Obesity's Helper in Triggering Diabetes

The role of POPs in the pathogenesis of type 2 diabetes mellitus

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In 2006, an international team of researchers analyzed a data subset of the U.S. National Health and Nutrition Examination Survey (NHANES) and discovered striking dose-response relations between serum concentrations of persistent organic pollutants (POPs) and prevalence of diabetes.[1] NHANES, conducted by the U.S. Centers for Disease Control and Prevention, was designed to be nationally representative of the non-institutionalized U.S. civilian population. This first study revealed strong associations between both organochlorine (OC) pesticides and nondioxin-like polychlorinated biphenyls (PCBs) and diabetes. Moreover, the prevalence of diabetes was quite low among subjects with high BMIs but low serum concentrations of POPs.[1] POPs stored in adipose tissue may therefore play a considerable role in the pathogenesis of diabetes.[2,3]

Objective

In a recently published subsequent study, the team of authors reviewed the same dataset to investigate POPs and insulin resistance (a frequent precursor of type 2 diabetes) in non-diabetic subjects.

Research design and methods

The NHANES surveys included data on serum concentrations of various biologically important POPs or their metabolites and estimated insulin resistance using the homeostasis model assessment (HOMA) method.[4] The authors selected 19 POPs detected in at least 60% of study subjects and then examined associations of POPs and HOMA of insulin resistance (HOMA-IR) within 5 POP subclasses.

Results

The sample of 749 participants included 46.3% males and 49.7% Caucasians. Mean age was 48.2 ± 18.9 years. Among 5 subclasses of POPs, only OC pesticides correlated strongly with HOMA-IR in these non-diabetic subjects, although specific individual nondioxin-like PCBs were also associated with higher HOMA-IR values. The findings suggest that chlordane (an agricultural pesticide banned in the US since the 1980s) may be the most important POP involved in the pathogenesis of type 2 diabetes by influencing insulin resistance, although there has been no experimental study on the possible biological mechanism(s).

Conclusions

The present study found serum concentrations of OC pesticides to be strongly and positively associated with insulin resistance among non-diabetic subjects. Coupled with the previous study's findings on associations between POPs and diabetes, the current results suggest that background environmental exposure to some POPs, especially OC pesticides, may be critically involved in the pathogenesis of diabetes through a pathway involving insulin resistance. In the POP subclass of OC pesticides and their metabolites, oxychlordane (a chlordane metabolite) and trans-nonachlor (a chlordane impurity) were most strongly associated with insulin resistance in non-diabetic subjects. The interaction between OC pesticides and obesity on the risk of both insulin resistance and diabetes suggests that POPs stored in adipose tissue may play a role in the current epidemic of type 2 diabetes.

(*Excerpted from:* Lee DH, Lee IK, Jin SH, Steffes M, Jacobs DR. Association between serum concentrations of persistent organic pollutants and insulin resistance among nondiabetic adults. *Diabetes Care* 2007; 30(3):622-628.)

References:

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