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Slow and steady wins the race: Better walking than running. The turtle's lesson in the times of COVID-19

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Dear Editor,—as recently hypothesized,[1, 2] pollution and particulate matter could have played a crucial role in the spread and clinical severity of patients infected with SARS-CoV2.

Therefore, some specific groups of exposed population could be more affected by the inhalation of particulates. Among these, those who practice outdoor aerobic physical activity could be the most severely affected by the SARS-CoV2. Infection, constantly and chronically exposed to inhaled pollutants, during outdoor exercises.[3,4]

Oxygen is indispensable to the metabolic processes and it allows the survival of our cells. The air we breathe, however, contains only about 20% of Oxygen, which is mixed with Nitrogen (78%), Carbon dioxide (0.04%) and Argon (0.9%) and other substances that vary according to of the place and season, such as pollen, dust of all kinds from domestic to siliceous, micro-particulate, microbial particles, chlorine and many others.[5,6] Every time we inhale, it is not only oxygen that enters our respiratory tract, but the mixture of gases and volatile substances that are found in the air around us. These acquisitions have been connected to different pathological conditions.[7–9]

Each quiet inspiration brings between 300 and 500 ml of air into our respiratory tract; a part of it stops in the upper airways (nose, trachea, bronchus and terminal bronchioles), while about 150–300 ml reach the alveolar membrane where the gas exchange takes place.[10]

During exercise, the need to obtain oxygen and eliminate carbon dioxide increases, sympathetic bronchodilation causes a reduction in resistance and an increase in flow. The respiratory rate of 15 acts/minute (12 L of air) at rest can reach 40–60 acts/minute (100 L of air) during the exercise phase.[11]

Furthermore, breathing is generally oral and non-nasal during prolonged exercise. The air that reaches the lower respiratory tract will therefore be colder and unfiltered.[12] Exercise always causes greater airflow to the lung, but the exercises are not all the same. Endurance sports such as marathon, cross-country skiing, cycling involve greater exposure to ambient air and therefore a greater risk of lung contact with toxic substances and harmful agents.[12]

In addition, exercise is universally recognized as a protective factor for cardiovascular and metabolic diseases, although it is important to know the environmental conditions open-air sports are practiced.[12,13]

Physical activity enables us to increase our interface with the external environment, in particular with the invisible substances that surround us and that can be harmful.[5,6] A walk lasting twenty minutes, for example, involves a flow of about 240 L of air in our respiratory system, while with a run of the same duration you can reach 2000 L of flow.[11] Considering that one thousand liters of air equals one meter3, we can compare these values with the measurements of PM2.5 and PM10 of the ARPA Agency in Lombardy.[14]

In Milan (ARPA Verziere station) the daily average of PM10 corresponds to 53 μg / m3, a run would make inhale about 106 μg of this substance to the runner. In Bergamo (ARPA Via Garibaldi station) the average daily quantity of PM2.5 is 34 μg / m3, and 41 μg / m3 of PM10. Thus, a 20 min run would expose to the inhalation of approximately 68 μg of PM 2.5 and 81 μg of PM10. To reach this amount of inhaled pollutants, it is necessary a 3 h walk.[15]

Multiple are the effects on amateur athletes' body. The particulate matter has a substantially pro-inflammatory effect, and correlates with acute effects such as asthma crisis, cough and hospitalizations for respiratory disease. Chronic exposure instead is associated with chronic obstructive pulmonary disease, respiratory failure, cardiovascular diseases.[3] The polluting micromolecules are capable of

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weakening and destroying the alveolar membrane, making it more susceptible to any kind of insult, including the infections.[1,16]

The damage mediated by these substances has been demonstrated, as well as there is no real threshold value below whom there is no danger according to the WHO, and the concentration must be kept as low as possible.[17,18]

All considered, running in this period in Milan, as in Bergamo and in all the places where the levels of PM10 and PM2.5 are close to or above the threshold values can basically mean making a feast of pro-inflammatory polluting agents that could make the lungs more susceptible to infections and complications, including those from SARS-CoV2.

Although the certain advantages on the cardiovascular system of constant physical activity remain firm and certain,[19] outdoor activities must be carefully chosen, in order to expose the individual as little as possible to the effects of intense ventilation in highly polluted areas. We hope that health authorities and individuals will take due account of air pollution levels when choosing the type of physical activity to undertake in the near future.

Declaration of Competing Interest

None.

CRediT authorship contribution statement

S. Sciomer: Conceptualization, Writing - review & editing. **S. Gallina:** Conceptualization, Writing - review & editing. **A.V. Mattioli:** Conceptualization, Writing - review & editing. **P.G. Agostoni:** Conceptualization, Writing - review & editing. **F. Moscucci:** Conceptualization, Writing - review & editing, Writing - original draft.

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