微環境微粒空氣污染物對氣喘學童尖峰吐氣流量率之影響

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(中)	
關鍵字(英)	articulate matter, asthmatic children, peak expiratory flow rate, microenvironmental exposures, lag effect, cumulative effect before data
摘要(中)	摘要 目的：許多的小組研究指出氣喘學童的健康狀態和微粒（particulate matter, PM）空氣污染物濃度有密切的相關，但此類研究多數應用空氣品質測站監測所得的 PM 以及其他污染物質資料，用以評估易感受族群的健康效應，然而利用此類資料可能造成錯誤的暴露推估，導致無法正確的評估 PM 暴露與健康效應之相關，且目前文獻對於細粒徑（PM2.5）和粗粒徑（PM2.5-10）微粒對氣喘學童肺功能指標之一的尖峰吐氣流量率（peak expiratory flow rate, PEFR）之影響也尚未有一致性的定論，本研究目的在於瞭解微環境中不同粒徑與不同時序的微粒暴露對氣喘學童 PEFR 下降的影響。 方法：本研究利用可攜式微粒分析儀（GRIMM 1.108 , Germany）針對新莊市新泰國小 30 名氣喘學童進行微環境的微粒暴露（PM10、PM2.5、PM1）監測，並使用 PF－100（Microlife , Taiwan）測量學童每日早晚的 PEFR 變化，另利用活動日誌紀錄氣喘學童各種微環境的活動以求精確的評估微粒暴露量，再以線性混合因子模型進行不同時序與不同粒徑之微粒暴露濃度和 PEFR 之相關分析，本研究以 PEFR 測定時間的前 24 小時（Lag 0）、前 24 至 48 小時（Lag 1）、前 48 至 72 小時（Lag 2）的 PM 平均濃度來觀察對 PEFR 的延遲效應，以 Lag 0、前兩天（2 day mean）、前三天（3 day mean）的 PM 平均濃度來觀察對 PEFR 的累積效應，並同時應用超級測站之微粒空氣品質資料來比較與微環境微粒暴露對評估 PEFR 的差異性。 結果：本研究調查的氣喘學童族群其微環境 PM 暴露平均濃度（PM10 = 51.9 μg/m3、PM2.5-10 = 17.9 μg/m3、PM2.5 = 34.0 μg/m3）均高於超級測站之 PM 平均濃度（PM10 = 48.4 μg/m3、PM2.5-10 = 17.0 μg/m3、PM2.5 = 31.4 μg/m3）。經線性混合因子模型分析之結果雖未達統計上之顯著但可觀察到下列趨勢：不同粒徑之 PM 暴露對早上的 PEFR 下降的延遲效應（Lag 0、Lag 1、Lag 2）皆以粗粒徑（PM2.5-10）的影響較大，粗細粒徑的累積效應差異則無規律；不同時序之 PM 暴露對早上 PEFR 的延遲效應中， PM1 與 PM1-2.5 皆以 Lag 2 的影響較大；累積效應則以 2 day mean 影響較大。PM 對晚上 PEFR 的延遲效應與累積效應僅觀察到粗粒徑（PM2.5-10）之 Lag 0 影響，其它粒徑與時序之影響則較無規律。另外，研究結果中顯示氣喘學童 PEFR 監測之微環境 PM 暴露與相同時序之超級測站 PM 數據的皮爾森相關係數（Pearson's coefficient）顯示細粒徑微粒的相關性較粗粒徑佳（PM 2.5 > PM2.5-10），而從線性混合因子模型的模擬程度比較中，顯示微環境 PM 監測較能評估學童的 PEFR 變化。 結論：本研究調查中的新泰國小氣喘學童族群，微環境暴露監測資料各粒徑 PM 平均濃度均高於超級測站 PM 平均濃度，且微環境中 PM 暴露的濃度變化較大，顯示氣喘學童 PM 暴露明顯高於超級測站監測資料。另外，不同粒徑與不同時序的 PM 暴露對氣喘學童 PEFR 下降的延遲效應與累積效應未達統計上的顯著，僅有部分的趨勢出現。與超級測站 PM 資料相較，微環境監測資料較能評估學童的 PEFR 變化。 關鍵字：微粒空氣污染物、微環境暴露、氣

