

Evaluation of Airborne Particulate Matter Early Biological Effects in Children with Micronucleus Cytome Assay: The MAPEC_LIFE Project

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Abstract : In 2013, air pollution and particulate matter were classified as carcinogenic to human by the IARC. At present, PM is Europe's most problematic pollutant in terms of harm to health, as reported by European Environmental Agency (EEA) in the EEA Technical Report on Air quality in Europe, 2015. A percentage between 17-30 of the EU urban population lives in areas where the EU air quality 24-hour limit value for PM₁₀ is exceeded. Many studies have found a consistent association between exposure to PM and the incidence and mortality for some chronic diseases (i.e. lung cancer, cardiovascular diseases). Among the mechanisms responsible for these adverse effects, genotoxic damage is of particular concern. Children are a high-risk group in terms of the health effects of air pollution and early exposure during childhood can increase the risk of developing chronic diseases in adulthood. The MAPEC_LIFE (Monitoring Air Pollution Effects on Children for supporting public health policy) is a project founded by EU Life+ Programme (LIFE12 ENV/IT/000614) which intends to evaluate the associations between air pollution and early biological effects in children and to propose a model for estimating the global risk of early biological effects due to air pollutants and other factors in children. This work is focused on the micronuclei frequency in child buccal cells in association with airborne PM levels taking into account the influence of other factors associated with the lifestyle of children. The micronucleus test was performed in exfoliated buccal cells of 6-8 years old children from 5 Italian towns with different air pollution levels. Data on air quality during the study period were obtained from the Regional Agency for Environmental Protection. A questionnaire administered to children's parents was used to obtain details on family socio-economic status, children health condition, exposures to other indoor and outdoor pollutants (i.e. passive smoke) and life-style, with particular reference to eating habits. During the first sampling campaign (winter 2014-15) 1315 children were recruited and sampled for Micronuclei test in buccal cells. In the sampling period the levels of the main pollutants and PM₁₀ were, as expected, higher in the North of Italy (PM₁₀ mean values 62 µg/m³ in Torino and 40 µg/m³ in Brescia) than in the other towns (Pisa, Perugia, Lecce). A higher Micronucleus frequency in buccal cells of children was found in Brescia (0.6/1000 cells) than in the other towns (range 0.3-0.5/1000 cells). The statistical analysis underlines a relation of the micronuclei frequency with PM concentrations, traffic level near child residence, and level of education of parents. The results suggest that, in addition to air pollution exposure, some other factors, related to lifestyle or further exposures, may influence micronucleus frequency and cellular response to air pollutants.

Keywords : air pollution, buccal cells, children, micronucleus cytome assay

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