Measurements of the distal airspaces in children using the novel AiDA technique

Linell, Julia; Petersson Sjögren, Madeleine; Wollmer, Per; Löndahl, Jakob; Rissler, Jenny

2023

Measurements of the distal airspaces in children using the novel AiDA technique

J. Linell[1,2], M. Petersson Sjögren[1,2], P. Wollmer[3,4], J. Löndahl[1,2] and J. Rissler[1,2,5]

[1]Ergonomics and Aerosol Technology, Lund University, Sweden [2]NanoLund, Lund University, Sweden [3]Translational Medicine, Lund University, Sweden [4]Centre for Medical Imaging and Physiology, Skåne University Hospital, Malmö, Sweden [5]Bioeconomy and health, RISE Research Institutes of Sweden, Lund, Sweden.

Motivation

To better ***understand particle deposition*** in the respiratory tracts of children and adolescents—and their ***susceptibility to health effects caused by air pollution***—more knowledge about the distal lung development of these groups is needed.

Conclusions

- Age dependent trend of distal airspace radius for the groups 9–15, 15–18 year-olds and adults
- Distal airspaces grow from childhood through adolescence to adulthood

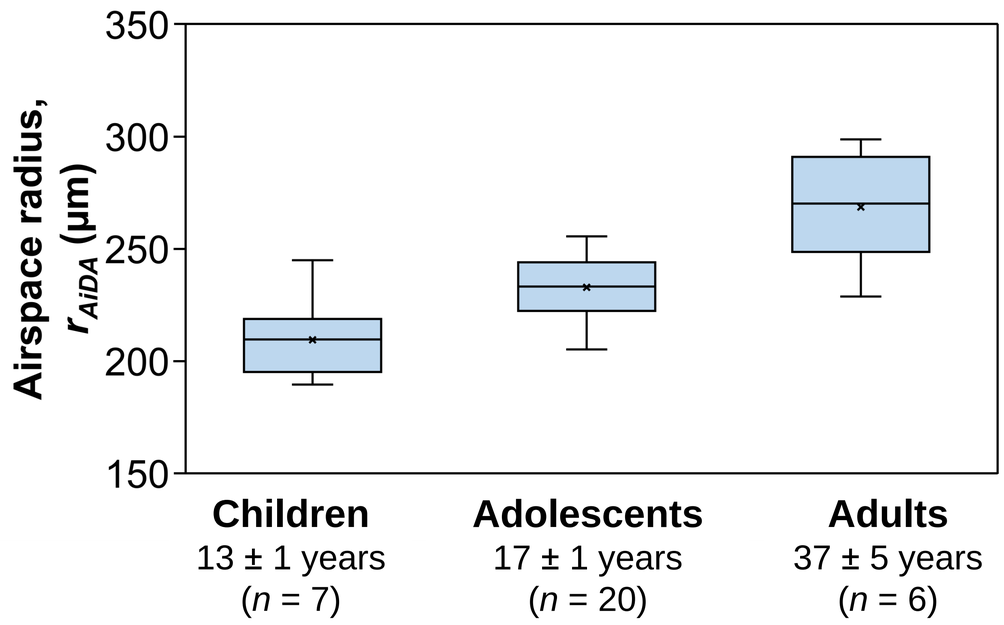
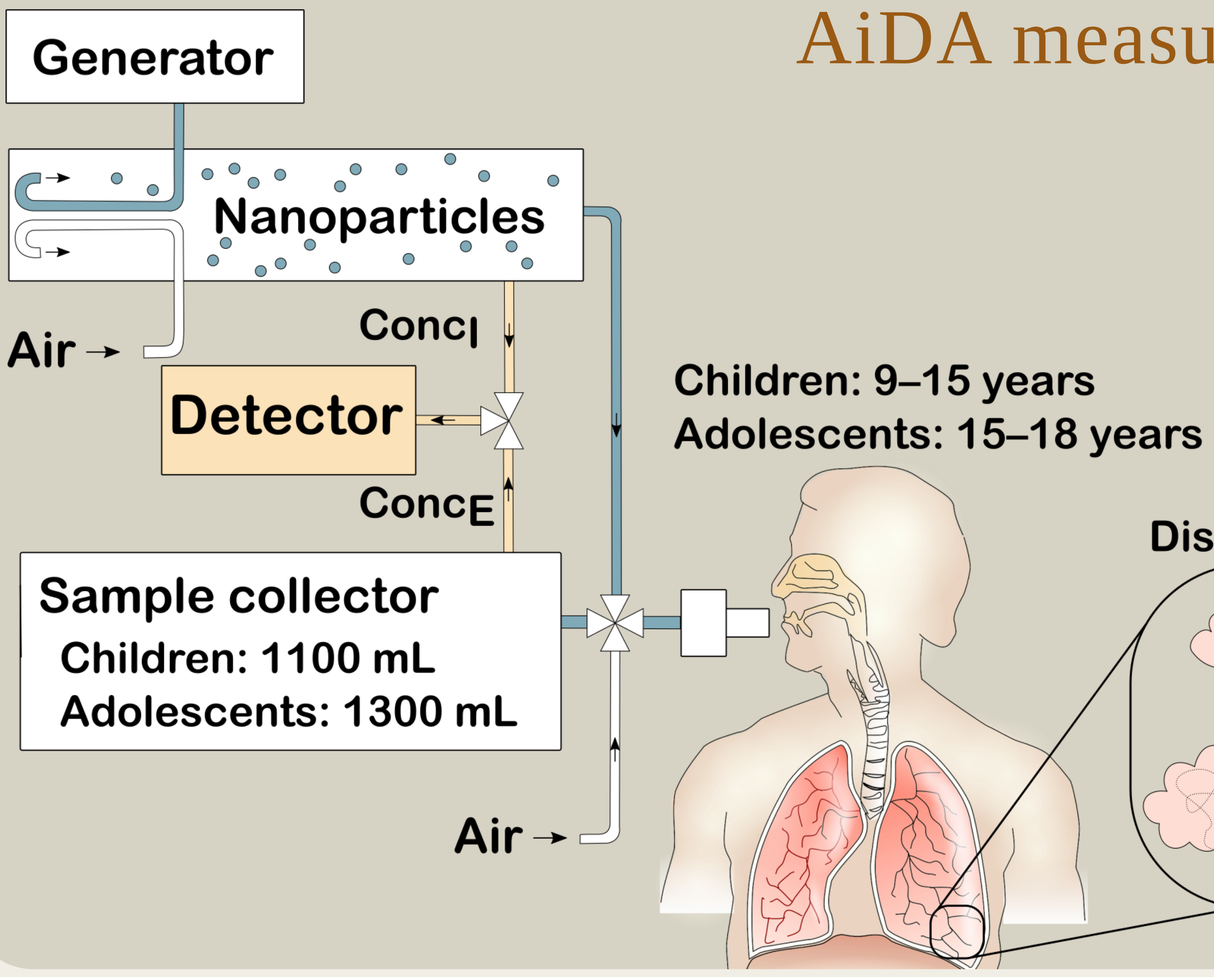
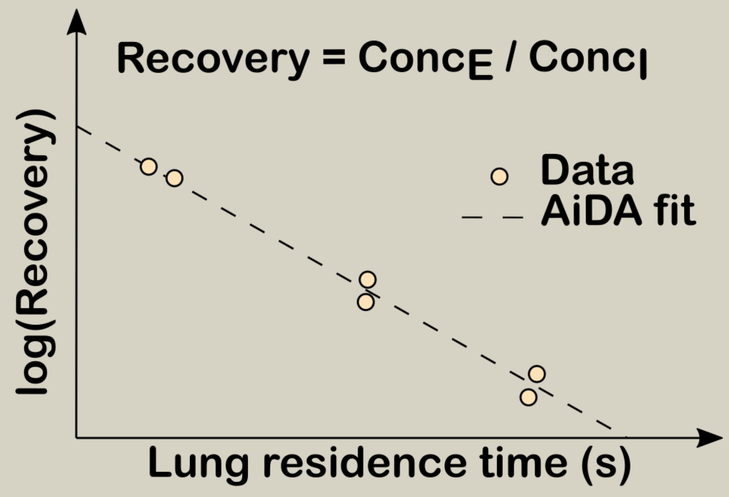


