Smoking during pregnancy lowers levels of 'good' HDL cholesterol in children

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Researchers in Australia have discovered that mothers who smoke during pregnancy are causing developmental changes to their unborn babies that lead to them having lower levels of the type of cholesterol that is known to protect against heart disease in later life – high-density lipoprotein (HDL) cholesterol.

The research, published online today in the *European Heart Journal*, showed that, by the age of eight years, children born to mothers who smoked while they were pregnant had HDL cholesterol levels of about 1.3 millimoles per litre (mmol/L), compared to the more normal level of 1.5 mmol/L in children born to mothers who had not smoked. After adjustments for various factors that might affect the result, the difference attributable to mothers' smoking was about 0.15 mmol/L. The researchers found that this effect was independent of whether the children had been exposed to other people's smoke after birth, suggesting that prenatal exposure had the most impact on the children's subsequent development.

David Celermajer, Scandrett Professor of Cardiology at the University of Sydney, Australia, who led the study, said: "Our results suggest that maternal smoking 'imprints' an unhealthy set of characteristics on children while they are developing in the womb, which may well predispose them to later heart attack and stroke. This imprinting seems to last for at least eight years and probably a lot longer."

Although cigarette smoking during and after pregnancy is known to be

linked to a range of childhood health problems, including behavioural and neurocognitive problems and sudden infant death, until now it has been unclear what effect prenatal exposure to cigarette smoke had on the risk of future cardiovascular disease.

Prof Celermajer and his colleagues decided to examine the effects of maternal smoking during pregnancy on the thickness of the arterial wall and the levels of lipoproteins in a group of 405 healthy eight-year-olds, born between 1997 and 1999, who had been enrolled before birth into a randomised controlled trial that was investigating asthma and allergic diseases. The researchers collected data before the children were born and as they grew up, including information on mothers' smoking habits before and after pregnancy, the children's exposure to passive smoking, and measurements of height, weight, waist circumference and blood pressure. They used ultrasound scans to measure the arterial wall thickness and, in 328 children who agreed, they took blood in order to measure lipoprotein levels.

Although there was no effect on the thickness of the children's arterial wall, Prof Celermajer found that there was an effect on levels of HDL cholesterol, which remained statistically significant after adjusting for a range of factors that might have been different in children born to mothers who smoked, such as post-natal smoke exposure, duration of breast feeding, physical inactivity and body mass index.

The researchers believe that the lower levels of HDL cholesterol at this age suggest there could be a serious impact on health in later life, as the children will probably continue to have low levels in adulthood. "Cholesterol levels tend to track from childhood to adulthood, and studies have shown that for every 0.025mmol/L increase in HDL levels, there is an approximately 2-3% reduction in the risk of coronary heart disease. If we extrapolate this, we can suggest that the difference of 0.15mmol/L between children of smoking mothers versus non-smoking

mothers might result in a 10-15% higher risk for coronary disease in the children of smoking mothers. This is an approximation only, but the best one we have," said Prof Celermajer.

The researchers point out that the prevalence of smoking during pregnancy is still high, at around 15% in many Western countries. Therefore, their findings may be important for informing population-based strategies for preventing heart disease in later life, especially as HDL cholesterol plays an important role in protecting against atherosclerosis – a condition in which fatty materials collect along the walls of arteries, thickening and eventually blocking them, leading to problems such as angina and heart attacks.

"Children born to mothers who have smoked during pregnancy will need to be watched particularly carefully for other coronary risk factors, like high blood pressure, high LDL, 'bad' cholesterol levels, and especially cigarette smoking themselves," said Prof Celermajer.

"The only ways to increase HDL levels are regular exercise and with the use of certain medications such as Niacin. We will have to do long-term follow-up to see if these particular children continue to have lower HDL cholesterol levels than normal, but one should presume that this risk factor might indeed be persistent."

The mechanism whereby maternal smoking during pregnancy lowers HDL cholesterol in children is unknown. "One of the advantages of studying this in eight-year-old children is that the usual factors that drive down HDL cholesterol, such as obesity and diabetes, are absent, and so we can infer a more or less direct effect of smoking on HDL levels, rather than one mediated through changes in body composition or vulnerability to diabetes," concluded Prof Celermajer.

More information: "Maternal cigarette smoking is associated with

reduced high-density lipoprotein cholesterol in healthy 8-year-old children". *European Heart Journal*. doi:10.1093/eurheartj/ehr174

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