fertility declines, owing to fewer healthy oocytes or eggs accessible for fertilization, and those that are available for fertilization often contain chromosomal abnormalities, resulting in a higher rate of miscarriage and genetic illnesses like Down's syndrome.

In collaboration with Monash IVF, a team from the Monash Biomedicine Discovery Institute (BDI) and Robinson Research Institute has discovered a potential medication that targets mitochondria to help avoid these chromosomal defects in mouse and human eggs.

Researchers led by Professors John Carroll and Rebecca Robker utilized two mitochondria-targeted therapies – MitoQ and BGP-15 – that appeared to protect eggs against the chromosomal defects seen in older or defective eggs in a work published in the journal Human Reproduction [1,2].

When immature human eggs were matured in laboratory circumstances, the addition of these substances improved how their chromosomes were organized. If this effect holds true for eggs maturing in the body, it could protect human eggs from chromosomal defects and miscarriage, as well as hereditary implications like Down's syndrome.

“Given that a rising number of women are delaying childbearing, there is an imperative to increase fertility and reduce miscarriage and chromosomal defects associated with maternal ageing,” says a Monash University researcher.

“Two outstanding candidates,” according to the study, “may one day help to increase fertility in older women.”

Ovarian ageing, reduced ovarian reserves, and a decline in oocyte quality are all factors in the age-related drop in fertility. Increased oxidative stress within the oocytes is one reason for this [3,4].

Mitochondria use oxygen to make energy, and one of the by-products is the creation of free radicals, whether in an oocyte or any other cell in the body. Because oocytes are formed during the early stages of life, they have plenty of opportunity to accumulate oxidative damage. In addition, as eggs age, their resistance to oxidative damage weakens. MitoQ and BGP-15 appear to protect eggs in part by increasing mitochondrial function and reducing oxidative stress at critical moments when the eggs' chromosomes are dividing.

The next step will be to determine the ideal settings for these medicines to act when eggs are maturing inside the ovary, as well as whether the effects on chromosome organisation transfer into healthier eggs with a better likelihood of developing into healthy pregnancies. Professor Carroll stated, "Increasingly, fertility research is turning to medicines that precisely target these mitochondria with the goal of preventing the chromosomal defects that emerge as a result of ageing and oxidative stress."

“In our research, we looked at two of these candidates to see if they made a difference in older eggs from humans and mice, and we discovered that they can make older eggs ‘younger' again.” They were quite effective on one level, but we are currently investigating if this strategy can be used in patients”.

Both MitoQ and BGP-15 have already been tested in humans, with MitoQ being used to treat age-related hypertension and BGP-15 being utilised in diabetic clinical trials. Luk Rombauts, an IVF professor at Monash University, said that boosting mitochondrial function, which he refers to as "the small energy factories within the eggs," is one of the potential techniques to improve egg quality and reproductive success, especially in older women. “Monash IVF is excited to continue working with Professor John Carroll's group to develop novel treatment techniques based on this research [5].”

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