Fig. 2. Airspace radii for children, adolescents and an adult reference group. Box limits, 1st and 3rd quartiles; line in box, median; X, mean; whiskers, maximum and minimum.

AiDA measurements



Inhale nanosized aerosol – Hold breath – Measure exhaled recovery of inhaled particles from specified volumetric lung depth – Calculate effective airspace radius (r_{AiDA})



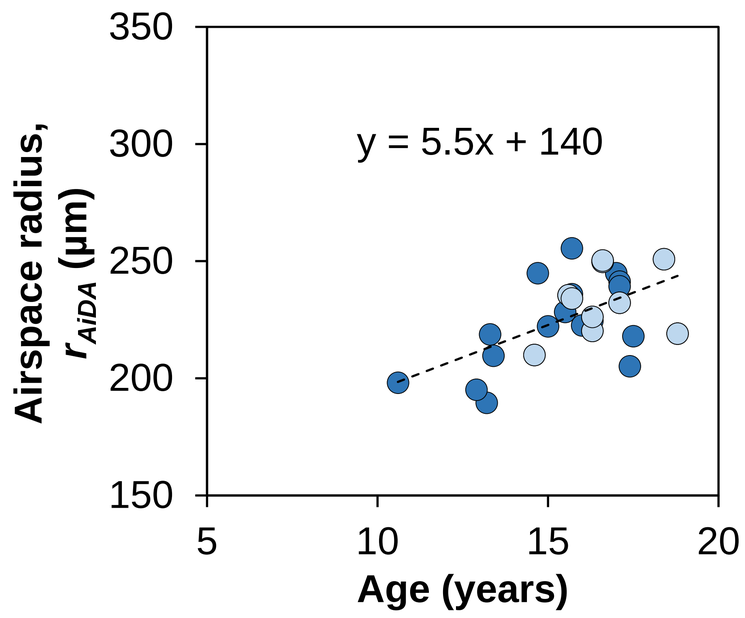


Fig. 1. Age-dependence of the airspace radii for children and adolescents. Both males (light blue) and females (dark blue) are included.

Results

An age-dependent trend of r_{AiDA} (Pearson's r = 0.57; p = 0.002) was found for subjects in the ages 9–18 years (Fig. 1).

The r_{AiDA} were (mean ± standard deviation):

- 209 ± 17 µm for children,
- 233 ± 13 µm for adolescents
- 267 ± 23 µm for an adult reference group.

These results suggest that the distal lung structure and alveoli are developed at a young age, and that distal airspaces grow from childhood, through adolescence, to adulthood (Fig. 2).

Acknowledgements

This research was supported by The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, FORMAS (grant number 2018-00693).

Contact

Julia Linell, Ergonomics and Aerosol Technology, LTH
julia.linell@design.lth.se