

Maternal diet and genes interact to affect heart development

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A pregnant mother's diet may be able to interact with the genes her unborn child inherits and influence the type or severity of birth defect according to research funded by the Wellcome Trust and the British Heart Foundation (BHF). The study, published in the journal *Human Molecular Genetics*, suggests that mothers who eat a high fat diet before and through pregnancy could be inadvertently putting the health of their offspring at risk.

Congenital heart disease is the commonest form of a [birth defect](#). It is already known that children born to mothers who have diabetes or are overweight have an increased risk of congenital heart disease and other birth defects. It is also known that certain [genetic changes](#) can result in congenital heart disease. However it is not known if [environmental factors](#) such as a mother's diet could interact with these genetic changes to affect the outcome.

To investigate this, a team of researchers at the Wellcome Trust Centre for Human Genetics at the University of Oxford studied the effect a high fat diet might have in mice on their offspring.

The researchers compared healthy mice against those lacking a gene called *Cited2*. *Cited2* deficiency results in [heart defects](#) in mice and in humans. It also sometimes results in an especially serious type of heart defect called atrial isomerism, where the left-right asymmetry of the heart is disturbed.

The mice were fed a diet high in fat before and through pregnancy, and the development of their offspring studied using [magnetic resonance imaging](#). The results were then compared to mice from a control group fed with a balanced diet.

Amongst offspring mice that were deficient in *Cited2*, the risk of atrial isomerism more than doubled, and the risk of cleft palate increased more than seven fold when the mothers were fed a high fat diet. These changes did not happen in the genetically normal offspring of mothers fed a high fat diet, indicating that it is the combination of high fat diet and the genetic defect that is responsible.

The researchers showed that high fat diet and *Cited2* deficiency interacted by reducing the expression of another gene called *Pitx2*. This latter gene is also necessary for heart development and the body's natural asymmetry.

"These are very important findings as we have been able to show for the first time that gene-environment interactions can affect development of the embryo in the womb," says Dr Jamie Bentham, first author of the study.

"We know that poor diet and defective genes can both affect development, but here we have seen the two combine to cause a much greater risk of developing health problems and more severe problems. We are excited by this as it suggests that congenital heart defects may be preventable by measures such as altering maternal diet."

"There is a growing amount of research which suggests that a mother's diet can have a long term impact on the health of her offspring," says BHF Professor Shoumo Bhattacharya. "This is concerning when we also consider the increasing problem of obesity in women of reproductive age. A healthy, balanced diet is important at all times, but our research

shows that this is particularly true during pregnancy when diet can potentially affect both the mother and her child."

Professor Jeremy Pearson, Associate Medical Director of the BHF, which part-funded the study, said:

"This research shows that diet during pregnancy can directly affect which genes get switched on in unborn offspring. The study was with mice, but a similar link may exist in humans, leading to some cases of [congenital heart disease](#).

"We already know that if pregnant women lack certain nutrients in the [diet](#), such as folic acid, it can lead to abnormal development in the baby, so it's not surprising that eating too much of something can also cause problems.

"The findings suggest it's wise for pregnant women to stick to a [balanced diet](#) and avoid eating too much fatty food. This is good advice for everyone, especially mothers and their children."

Provided by Wellcome Trust

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