Assessing DNA damage in children environmentally exposed to pesticides through using the comet assay and the micronucleus test

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Background
Environment pesticide effects principally depend on their niche distribution and chemical stability/decomposition, according to seasonal variations. In areas of intensive pesticide use, populations are therefore more vulnerable to any detrimental effects, eg increased hypersensitivity, and may become conditioned to their short/long term actions depending on the patterns of use. Of particular concern are developmental disorders arising in children whenever the exposure is constant and of sufficient duration, even at low pesticide concentrations.

Methods
A study investigated whether cytogenetic damage increased through prolonged pesticide exposure in n = 117 children, aged 7-11 years, living in rural areas of intensive agriculture; controls being n = 87 children from an agri-tourism region without pesticide exposure. DNA Single-Strand Breaks (SSB) were detected by the Comet assay in whole fresh blood samples together with 'formamidopyrimidine DNA-glycosylase (FPG)-sensitive sites' with the bacterial FPG protein in isolated lymphocytes. Micronuclei (MN) levels were measured by the cytokinesis-block MN assay. Acetylcholinoesterase (AChE) and Pseudocholinesterase (PChE) activities were used as biomarkers of exposure.

Results
Subjects exposed to pesticides had significantly higher AChE and PChE activities than controls, although average levels were well below the biological exposure limit. In addition, those exposed to pesticides had significantly higher levels of steady-state FPG sites and SSB levels ($p < 0.001$), as well as MN levels. A positive correlation was found between PChE activity and FPG-sensitive sites and also between MN levels and FPG-sensitive sites, (both $p < 0.01$).

Conclusions
In conclusion, despite the relatively low pesticide exposures in the test group of children, significant biological/developmental effects were detected.

Key message
- Children from rural areas exposed to pesticides demonstrated significant DNA damage as determined by various standard biochemical tests.

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