“You can leave your mask on”: effects on cardiopulmonary parameters of different airway protective masks at rest and during maximal exercise

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Protective mask use in healthy subjects is associated with modest respiratory discomfort and a slight reduction in exercise performance, mainly due to an increase in airflow resistance https://bit.ly/3aOCpwB


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Abstract
During the COVID-19 pandemic, the use of protective masks has been essential to reduce contagions. However, public opinion is that there is an associated subjective shortness of breath. We evaluated cardiorespiratory parameters at rest and during maximal exertion to highlight any differences with the use of protective masks.

12 healthy subjects performed three identical cardiopulmonary exercise tests, one without wearing a protective mask, one wearing a surgical mask and one with a filtering face piece particles class 2 (FFP2) mask. Dyspnoea was assessed using the Borg scale. Standard pulmonary function tests were also performed.

All the subjects (40.8±12.4 years; six male) completed the protocol with no adverse events. Spirometry showed a progressive reduction of forced expiratory volume in 1 s (FEV1) and forced vital capacity (FVC) from no mask to surgical to FFP2 (FEV1: 3.94±0.91 L, 3.23±0.81 L, 2.94±0.98 L; FVC: 4.70±1.21 L, 3.77±1.02 L, 3.52±1.21 L; p<0.001). Rest ventilation, O2 uptake (V˙O2) and CO2 production (V˙CO2) were progressively lower, with a reduction in respiratory rate. At peak exercise, subjects had a progressively higher Borg scale when wearing surgical and FFP2 masks. Accordingly, at peak exercise, V˙O2 (31.0±23.4 mL·kg⁻¹·min⁻¹, 27.5±6.9 mL·kg⁻¹·min⁻¹, 28.2±8.8 mL·kg⁻¹·min⁻¹; p=0.001), ventilation (92±26 L, 76±22 L, 72±21 L; p=0.003), respiratory rate (42±8 breaths·min⁻¹, 38±5 breaths·min⁻¹, 37±4 breaths·min⁻¹; p=0.04) and tidal volume (2.28±0.72 L, 2.05±0.60 L, 1.96±0.65 L; p=0.001) were gradually lower. There was no significant difference in oxygen saturation.

Protective masks are associated with significant but modest worsening of spirometry and cardiorespiratory parameters at rest and peak exercise. The effect is driven by a ventilation reduction due to increased airflow resistance. However, because exercise ventilatory limitation is far from being reached, their use is safe even during maximal exercise, with a slight reduction in performance.