	喘學童、尖峰吐氣流量率、延遲效應、累積效應
摘要(英)	Abstract Objective: Many panel studies have indicated the relationship between the concentrations of particulate matter (PM) and the health status of children with asthma. Most of the studies used PM (or other air pollutants) data obtained from the ambient air monitoring sites to access the health effects for susceptible groups, while the data gathered from the ambient sites might introduce certain statistical errors or biases. As a result, it is difficult to estimate the relation between PM exposures and health effect. Currently, results of previous studies have been inconsistent with the effects of fine particle (PM2.5) and coarse particle (PM2.5-10) on the peak expiratory flow rate (PEFR) for asthmatic children. Therefore, we conducted the research to achieve further understanding of the effects of different PM diameters and time frames on the peak expiratory flow rate for asthmatic children. Method: In this study, we recruited 30 asthmatic children form SinTai Elementary School, SinChuang City, and used a portable particle monitor (GRIMM 1.108, Germany) to measure their microenvironmental particle exposures (PM10, PM2.5, and PM1). Subjects’ PEFR data were obtained using PF-100 (Microlife, Taiwan) twice a day in both of the morning and the evening. In order to estimate the actual PM exposures in different microenvironments, activity data were also recorded via time-activity diary. Linear mixed-effect model was used to analyze the association between PM exposures and peak expiratory flow rate in different time frames and different diameters. In the study, lag effects of PM concentrations on PEFR were observed by different time frames, including 24-hour PM concentrations before the PEFR tests (Lag 0), 24-hour to 48-hour PM concentrations before the PEFR tests (Lag 1), 48-hour to 72-hour PM concentrations before the PEFR tests (Lag 2), 2-day cumulative PM concentrations before the PEFR tests (2-day mean), and 3-day cumulative PM concentrations before the PEFR tests (3-day mean). In addition to microenvironmental PM exposures, PM concentrations measured at the particle Supersite were also applied in the analysis to evaluate the PM effects on the PEFR changes. Results: The mean microenvironmental concentrations of each PM size for asthmatic children (PM10 = 51.9 ?g/m3, PM2.5-10 = 17.9 ?g/m3, and PM2.5 = 34.0 ?g/m3) were significantly higher than the corresponding concentrations gathered from the Supersite (PM10 = 48.4 ?g/m3, PM2.5-10 = 17.0 ?g/m3, PM2.5 = 31.4 ?g/m3). Although results obtained from the linear mixed-effect model analysis were not statistically significant, several relationship trends were observed. For example, PM2.5-10 levels showed greater lag effects (Lag 0, Lag 1, and Lag 2) on the morning PEFR, while no apparent trends were found for the cumulative effects of coarse particle and fine particle. Furthermore, PM1 and PM2.5 had stronger lag effect of Lag 2 on the morning PEFR. PM2.5-10 was the only size of particles shown effects (lag and cumulative effects) on evening PEFR. Lastly, stronger Pearson’ s coefficients were found for the association between microenvironmental exposures and Supersite ambient levels for fine particles, as compared to those for coarse particles. Results of the linear mixed-effect model also suggested microenvironmental PM data were better fit for children’ s PEFR change assessment. Conclusion: In this study, asthmatic children’ s averaged

microenvironmental PM exposures were significantly higher than the corresponding ambient PM concentrations measured at the Supersite. Stronger variability was found for microenvironmental PM exposures as compared to the corresponding ambient levels. Although no statistically significant trends were shown between PM exposures and asthmatic children’ s PEFR decreases, some relationship trends were observed. Finally, compared to the Supersite, the PM data monitored in different microenvironments were better fit for children’ s PEFR change assessment. Key words: particulate matter, asthmatic children, peak expiratory flow rate, microenvironmental exposures, lag effect, cumulative effect

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