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Effect of Face Masks on Respiratory Parameters After Six Minute Walk Test in Apparently Healthy Individuals

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ABSTRACT

Objectives: To see the effect of wearing of face masks on the oxygen saturation (SpO2) and respiratory rate after six minute walk test in apparently healthy individuals.
Materials and Methods: Cross sectional study, Clearance from the ethical committee of KGMU is taken. The study has been done on 104 subjects (86 male and 18 female) aged between 20 to 50 yrs. 30 meter corridor common among departments of physiology and biochemistry (KGMU) were selected. Three layer face masks from company "Romsons" (Dispo Guard) were used in the study.
Discussion & Result: 6MWT is to evaluate CRF in clinical scenario. We are using it to determine the effect of face masks on oxygen saturation and respiratory rate after six minute walk test. we found significant change ($p<0.001$) in SpO2 and RR.in both conditions i.e. after walk without masks and walk with masks
Conclusion: A conclusion has been drawn that respiratory parameters changes significant which suggests that face masks use matters significantly but as the benefits from its use is to protect from infections and pollutions and many more so the use is to be continued.

***KEYWORDS*:** 6MWT, Face Mask, Healthy Individuals

INTRODUCTION

Throughout history, face masks have evolved as essential tools for controlling the spread of infections, from early cloth masks to the modern three-layer surgical masks. Significant figures in the development of mask technology include Joseph Lister, Louis Pasteur, and Ignaz Semmelweis, butlesser-known contributors like Carl Friedrich Flügge and Johannes von Mikulicz also played crucial roles. Flügge's research on droplet infections[1], particularly related to tuberculosis, and Mikulicz's development of the surgical mask were instrumental in advancing infection control practices. Mikulicz's practical insights into the comfort and functionality of early face masks[2], including a two-layered design, laid the groundwork for the modern three-layer face mask. Despite these innovations, widespread adoption in surgical and medical settings only became common in the early 20th century, as demonstrated by Moynihan's illustrations of multilayered masks in surgical teachings. The COVID-19[3] pandemic has reinforced the importance of face masks in reducing the spread of the virus. Face masks, including cloth masks[4], surgical masks, and N95[5] respirators, serve to block respiratory droplets and provide varying levels of filtration. Surgical masks, particularly three-layer variants, have become a common choice due to their balance of filtration efficiency and comfort. Three-layer masks[6] typically consist of an outer hydrophobic layer (often polypropylene), a middle filtration layer (usually melt-blown polypropylene), and an inner absorbent layer (commonly cotton). This construction enhances protection by repelling moisture, filtering out particles, and ensuring comfort. However, three-layer masks come with some disadvantages, including potential breathability issues, discomfort, increased cost, environmental impact, and variability in quality. To understand the impact of face masks on physical activity, particularly in healthy individuals, a study is utilizing the Six-Minute Walk Test (6MWT). The 6MWT[7] is a straightforward assessment that measures the distance a person can walk in six minutes on a flat surface. This test evaluates functional exercise capacity and endurance, providing insights into the effects of face masks on respiratory parameters during physical exertion. The study employs three-layer face masks from Romsons (Dispo Guard), which include an absorbent cotton inner layer, a melt-blown polypropylene middle layer, and a hydrophobic polyester outer layer. These masks, also known as Fluid-Resistant Surgical Masks (FRSM)[8], are designed to block large droplets but may not be highly effective against tiny aerosol particles. Key aspects of the study include proper mask usage, ensuring the participant's safety, and the environmental considerations of mask disposal. Used masks should be handled with care to prevent contamination and disposed of properly, particularly considering the environmental impact of disposable masks. Reusable cloth masks, when cleaned and disinfected properly, offer an alternative to reduce waste. The study aims to evaluate the risk-benefit ratio of wearing three-layer masks during physical activity[9] by measuring the distance covered in the 6MWT and assessing any impact on respiratory parameters. Healthy individuals[10] are selected for the study to ensure baseline normalcy and to isolate the effects of mask-wearing from underlying health conditions. The results will provide valuable insights into the practicality of wearing face masks during exercise and contribute to a broader understanding of their benefits and limitations.

