EFFECTS OF LONG-TERM EXPOSURE TO AIR POLLUTION ON RESPIRATORY FUNCTION AND PHYSICAL EFFICIENCY OF PRE-ADOLESCENT CHILDREN

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Objective: Health effects of exposure to air pollution have been indicated by previous studies suggesting that long-term exposure to ambient particles, nitrogen oxides (NO2), and inorganic acid vapor negatively affects the growth in lung function and increases the risk of chronic respiratory illness in adulthood. It has also been documented that increased concentration of total suspended particulates is a significant predictor of the incidence of upper respiratory symptoms in children. However, the effects of long-term exposure to air pollution on respiratory function adaptation to physical activity are less clearly defined. In this study, we analyzed the relationship between the levels of air pollutants and respiratory function/physical efficiency of pre-adolescent children living in the Upper Silesian Industrial Region.

Methods: Spirometric evaluations and physical exercise test were performed at school during morning hours in 103 children aged 14 to 16. Each subject was asked to perform the maximal forced expiratory maneuver from which FVC, FEV1, and forced expiratory flow of 25-75% (FEF25-75) were recorded. From 1994 through 2008 air pollutants (SO2, NO2, PM10, CO) were regularly monitored, and compared with the reference ranges.

Results: Differences were noted in the average annual pollutant concentrations during the observation period. The SO2, PM10, and CO levels constitute a major air pollution problem in the Upper Silesian Industrial Region. It should be emphasized that Polish air quality standards have only recently met the World Health Organization recommendations; before 1998 higher air pollution limits had been permissible. Compared with the reference ranges, the mean FEV1 was significantly lower in subjects examined ($P<0.001$). Similar tendency was observed in boys and girls. ANOVA revealed a significant influence of high PM10 and NO2 concentrations on respiratory function (VC, FEV1, MVV). Significant influence of air pollution on physical efficiency was observed in the 16-year-old boys ($P<0.05$). The mean PM10 and NO2 concentrations showed aignificant correlations with the FEV1 decrease ($r=0.30$; $P<0.01$ and $r=0.24$; $P<0.05$, respectively). A negative correlation was found in all subjects between concentrations of monitored pollutants and maximal voluntary volume ($P<0.05$).

Conclusions: Exposure to air pollution is associated with reduced respiratory function and may lead to physical efficiency decline in children and adolescents. We suggest that pollution related reduction of lung function in childhood might be related, at least partially, to long-term exposure to particulate air pollutants, and especially in those children who spend more time practicing outdoor sports.