Neonatal cytokines: mediator and indicator of $PM_{2.5}$ exposure during early pregnancy and childhood eczema

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Background: Previous studies have shown that neonatal cytokines could have harmful effects on allergic diseases in childhood. However, the impact of maternal exposure to $PM_{2.5}$ and its components on the development of fetal immune systems and allergic diseases in childhood remains unclear.

Methods: A total of 482 mother-infant pairs were included. Maternal exposure to $PM_{2.5}$ and its six main components was assessed, and 27 kinds of cytokines were detected using heel-prick blood specimens from newborns. General linear regression and weighted quantile sum regression analyses were used to investigate the association between maternal exposure and neonatal cytokines. The K-means algorithm was used for cluster analysis to categorize the infants into different groups based on their cytokines. Principle component analysis was then used to validate it. Finally, general linear regression models and LASSO regression were employed to identify the associations between neonatal cytokines and eczema in childhood.

Results: Negative associations were observed between maternal exposure to $PM_{2.5}$ and components with neonatal IL7 (β= -0.05, 95%CI: (-0.07, -0.03), p<0.001), IL12 (β= -0.04, 95%CI: (-0.06, -0.01), p=0.05) and IL13 (β= -0.04, 95%CI: (-0.06, -0.02), p=0.02) while positive associations with neonatal Eotaxin (β= 0.17, 95%CI: (0.09, 0.25), p<0.001), PDGFbb (β= 0.05, 95%CI: (0.07, 0.23), p=0.01), MIP1b (β= 0.10, 95%CI: (0.05, 0.15), p<0.001), RANTES (β= 0.32, 95%CI: (0.22, 0.41), p<0.001). Meanwhile, WQS indexes were statistically associated with all seven neonatal cytokines in both robust and fully adjusted models (p<0.001). In addition, children with higher IL7 (OR= 10.57, 95%CI: (1.60,73.82) , p =0.02) and lower RANTES (OR= 0.65, 95%CI:

(0.43,0.95), p =0.03) levels were significantly associated with an increased risk of eczema in childhood.

Conclusions: Maternal exposure to $PM_{2.5}$ was associated with neonatal cytokines and had lasting effects on eczema in childhood. IL7 and RANTES could act as mediators between $PM_{2.5}$ exposure and eczema in children.

Keywords: cytokines, $PM_{2.5}$, pregnancy, fetal immune system, eczema