MATERIALS AND METHODS

The presents study is being conducted in the king George's medical university. Department of Physiology, Lucknow. The study is being conducted with all the standard guidelines of the university. The approval for the study is being taken by the ethical committee[11] of the KGMU. The study was performed on healthy individuals of age 20-50 years. They have been selected from the near vicinity of university and attainders and relatives of patients visiting different OPD's of medical university. They were explained with the procedures and their consent is being taken. Only after their written consent has been taken, they were taken to the track where a 30 m hallway is being made and study is performed there.

INCLUSION CRITERIA

Apparently Healthy individuals who are in between age 20-50 years irrespective of age. Do not have any diagnosed illness (i.e. apparently healthy individuals)

EXCLUSION CRITERIA

Cardio-pulmonary illness, Anemia, Thyroid disorders, Diabetes, CAD, COPD, Asthma

Any other known medical condition.

Sample Size = Sample size is calculated on the basis of this formula.

The sample size n

$n = N \times X / (X+N-1)$,

Where,

$$X = \frac{Z_{a/2}{}^{2} \times p \times (1-p)}{MOE^2}$$

and Za/2 is the critical value of the normal distribution at a/2 (for a confidence level of 95%, a is 0.05 and critical value is 1.96), MOE is the margin of error which is 10%, p is the sample proportion which is taken to be 50% and N is the population size which is taken to be 100000.So sample size of 96 is being calculated. However, a total number of 104 subjects have been involved till the completion of study. In our study we are seeing its effect on respiratory parameters that which is more beneficial or harmful. So that use of the face masks can be judged in terms of benefits and harms.

STUDY PROCEDURE

Type of Study: Cross Sectional Study
Total Study Period = 1 Year
Total Number of Subjects = 104
All the essential instruments which were essential for study were collected at the site. A three layer face masks which belonged to the "Romsons" company A stop watch, B.P instrument (sphygmomanometer) of company diamond, measuring tape[12] of 30 m length, pulse oximeter[13] of company Beaurer. Every subject has been performed with the 6MWT. Before starting the procedure basic anthropometry has been taken and their SpO2 and R.R are being recorded. After the measurement Six minute walk test is conducted. By saying 'Go' subject is made to walk for six minute on the hallway. When the six minute walk is conducted the subject is being stopped by saying "STOP". Now after the subject the respiratory parameters have been measured. Again after a gap of 6 hours to 24 hours the same process is repeated but this time subject is covering the face with face masks. Again all the respiratory parameters have been recorded.

STATISTICAL ANALYSIS

Then the data has been saved in the excel sheet and results have been interpreted with the help of SPSS. A total of 104 subjects. Who are apparently healthy individuals aged between 20-50 years who has no sign and symptoms of any disease or any history of diseases have been involved in the study.
Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean and SD. With and without mask readings were compared using Paired t test. A p value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 23.

RESULT

This study included a total of 104 healthy individuals which were aged between 20-50 years. In the Table-1 the age distribution is as 20-30 years is 54 i.e 51.9% 31-40 years is 36 i.e 33.65% and 41-50 years is 15 i.e 14.42% this shows persons lesser in age are more enthusiastic in participation in such studies.

Table 1: Distribution of participants according to age

		N	%
Age (years)	20-30	54	51.90
	31-40	36	33.65
	41-50	15	14.42

In the Table-2 of these 104 individuals only 18 were female. Thus 83% male and 17% female participated in the study. This shows females are more reluctant in participation in such studies.

Table 2: Distribution of participants according to Gender

		n	%
Gender	Male	86	83
	Female	18	17

In the Table-3 mean height of subjects is 167.21 cm and mean weight is 65.49 kg.

Table 3: Details of height and weight of the participants

	Mean	Median	Std. Deviation	Minimum	Maximum
Height (cm)	167.21	168.00	6.73	150.00	186.00
Weight (kg)	65.49	65.00	10.12	43.00	93.00

In the Table-4 BMI of the subject are seen in which under weight is <18.5 kg/m^2 is 4.81%, healthy weight 18.5-22.9 kg/m^2 is 42.31%. The overweight is 23.0-24.9kg/m^2 is 26.92% and obese i.e. 25.0 and above is 25.96%

Table 4: Distribution of the participants according to Underweight, Healthy Weight, Overweight and Obesity

		BMI (kg/m2)	n	%
BMI	Underweight	Below 18.5	5	4.81
	Healthy Weight	18.5 –22.9	44	42.31
	Overweight	23.0 – 24.9	28	26.92
	Obesity	25.0 and above	27	25.96
	Mean ± SD		23.32±2.97	

In the Table-5 it is seen that mean SpO2 is 97.44% and all subjects before the 6MWT. The mean SpO2 after the 6MWT without masks is 96.11% and the mean SpO2 after the 6MWT with masks is 95.05%.

