BPA alters development of in vitro ova and could increase risk of Down syndrome

September 21 2011

Researchers at Universitat Autonoma de Barcelona analysed the effects of Bisphenol A (BPA), a polymer widely used to manufacture plastics, in an in vitro culture of ovaries. The research demonstrated that exposure to this substance gravely altered the development of oocytes and future ova, possibly diminishing the fertility of a woman's offspring and at the same time increasing the risk of Down Syndrome in following generations.

The research, published in Human Reproduction, was carried out with a culture of 21,570 in vitro oocytes. Results demonstrated that exposure to Bisphenol A in concentration levels permitted by health authorities is harmful to the fetus. BPA reduces the number of oocytes (cells which develop into ova) and therefore can affect negatively a woman's fertility and double the risk of chromosome exchange during the cell division process. Specific observations of chromosome 21 in the development of 90 oocytes revealed that exposure to BPA could increase the risk of Down Syndrome in the future offspring of the fetus.

The research provides conclusive data for the debate on how BPA affects the health of individuals. Previous studies on mice and worms demonstrated that reproduction is affected and that exposure to BPA during gestation affects the viability and quality of the cells which later become ova developing in the fetus.

For the first time, human cells were used in a research to analyse the process of cell division of the oocytes - meiosis - in which chromosomes

join and exchange material, i.e. meiotic recombination. Oocytes were cultured for 7, 14 or 21 days in different environments, with the presence of BPA and in control cultures without the substance. Data obtained in vitro with human cells was practically identical to that obtained with in vivo animal models, while the effects on meiotic recombination, which could lead to the appearance of Down Syndrome, in humans are even greater than those observed in mice.

"According to our results, BPA does not directly affect the fertility of pregnant women, but that of their daughters and granddaughters. It is a multigenerational effect", explains UAB professor Montserrat Garcia Caldés, director of the research. She goes on to say that "the increase in oocyte mortality in the fetus could diminish ovarian reserve numbers and the quality of the future mother's ova. At the same time, alterations in the recombination of chromosomes in the process of cell division increase the possibility of numerical alterations, such as monosomy (only copy of a chromosome in embryo cells) or trisomy (three copies)."

Concentration levels applied in the experiments were within the safety limits marked by European (EFSA) and US (EPA) authorities. The research therefore suggests that staying within legal limits does not imply that exposure to the substance is innocuous.

"We are exposed to BPA on a daily basis, mainly through oral exposure, since we can find it in lunch boxes, beverage bottles and food storage containers", Miguel Àngel Brieño-Enríquez reminds us. First author of the article, Brieño-Enríquez, from the University of San Luis Potosí, Mexico, is now researcher at the UAB Department of Cell Biology, Physiology and Immunology. According to him, "although we generally metabolise the substance, pregnant women retain more fluids and the fetus could be affected by high concentration levels."