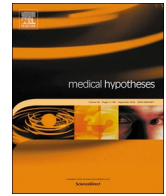




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Letter to Editors

Dr. Chandrasekaran's reply to "Exercising and face masks: An important hypothesis buried in a selective review"


Dear Authors

Thank you very much for your interest and critical feedback on our recent hypothesis article published in "Medical Hypotheses" journal. We are happy to address the concerns posed by Prof Greenhalgh and colleagues with respect to our recent paper. Please find below clarifications with our viewpoint, to the concerns directed to us.

Firstly, we would like to clarify to the authors and readers that our article focuses only on the possible physiological mechanisms that could be associated with wearing the tight custom made cloth masks during moderate to heavy exercise (60–80% VO₂ max or above anaerobic threshold). Our article does not try to demote the theory of mask usage in the community. We second the directives given by the reputed health institutions regarding the usage of mask during community visits/ interaction/ use of community resources (while using public transportation, grocery store visits, meetings etc) as this measure will help reduce the airborne transmission of the deadly virus.

Second, being a hypothetical proposition our literature search was directed specifically towards the possible potential physiological mechanisms that the non-respiratory masks could induce in the exercising population during moderate to heavy exercise, rather than the effects of N95 or surgical masks used by health care professionals. The systematic review by Bahl et al. 2020 investigated droplet transmission during social distancing, but they have not investigated the effect of face masks [1]. The systematic review by Bakhit et al. investigated the effects of facemasks on the difficulty in breathing, as well as face irritation, and our hypothesis solely tries to address the physiological mechanisms underpinning the use of facemasks during exercise [2]. Though the systematic review by Bakhit investigated downsides of the use of facemasks, majority (34 of 37) of the studies that were included, mainly reported comparison of surgical and facemasks and only a few studies reported discomfort claims. Our hypothesis pertains to the use of tight custom made masks during moderate to vigorous exercise, not general household work nor in healthcare professionals. We agree with the authors that facemasks should be used in public places and can help curb COVID transmission to almost 40% (Mitzie 2020), however, this was published after the acceptance of our manuscript <http://ftp.iza.org/dp13319.pdf>. We would once again like to reiterate that our hypothesis was framed on the premise to link potential physiological mechanisms associated with strenuous exercise rather than general public gathering or household or healthcare work.

Third, we definitely support the statement made by WHO regarding the use of masks for the general population in specific situations and settings. However, WHO on June 16th 2020 advised against wearing facemasks during exercise, considering the sweat accumulation leading to breathing difficulties (<https://www.who.int/images/default-source/health-topics/coronavirus/myth-busters/mythbuster—masks-and-exercise.png>, accessed on 11/June/2020 on "Coronavirus disease

<https://doi.org/10.1016/j.mehy.2020.110302>

0306-9877/ © 2020 Elsevier Ltd. All rights reserved.

(COVID-19) advice for the public: Mythbusters".

Fourth, we respect the work of the authors on facemask usage during COVID 19 [3], and by no means meant to offend the sentiment of the authors or their paper. We feel the message from our hypothesis has been gravely misconstrued. We are aware of the limited evidence available, with respect to facemasks curbing virus transmission (from the references the authors quoted), and we only meant to convey that the general population who do not generally exercise are exploiting the use of masks and are getting out to exercise going against the government regulations of home quarantine (Regulations that have urged individuals to step outdoors only for essential services and supplies, using adequate precautionary measures). We meant no false interpretation or disregard for the author's work.

Fifth, we would like to clarify the authors that the concept of our hypothesis is more relatable with low-middle income countries that would potentially practise use of facemasks during exercise, where sports medicine practises are still at the stage of infancy, compared to the established Western world of sports medicine. The authors would agree with us, when we say that social exercisers engaging in strenuous exercise in public places during the pandemic, would mainly be using tight-fitting masks (not made for therapeutic purposes) that are easily available, worldwide. The knowledge, availability and access of aerodynamically designed masks as mentioned by the authors is highly doubtful, especially in developing countries. Further, the authors seem to agree with our stand that masks are necessary unless the people are exercising alone or at home.