Table 5: Details of SpO2 of the participants

	Mean	Std. Deviation (±)	Minimum	Maximum
BASE LINE SpO2 in %	97.44	0.68	96.00	99.00
WITHOUTMASKS SpO2 in %	96.11	0.77	93.00	98.00
WITH MASKS SpO2 in %	95.05	0.86	93.00	97.00

Here we are applying paired-t test for significance now a value of p<0.001 is seen each pair i.e. pair 1 SpO2 baseline and SpO2 with masks, pair 2 SpO2 baseline and SpO2 without masks, pair 3 SpO2 with masks and SpO2 without masks.

Paired Samples Statistics							
		Mean	**N**	**Std. Deviation**	**% mean change**	**t value**	**p-value**
Pair 1	SPO2 base	97.4423	104	.68019	1.37%	24.0	**<0.001**
	SPO2 with mask	96.1058	104	.77483			
Pair 2	SPO2 base	97.4423	104	.68019	2.46%	29.04	**<0.001**
	SPO2 without mask	95.0481	104	.86327			
Pair 3	SPO2 with mask	96.1058	104	.77483	1.10%	13.51	**<0.001**
	SPO2 without mask	95.0481	104	.86327			

Applied paired t test for significance.

In Table-6 we see baseline respiratory rate 15.13, without masks respiratory rate 20.05 and with masks respiratory rate is 21.60.

Table 6: Details of respiratory rate of the participants

	Mean	Std. Deviation (±)	Minimum	Maximum
BASE LINE RESPIRATORY RATE	15.13	0.97	12.00	17.00
WITHOUTMASKS RESPIRATORY RATE	20.05	1.57	18.00	27.00
WITH MASKS RESPIRATORY RATE	21.60	1.42	18.00	28.00

Now applying paired-t test for significance is (p value < .001) in pair 1 i.e RR baseline and RR with masks, pair 2 RR baseline and RR without masks, Pair 3 RR with masks and RR without masks.

Paired Samples Statistics						**t value**	**p-value**
		Mean	**N**	**Std. Deviation**	**% mean change**		
Pair 1	RR baseline	15.1250	104	.97231	24.56%	-28.51	**<0.001**
	RR with mask	20.0481	104	1.56652			
Pair 2	RR baseline	15.1250	104	.97231	29.96%	-39.47	**<0.001**
	RR without mask	21.5962	104	1.42461			
Pair 3	RR with mask	20.0481	104	1.56652	7.17%	-12.59	**<0.001**
	RR without mask	21.5962	104	1.42461			

Applied paired t test for significance.
Table-7 shows the details of distance without masks and distance with masks of the participants. The mean distance without masks and distance with masks of the participant were 572.59±43.87 m and 554.24±42.51 m.

Table 7: Details of Distance without and with masks of the participants

	Mean	**Std. Deviation**	**Minimum**	**Maximum**
DISTANCE WITHOUT MASKS (m)	572.59	43.87	428.00	637.00
DISTANCE WITHOUT MASKS (m)	554.24	42.51	413.00	621.00

