Key finding: Even at low levels of exposure, there was an association between long-term exposure to particulate matter (PM) and increased values of red blood cell distribution width (RDW)...

Background and Aim

• PM is being considered an important risk factor for cardiovascular (CV) diseases, which continue to be the leading cause of death in many countries, including Portugal (1,2).

• The pathophysiological mechanisms linking PM and CV diseases are not entirely known, being a currently research area with a lot of scientific debate (3).

• Epidemiological studies on the association between PM and biomarkers of CV risk conditions are essential to establish the causal relationship of the association between PM and CV morbidity and mortality.

• RDW has been identified as an independent prognostic biomarker of multiple cardiovascular diseases (4-6).

• The present study aims to assess the association between long-term exposure to PM10 and RDW values, in the adult Portuguese mainland population, in 2015.

Materials and Methods

Study population: 2211 participants of the 1st Portuguese Health Examination Survey (INSEF, 2015) with available data on RDW parameter and living within a 30 km radius of an air quality monitoring station from the air quality monitoring network of the Portuguese Environment Agency with available PM10 measurements.

Environmental data: PM10 values were obtained from the QuaBe database, available online at the Portuguese Environment Agency (APA) website. For each individual the allocated 1-year average PM10 concentrations was the average of PM10 concentrations from all stations within 30 km from the participant’s residence, in the previous 365 days. This average was weighted by the inverse of the squared distance between the residence and the air quality monitoring stations.

Statistical analysis: Regression coefficients (β) with the corresponding 95% confidence intervals (CI) were obtained by generalized linear regression models analyses for each 10 μg/m³ increment of PM10. The minimal sufficient adjustment set of variables considered to adjust the models were age, sex, socioeconomic status (educational level and occupation), lifestyles (smoking, excessive alcohol consumption, unhealthy diet and sedentary) and ambient air temperature.

Health and sociodemographic data: Age, sex, educational level, occupation and lifestyles variables (smoking, excessive alcohol consumption, sedentary and unhealthy diet) were obtained by self-report through the interview. Fresh non-fasting whole blood samples were used to RDW determination.

Results

<table>
<thead>
<tr>
<th>Characteristics of the study participants</th>
<th>Females (n=1195)</th>
<th>Males (n=1016)</th>
<th>Total participants (n=2211)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (n=2211) - %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-49</td>
<td>27.2</td>
<td>28.6</td>
<td>27.7</td>
</tr>
<tr>
<td>50-64</td>
<td>37.0</td>
<td>34.4</td>
<td>35.9</td>
</tr>
<tr>
<td>65-74</td>
<td>36.0</td>
<td>37.6</td>
<td>36.7</td>
</tr>
<tr>
<td>PM10 (n=2211) - (mean, sd)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.9, 4.1</td>
<td>17.5, 3.0</td>
<td>16.9, 4.0</td>
<td>17.5, 3.0</td>
</tr>
</tbody>
</table>

Association between PM10 and RDW values

• 2.82% RDW increase per each 10 μg/m³ PM10 increment (95%CI: 0.62% - 5.02%)

• Results supported by the sensitivity analysis.

Conclusions

• To the best of our knowledge, this is the first study describing an association between ambient PM10 exposure and RDW. It is uncertain whether changes in RDW due to PM10 exposure constitute an adverse health outcome. However, RDW has been identified as an independent prognostic biomarker of multiple cardiovascular diseases and its relevance to health needs to be evaluated to explain the effect of PM10 in triggering cardiovascular events.

• Even at relatively low levels of PM10 concentrations, in Portugal, it was possible to detect the PM10 exposure effect on RDW values, suggesting there is no safe level of air pollutants. Our findings suggest that reducing PM10 levels would result in additional benefits concerning the cardiovascular health of the population.

References


Sensitivity analysis

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Results: Association between PM10 and RDW values...

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