Sixth, in our opinion the results from Roberge RJ et al study that reported "2 out of 10 health care workers, going into hypercapnia with the use of masks [4]", does contribute to a significant risk (20%) in patients with chronic diseases during strenuous exercise. Prof Greenhalgh and colleagues quoted a study by Person et al., which showed a significant variation in dyspnea associated even with surgical masks [5]. We hypothesised ill-fitting tight facemasks may aggravate the underlying dyspnea in persons with chronic diseases while exercising. Further Person et al. 2017 demonstrated the efficacy of surgical mask on the six minute walk test, which is a submaximal test [5]. However, our hypothesis revolves around the anticipated physiological alterations with facemasks during maximal exercise (moderate to vigorous intensity: 60–80% VO₂Max)

We agree with the authors that our arguments regarding the risks of respiratory alkalosis, increased lactate levels and early fatigue, down-regulation of immune response, increased cardiac overload, compromised renal function and reduced cerebral perfusion are speculative. There remains a dearth in literature investigating facemask effects on strenuous exercises (not low intensity activities such as, household or office work, activities of daily living etc). We propose future studies that could concentrate on the molecular level changes induced by even slight hypercapnia in healthy adults with facemasks not asymptomatic

COVID 19 patients, as mentioned by the authors in their third query.

Seventh, we too agree with the authors that only newspaper articles and blogs are available to claim that masks can increase the spread of COVID-19 and thus warrants further investigations at the primary care level.

Lastly, the author's statement is in line with our hypothesis that during prolonged exercise, there may be increased hypercapnia and hypoxia. The available evidence is not strong enough to emphasize the physiological alterations even during low-moderate exercise. We again stress our point that our hypothesis focuses only on the speculated physiological changes associated with tight custom made masks during moderate to vigorous or prolonged exercise and not with basic household, occupational activities or public gathering.

We commend the authors for proposing a study that could objectively measure the effects of face masks on strenuous exercise. As exercise and physical activity professionals, we eagerly await these results, which could be further advised to the general healthy population.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to

influence the work reported in this paper.

References

- [1] Bahl P, Doolan C, de Silva C, Chughtai AA, Bourouiba L, MacIntyre CR. Airborne or Droplet Precautions for Health Workers Treating Coronavirus Disease 2019? *J Infect Dis* 2020.
- [2] Bakhit M, Krzyzaniak N, Scott AM, Clark J, Glasziou P, Del Mar C. Downsides of face masks and possible mitigation strategies: a systematic review and meta-analysis. *medRxiv*. 2020;2020(06). 16.20133207.
- [3] Greenhalgh T, Schmid MB, Czypionka T, Bassler D, Gruer L. Face masks for the public during the covid-19 crisis. *BMJ* 2020;369:m1435.
- [4] Roberge RJ, Coca A, Williams WJ, Powell JB, Palmiero AJ. Physiological impact of the N95 filtering facepiece respirator on healthcare workers. *Respir Care*. 2010;55(5):569–77.
- [5] Person E, Lemerrier C, Royer A, Reychler G. Effect of a surgical mask on six minute walking distance. *Rev Mal Respir*. 2018;35(3):264–8.

Baskaran Chandrasekaran*, Shifra Fernandes
Assistant Professor in Physical Activity, Behavioral Science and Health Promotion, Research & Alumni Coordinator, Department of Exercise and Sports Sciences, Manipal College of Health Professions, Manipal Academy of Higher Education, Manipal, India
E-mail addresses: baskaran.c@manipal.edu (B. Chandrasekaran), shifra.fernandes@manipal.edu (S. Fernandes).

* Corresponding author at: Department of Exercise and Sports Sciences, Manipal College of Health Professions, Manipal Academy of Higher Education, Manipal, Karnataka, India.