



Scientific letter

Environmental Microplastics in the Lower Airway of Shoe Manufacturing Workers



Microplásticos ambientales en la vía aérea inferior de trabajadores del calzado

Dear Editor,

Microplastic (MP) pollution has become a serious global environmental threat. There is an increasing awareness that plastic fragments are in the air and can be inhaled by humans, which may cause adverse effects on the respiratory system and on other systems.^{1,2} Recent evidence shows that ambient MP particles, when inhaled, are capable of depositing in the human airway.²⁻⁴ Following lessons learned from other particles, there have been concerns about the possible health impact of this exposition.^{4,5} In fact, it has been shown that MPs induce chronic inflammation and DNA damage and oxidative stress, leading to carcinogenesis.⁶ Studies in humans have demonstrated that these products are more frequently detected in patients with worse pulmonary function and in lung cancer tissue.^{2,3} Some characteristics of MP toxicity in studies on rats include bio-persistence, presence of reactive sites and soluble toxicants.⁴

Although the influence of airborne MPs on indoor and outdoor air quality remains largely unknown, recent data have shown that significant amounts of MPs can be found in the workplace.⁷ Consequently, the impact of occupational airborne MPs on workers' health is a major concern.^{5,7} Among the different occupational exposures, it is well known that shoe factory workers are exposed to a variety of products including synthetic fibres at a relatively high concentration.⁸ Shoe workers have a high prevalence of acute and chronic respiratory symptoms⁸ and different studies have shown contradictory results on an increased risk of lung cancer.⁹ In our health area there is a large concentration of shoe industry and this has allowed us to assess the presence of MPs in various shoe manufacturing workers. We set out to investigate whether shoe workers had microplastics more frequently than the rest of the population analyzed or were differentially affected by any product.

We have conducted a study on the presence of microplastics in bronchoalveolar lavage samples in 44 consecutive unselected patients who were to undergo bronchoscopy. The age of the participants ranged between 35 and 86 years-old; 32 (73%) were men and 12 (27%) women.³ The identification and characterization of microplastics was performed using Olympus SZ-61TR Zoom Trinocular Microscope (Olympus Co., Tokyo, Japan), and μ -FTIR analysis (Perkin-Elmer Spot-light™ 200 Spectrum Two, Waltham, MA, USA). The surface characteristics and chemical composition were examined using a scanning electron microscope coupled to energy dispersive X-ray spectrometry (SEM-EDS) (Hitachi S-3500N

SEM, Hitachi High-Technologies, Tokyo, Japan). The research was approved by the HGUE Health Department's Ethics Committee (ID PI 7/2021).

In the majority of patients the presence of MPs could be found, basically in the form of microfibrers. Of the 44 patients included in our initial study,³ nine individuals were shoe workers. The average MPs concentration in bronchoalveolar lavage fluid was 3.59 items per 100 ml in the group of shoe manufacturing workers and it was 4.30 items per 100 ml in the remaining patients (without statistically significant differences). Very interestingly, the chemical composition analysis identified the presence of polyacrylate microfibrers in shoe workers (0.34 items/100 ml) but they were not detected in the rest of the patients studied (*F*-test, *p*=0.01). Polyacrylate is a polymer which is part of the composition of many aqueous adhesives that are frequently used in the footwear industry.¹⁰ Some authors suggest that workers exposed to polyacrylate may be at respiratory risk.¹¹

The study of airborne MPs and its effect on health is an emerging field of research and contributions in this area can contribute to a global view of this problem. It is necessary to assess especially the risks for workers in environments with high concentrations of MPs, because of the consequences on their health and the possibility to propose preventive measures.

This study has obvious limitations. It was not designed to differentiate risks from occupational exposure and the number of individuals is very small. Nevertheless, it is the first description of these findings and opens new perspectives in the study of the contamination to which workers are exposed. Our data show that, although MPs concentration in the lower airway is similar to that of the rest of the population in the same area, some types of microfibrers are exclusively detected in shoe manufacturing workers. The presence of polyacrylate seem to be clearly related with the occupational exposure, and could pose a risk to respiratory health according to previous studies.

Authors' contributions

Each of the authors of the article has contributed substantially to the elaboration of the manuscript: the design of the study or acquisition data, or analysis and interpretation of data, drafting the article or revising it deeply and critically for important intellectual content, final approval of the version to be submitted.

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Conflicts of interest

The authors declare that they have no conflict of interest directly or indirectly related to the contents of the manuscript.

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