Can drinking alcohol harm the child before the mother knows she is pregnant?

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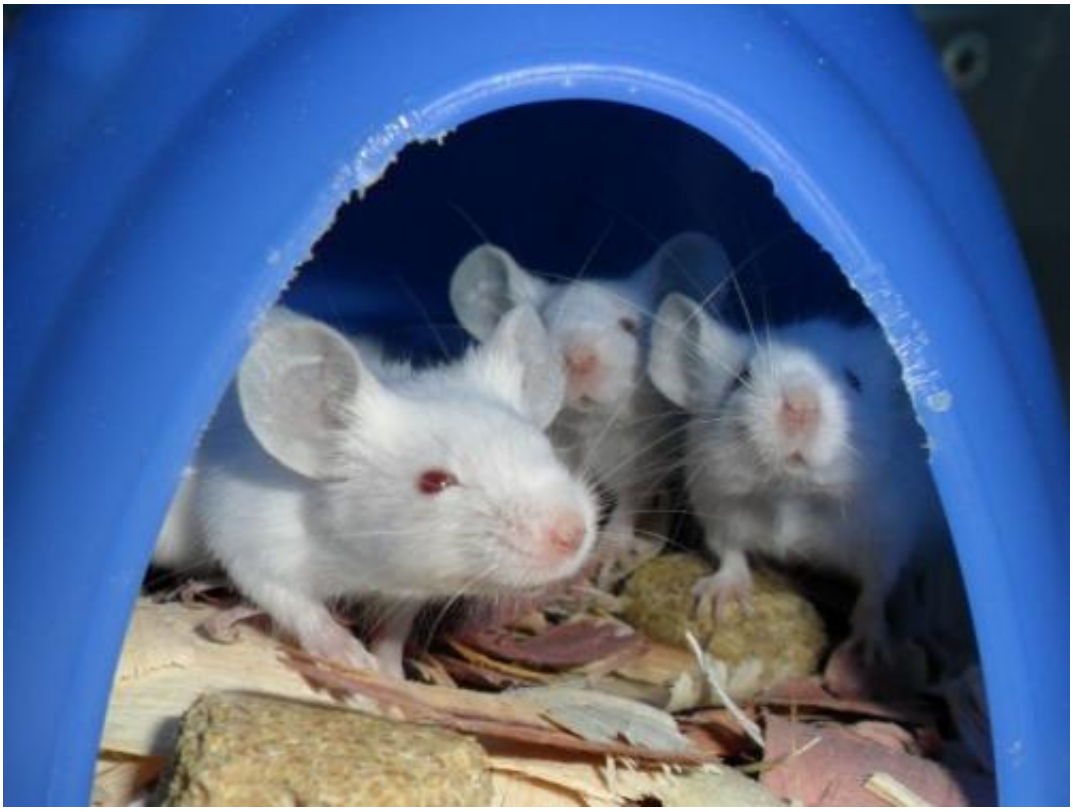

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Alcohol drunk by a mouse in early pregnancy changes the way genes function in the brains of the offspring, shows the recent study conducted at the University of Helsinki. The early exposure was also later apparent in the brain structure of the adult offspring. The timing of the exposure corresponds to the human gestational weeks 3-6 in terms of fetal

development.

In addition, the exposure to alcohol was found to cause similar changes to gene function in other tissues of the infant mice. These results suggest that alcohol causes permanent changes to gene regulation in the first cells of developing embryo.

Exposure to alcohol during pregnancy may damage the child in many different ways, including learning disabilities as well as congenital deformities. The mechanisms through which alcohol impacts fetal development are not yet fully understood, and diagnosing the damage caused to the child is difficult.

In the mouse model where the dam drinks alcohol in early pregnancy, the offspring exhibit symptoms similar to fetal alcohol syndrome (FAS) in humans: decreased growth rate, similar structural changes to corresponding areas of the face and scull, and hyperactivity. The early exposure begins at conception and continues until the nervous system begins to develop. In humans, this corresponds to the first three or four weeks after conception in terms of development - a period during which the mother-to-be is often unaware of being pregnant.

Early pregnancy is an active time for cell division and differentiation. All the different cell types share a similar DNA strand, but in each of them a unique epigenome is formed to regulate their gene function. At this stage, the embryo is vulnerable to external influences, and any changes can spread extensively to different tissues as cells divide.

The study, led by Dr. Nina Kaminen-Ahola, wanted to determine whether alcohol consumed in early pregnancy causes changes to the epigenome that regulates the embryo's genes. In addition, the researchers examined whether the potential changes would be seen later in the gene function and brain structure of the offspring.

The research focused on the hippocampus, a brain structure important for memory and learning. It is known to be particularly sensitive to alcohol. In the study, early exposure to alcohol changed the epigenome as well as the function of several genes in the hippocampi of infant mice. Alcohol-induced changes were also seen in the brain structures of the adult offspring: the hippocampi, olfactory bulbs and cerebral ventricles.

In addition to the hippocampus, alcohol caused similar changes to gene function in two different tissues of the infant mice - bone marrow and the olfactory epithelium of the snout.

"The results support our assumption that alcohol permanently alters gene regulation at a very early stage," states researcher Nina Kaminen-Ahola.

"This would be significant for the challenging diagnostics of alcohol-induced damage. The mechanisms and biological markers which can aid in diagnosis are studied so that we can offer the developmental support necessitated by the damage as early as possible. Ideally, a swipe sample from inside the mouth of a newborn could reveal the extent of damage caused by early pregnancy alcohol exposure," she continues.

More information: Early Maternal Alcohol Consumption Alters Hippocampal DNA Methylation, Gene Expression and Volume in a Mouse Model. Heidi Marjonen, Alejandra Sierra, Anna Nyman, Vladimir Rogojin, Olli Gröhn, Anni-Maija Linden, Sampsa Hautaniemi, Nina Kaminen-Ahola. *PLOS ONE* 13 May, 2015.

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