

Biological monitoring of genotoxicity to organophosphate pesticide exposure among rice farmers: exposure-effect continuum study

ABSTRACT

Background: This study has used biomarker of exposure-effect continuum to examine the biological characteristics of organophosphate (OP) toxicity and its genotoxic effect among rice farmers. **Materials and methods:** A cross-sectional study was conducted among 160 pesticide exposed rice farmers and 160 adults from the fishing village as the unexposed group. They share the common socio-economical background for inter-individual comparison in human toxicology assessment. In this study depression of blood cholinesterase is used as a biomarker of exposure to OP toxicity. Two genotoxic assays (micronuclei and comet assay) were conducted as a biomarker of genotoxic effect among the adult population. In this context, micronuclei assay is used to indicate the chromosome breakage and comet assay to estimate the possible DNA damage. **Results:** The study showed a significant difference of blood cholinesterase level ($p=0.001$) between the exposed- unexposed groups. Besides, the results showed that farmers had at least 2-2.5 folds of significant increase ($p=0.001$) in MN frequency (in 1000 cells) and comet tail length (μm) compared to the unexposed group. In addition, regression analysis among farmers showed that blood cholinesterase level decreased with the genotoxic effects. A small variation ($R^2=0.148$) of MN frequency could be explained by the depression of blood cholinesterase level; however, a significant reduction ($p=0.001$), with strong changes ($R^2=0.712$) in comet tail length was attributed to the depression of blood cholinesterase levels. Risk factors like age, body mass index, smoking status and years of working showed the different strength of the relationship with these genotoxic effects. **Conclusions:** This study suggests that chronic exposure to OP shows an inhibition to blood cholinesterase level, which is associated with the potential DNA breakage as indicated by comet assay. Age, smoking and years of working are the contributing factors influencing the biomarker of effects.

Keyword: Organophosphate; Cholinesterase; Depression; Chromosomal breakage; DNA damage