

LETTERS

Three-parent baby: Is it ethical?

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The UK was the first country to legalise mitochondrial donation in October 2015 (1). In 2016, the first three-parent baby was born in Mexico (2) and the US Food and Drug Administration declared that further research on mitochondrial donation is ethically permissible (3). It has now become an important issue, raising as it does, the spectre of “genetically modified designer babies”.

What is a three-parent baby?

Mitochondrial manipulation technology (MMT) or mitochondrial donation is a unique form of *in-vitro* fertilisation in which the prospective baby's mitochondrial DNA (mtDNA) comes from a third biological parent (4). Present in cell cytoplasm, mtDNA is inherited via the maternal side; thus, children born of women with mutations in mtDNA will inherit the mutations. MMT is used when mothers carry genetic mitochondrial diseases and conventional *in-vitro* fertilisation techniques do not work.

There are mainly two methods of mitochondrial transfer:

1. Maternal spindle transfer: the nucleus is extracted from the egg and the rest of the egg, with the unhealthy mtDNA, is discarded. The nucleus of an egg from a donor female is obtained to have an egg with healthy mtDNA. Next, the nucleus of the mother's egg is inserted into the second egg and fertilised with the father's sperm. The embryo is then placed in the womb of the mother (5).
2. Pronuclear transfer: the mother's egg is fertilised with the father's sperm. The egg of the donor is also fertilised, and its nucleus extracted and discarded. The fertilised nucleus of the mother is extracted from the egg and placed in the donor's egg, which has healthy mtDNA and finally, this donor egg is put in the mother's womb (6).

Ethical and social issues

Using human embryos for *in-vitro* research is controversial. Opponents consider it unethical to destroy the unwanted embryos generated during research; they argue that an embryo has personhood, and as such, has equal rights as an adult.

Financial compensation of the egg donor is another ethical issue. Egg donation requires powerful hormone therapy, stoppage of normal ovarian functions, superovulation for the woman to provide eggs, hormones to release matured eggs from the ovaries and minor surgery to remove them from the body. The financial compensation offered will always be less than the risk undertaken. The process may even lead to death, which cannot be compensated for.

People believe MMT “could have uncontrollable and unforeseeable consequences, affecting future generations and modifying genetic heritage in an irreversible way, inevitably affecting the human species as a whole” (7). Also pertinent is the impact on the child's sense of identity and psychological/emotional well-being, when compared to two-parent babies. Although, the donor egg is said to contribute only 1% to the genetic make-up of the child, there are still three identifiable parents in the genetic material (8). Further, although MMT has been successful in mice and monkeys, its safety cannot be directly extrapolated to humans.

Two pertinent issues are the risk to the embryo if there is a mismatch between the mtDNA haplotype of the donor and that of the intending mother; and the consequences of some defective mitochondria remaining attached to the nucleus during the process of transfer. The Department of Health of UK recommends that three-parent children be monitored for their current and future well-being. It remains to be seen whether it is ethically acceptable to enroll the children in such studies; if follow-up will extend to future generations; and whether incentives will be required to encourage continued participation (9).

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