Effect of Prolonged Use of Different Facemasks on Their Physical Performance and Physiological Impact on the Wearer

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Abstract

Background: Most published studies on potential facemask physical performances and physiological impairments had shorter observation periods, and the observed occupational physical activities had limited relevance to real occupational work. Thus, our study aimed to assess the impact of prolonged mask use on its physical performances and the associated physiological responses in wearers. Methods: The recruitment of study participants took place between November 2022 and March 2023. Facemask penetration and breathing resistance measurements were obtained at 4 and 8 hours using the TSI Model 8130 Automated Filter Tester and the INSPEC Breathing Resistance Rig. Facial skin temperature and transepidermal water loss were quantified using thermal imaging cameras and vapometers,

respectively. Results: A total of 216 workers participated in the study. A significant reduction in penetration ($p < 0.001$, partial $\eta^2 = 0.1$) and an increase in breathing resistance ($p < 0.001$, partial $\eta^2 = 0.9$) were observed only in case of surgical masks worn by cleaners after 8 hours. Facial skin temperature increased after 8 hours for KF94 ($p < 0.001$, partial $\eta^2 = 0.2$), surgical mask ($p < 0.001$, partial $\eta^2 = 0.4$), and cloth mask ($p < 0.001$, partial $\eta^2 = 0.2$). All three facemasks had a statistically significant interaction with use on facial skin temperature. Higher transepidermal water loss was only observed for the cloth mask (F ($p = 0.034$, partial $\eta^2 = 0.02$). Conclusion: Our findings suggest that prolonged use of face masks can lead to a deterioration in penetration, breathing resistance, and physiological impairment for the mask wearer. The implications are particularly critical for high–occupational activity jobs requiring prolonged use of masks. © 2025 Occupational Safety and Health Research Institute

Author keywords

breathing resistance; facemask; facial skin temperature; penetration; transepidermal water loss

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