

Harm-reduction cigarettes are more toxic than traditional cigarettes, study finds

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Typically, tobacco companies market harm-reduction cigarettes as being safer than traditional "full-flavored" brands, leading many smokers to conclude that the use of harm-reduction brands lowers their exposure to toxicants.

But a UC Riverside study now shows that smoke from these "light" or "low-yield" harm-reduction cigarettes retains toxicity and that this toxicity can affect prenatal development.

"Many chemicals found in harm-reduction cigarette smoke have not been tested, and some are listed by manufacturers as safe," said Prue Talbot, a professor of cell biology who led the study. "But our tests on mice clearly show that these chemicals adversely affect reproduction and associated development processes. The effects are likely to be the same in humans, in which case pregnant women would be particularly vulnerable to the effect of smoke from these cigarettes."

Talbot's research team used mouse embryonic stem cells (mESCs) as a model for pre-implantation embryos—embryos that have not yet implanted in the wall of the uterus—and compared the toxicity on these cells of cigarette smoke emanating from traditional and harm-reduction brands.

Further, they studied the effects on the mESCs of two kinds of cigarette smoke: mainstream smoke, which is smoke actively inhaled by smokers; and sidestream smoke, which is smoke that burns off the end of a

cigarette.

They found that both kinds of smoke from traditional and harm-reduction cigarettes are toxic to pre-implantation embryos and can retard growth or kill embryonic cells at this stage of development. Equally surprising to them was their discovery that mainstream smoke and sidestream smoke from harm-reduction cigarettes are more potent than the corresponding smoke from traditional brands of cigarettes.

"This result was unexpected since harm reduction brands purportedly have lower concentrations of toxicants," Talbot said.

"Dr. Talbot's work significantly enhances our understanding of the harmful effects of smoking on very early pregnancy," said Olga Genbacev, a researcher in the Department of Obstetrics, Gynecology and Reproductive Sciences at UC San Francisco, who was not involved in the research. "This study for the first time sends a clear message to nonsmoking women of reproductive age who are planning to become pregnant that they must avoid exposure to sidestream smoke."

Study results appear in the journal *Human Reproduction* (published online, Nov. 29). The hardcopy version of the research paper is scheduled to appear in January 2009.

"Clearly, the tobacco companies have not eliminated all toxins from harm-reduction brands of cigarettes," said Talbot, who also is the director of the UCR Stem Cell Center. "We found that both mainstream and sidestream smoke from traditional and harm-reduction cigarettes hindered the attachment of mESCs to extracellular materials. Such attachment is crucial to normal embryonic development. Moreover, cell survival and proliferation—also necessary for embryonic growth—were hindered as well."

The researchers' experiments on the mESCs showed, too, that on a per puff basis sidestream smoke was more potent than mainstream smoke in both traditional and harm-reduction brands of cigarettes.

"This may be because sidestream smoke is produced at a lower temperature and therefore contains higher concentrations of toxicants," Talbot said.

When she and her colleagues performed the experiments directly on pre-implantation mouse embryos that had been cultured for one hour in mainstream or sidestream smoke solutions from a harm-reduction brand, they found that the effect of smoke on the embryos was similar to the effect it had on the mESCs.

"This strongly supports our use of embryonic stem cells as a valuable and effective model to study embryo toxicity during pre-implantation development," said Sabrina Lin, a graduate student in the Cell, Molecular and Developmental Biology Program working towards her doctoral degree, and the first author of the research paper. "This means we can use human embryonic stem cells to draw conclusions about the effect of cigarette smoke on pre-implantation human embryos."

Next in their research, Talbot and Lin plan to conduct their experiments on human embryonic stem cells.

"To relate this research more strongly to humans, we have to use human embryonic stem cells," Talbot said. "Sabrina has already started working on them, and her preliminary results are similar to those with mESC."

Source: University of California - Riverside

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