DISCUSSION

Face masks have long been a topic of discussion, primarily due to their dual role in both preventing infection and potentially causing discomfort. Over time, masks have evolved from simple cloth coverings to advanced models like N95 and FFP masks, each designed to enhance protection against respiratory infections. The primary function of face masks is to act as a physical barrier, preventing the transmission of respiratory droplets that may contain infectious agents. When a person talks, coughs, or sneezes, droplets are expelled into the air. Masks, particularly those with multiple layers, block these droplets, reducing the chances of spreading infections like COVID-19. In addition to protecting others, masks also offer some protection to the wearer by filtering out a portion of incoming droplets. While the effectiveness of masks can vary based on factors such as material and fit, even basic cloth masks provide a level of protection. This dual function of masks protecting both the wearer and those around them is especially important in crowded or indoor settings where maintaining physical distance is challenging. When used widely within a community, masks can significantly reduce the overall transmission of respiratory infections, even among asymptomatic individuals. Despite their benefits, masks are most effective when combined with other preventive measures such as hand hygiene[14], physical distancing[15], and vaccination[16]. These strategies work together to provide multiple layers of protection against infection. Thus, the use of face masks is a crucial component of public health strategies to mitigate the spread of diseases, including COVID-19. However, face masks also have their drawbacks. Wearing a mask for extended periods can be uncomfortable and may cause breathing difficulties, especially for those with pre-existing respiratory conditions. Masks can trap heat and moisture, which can be particularly uncomfortable in hot or humid environments. Prolonged use can also cause skin irritation, especially around the ears and nose where the mask makes contact with the skin. This irritation can exacerbate existing skin conditions like acne or eczema[17]. Masks can also hinder communication by muffling speech and obscuring facial expressions, making it difficult for people, particularly those with hearing impairments, to understand speech and interpret emotions. This can impede effective communication in various settings, such as workplaces, schools, and public spaces. Another concern is that wearing a mask might give individuals a false sense of security, leading them to neglect other preventive measures like hand hygiene or physical distancing. Overreliance on masks without adhering to comprehensive preventive strategies could increase the risk of transmission in certain situations. Additionally, wearing a mask can induce feelings of anxiety, claustrophobia[18], or social discomfort for some individuals. The visibility of masks in public spaces can serve as a constant reminder of the ongoing pandemic, contributing to heightened stress levels or feelings of unease. The widespread use of disposable masks has also raised environmental concerns due to increased plastic waste. Improper disposal of masks can lead to littering, pollution, and harm to wildlife, particularly marine life, when masks end up in water bodies. Furthermore, improper handling or reuse of masks can compromise their effectiveness and pose a risk of contamination. Despite these negative aspects, the benefits of wearing masks in preventing the spread of infectious diseases generally outweigh the drawbacks. Wearing a mask reduces the risk of transmitting infections to others, especially vulnerable populations such as the elderly or immune compromised individuals. By wearing masks, individuals contribute to a culture of collective responsibility for public health. Widespread mask usage normalizes other preventive behaviors such as hand hygiene and social distancing, which are crucial for controlling the spread of infectious diseases. In addition to preventing the spread of infections, masks can also provide protection against airborne allergens like pollen and dust, offering relief to individuals with allergies[19] or respiratory conditions like asthma[20]. Reusable masks[21] made from sustainable materials also contribute to reducing waste compared to single-use disposable masks. The Six-Minute Walk Test (6MWT) is a commonly used test to assess functional exercise capacity, particularly in individuals with cardiopulmonary diseases. It measures the distance a person can walk on a flat, hard surface in six minutes, providing insight into their exercise tolerance and endurance. While the 6MWT is often used in clinical settings to evaluate patients with various health conditions, its application to healthy individuals is less common. The 6MWT procedure involves explaining the test to the participant, ensuring they are wearing comfortable clothing and footwear, and recording baseline vital signs such as heart rate, blood pressure, respiratory rate, and oxygen saturation. The test is conducted on a straight, flat, and unobstructed course, usually 30 meters in length. Participants are encouraged to walk as far as possible in six minutes at their own pace, and the distance covered is recorded at the end of the test. Vital signs and symptoms are monitored throughout the test, and the results are used to assess the participant's exercise tolerance and functional capacity. To investigate the impact of wearing a face mask on the 6MWT in healthy individuals, a study was conducted using three-layer face masks from Romsons (Dispo Guard).The study received ethical approval, and a sample size of 104 healthy individuals aged 20-50 years was selected. These individuals had no history of disease and no current symptoms. Written consent was obtained from all participants. The study aimed to assess the risk-benefit ratio of wearing face masks during the 6MWT. It was observed that wearing a mask might lead to increased respiratory impedance, potentially affecting breathing patterns and oxygen uptake during exercise. This could impact performance on the 6MWT, particularly in individuals unaccustomed to wearing masks during physical activity. Masks could also cause discomfort or distraction, influencing the participant's willingness to exert maximal effort during the test. The build-up of heat and moisture around the face while wearing a mask might contribute to feelings of breathlessness or fatigue during exercise, especially in warm or humid environments. Despite these potential challenges, the study found no significant difference in the distance walked with or without a mask. However, there was an increase in reported dyspnea[22], or shortness of breath, when participants wore a mask. This suggests that wearing a mask might independently contribute to dyspnea, regardless of underlying health conditions. The Borg Dyspnea Scale (BDS)[23], used to assess the severity of breathlessness, indicated higher scores when participants wore masks, aligning with findings from other studies. For example, research by Samannan et al. also found no significant differences in vital signs and gas exchange parameters in healthy individuals wearing masks, although they did not increase reported dyspnea. A French study on healthy volunteers reported similar results, with negligible differences in distance walked but a significant increase in dyspnea when masks were worn. The study's findings highlight the potential impact of masks on the subjective experience of dyspnea during exercise, even if objective measurements like distance walked remain unchanged. Given the importance of the 6MWT in determining patients' prognosis and management, understanding how mask-wearing affects the test is crucial, especially during public health crises like the COVID-19 pandemic. The study had some limitations, including a small sample size and a focus on healthy individuals. Future research should explore the effects of masks on 6MWT performance in larger populations, including those with cardiopulmonary conditions, to better understand the implications for patient care. Additionally, standardizing mask types in future studies could help limit variability and provide more consistent results.

