

Fine and ultrafine particle levels determined during everyday activities: the PM-CARE project

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Introduction

Exposure to particle number (particles $>0.02 \mu\text{m}$ in aerodynamic diameter, a.d.) and particle mass levels ($\text{PM}_{0.5}$, PM_1 , $\text{PM}_{2.5}$ and PM_{10}) were determined on 81 non-smoking senior volunteers living in the urban and suburban area of Milan, during the warm and cold seasons of 2005-2006.

Materials/Methods

Measuring devices, comprehending optical counters (6-channel OPC and CPC), a 4-stage cascade impactor, CO and O₃ monitors and a NO₂ passive sampler, were mounted on trolleys (25kg), especially equipped to provide 24h self-contained air-monitoring. Subjects' activities were individually recorded on timetables, used also for clinical purposes (see Fanetti et al.).

Results

24h-average particle number and mass (PM_{10}) concentration means were 19.500 \#/cm^3 and $41.4 \mu\text{g/m}^3$ in summer (overall monitoring duration 1913h) and 26.600 \#/cm^3 and $62.0 \mu\text{g/m}^3$ in winter (1894h), with a mean seasonal contribution of $\text{PM}_{0.5}$ to PM_{10} of 54% and 68%, respectively. Data plots logged by particle counters were apportioned and separately examined according to the most common activities arising from the timetable. Resulting particle number concentrations are presented in the following figures as the mean percent deviation from individual 24h-averaged levels.

Conclusions

With the exception of domestic and workplace activities, which could not be further specified, the results reported are indicative of human PM exposure patterns experienced in urban and suburban areas. Substantial increases of particle counts were associated with flame cooking and urban transfer by car, whereas $\text{PM}_{0.5}$ exposure was principally associated with outdoor sources.

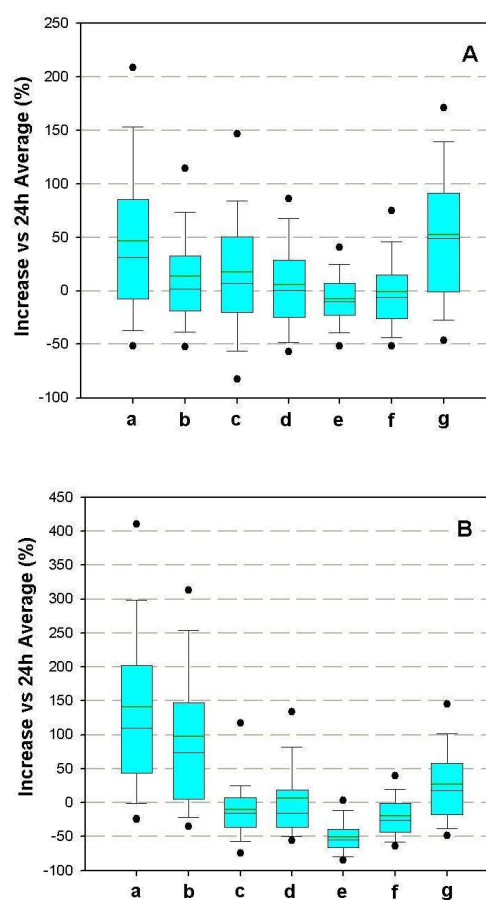


Figure 1. Mean percent deviation of ultrafine ($>0.02 \mu\text{m}$ a.d.; A) and fine particle ($0.3-0.5 \mu\text{m}$ fraction; B) levels, during activities as follows (cumulative sampling duration; number of volunteers investigated)

- a: moving by car (103h; 81 subjects)
- b: flame cooking (293h; 72 subjects)
- c: workplace activities (104h; 12 subjects)
- d: indoor domestic activities (307h; 75 subjects)
- e: sleep (1170h; 78 subjects)
- f: home at rest (1419h; 76 subjects)
- g: promenade (66h; 32 subjects)