CONCLUSION

The study indicated that impact of wearing a face mask (FM) on the performance of the 6-minute walk test (6MWT) in healthy individuals. We found negligible difference in the distance walked with or without a mask. It's important to note that the small number of participants in our study may have limited power to detect changes in 6MWT performances. Our results are consistent with other studies evaluating the effects of face masks on both healthy individuals and those with other diseases. These studies found significant differences in objective measurements such as vital signs and oxygen saturation, but did observe increased reported dyspnoea in one subject when wearing a face mask but the subject BMI was on higher side. While our study provides valuable insights into the potential impact of face masks on 6MWT performance. Thus, we can conclude that although wearing of face masks may be troublesome to some extent but we see there are more benefits than harm. We found that the use of face masks is of lot benefits in protecting us from infections of dreaded diseases however more future studies with larger samples and better setups are required to access the effects of face masks on human life.

Declaration by Authors

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REFERENCES

1. Shiu EYC, Leung NHL, Cowling BJ (2019) Controversy Around Airborne versus Droplet Transmission of Respiratory Viruses: Implication for Infection Prevention. CurrOpin InfectDis32(4): 372379.https://doi.org/10.1097/qco.0000000000 00056 3
2. Matuschek, C., Moll, F., Fangerau, H. *et al.* Face masks: benefits and risks during the COVID-19 crisis. *Eur J Med Res* 25, 32

(2020). https://doi.org/10.1186/s40001-020-00430-5
3. Haleem A, Javaid M, Vaishya R. Effects of COVID-19 pandemic in daily life. Curr Med Res Pract 2020;10(2):78–9.doi: 10.1016/j.cmrp.2020.03.011.
4. CDC (2020) Recommendation regarding the use of cloth face coverings, especially in areas of significant community-based transmission.
5. Kyung SY, Kim Y, Hwang H, Park JW, Jeong SH (2020) Risks of N95 face mask use in subjects with COPD. Respir Care 65(5):658–664. https ://doi.org/10.4187/respc are.06713
6. Kalaiselvan P, Tummanapalli SS, Kumar Vijay A, Bahl P, MacIntyre CR, Willcox MDP. The ability of face masks to reduce transmission of microbes. Clin Exp Optom. 2022 Mar;105(2):214-221. doi: 10.1080/08164622.2021.1971050. Epub 2021 Sep 30. PMID: 34592124.
7. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med. 2002 Jul 1;166(1):111-7. doi: 10.1164/ajrccm.166.1.at1102. Erratum in: Am J Respir Crit Care Med. 2016 May 15;193(10):1185. doi: 10.1164/rccm.19310erratum. PMID: 12091180.
8. Teo JY, Kng J, Periaswamy B, Liu S, Lim PC, Lee CE, Tan BH, Loh XJ, Ni X, Tiang D, Yi G, Ong YY, Ling ML, Wan WY, Wong HM, How M, Xin X, Zhang Y, Yang YY. Exploring Reusability of Disposable Face Masks: Effects of Disinfection Methods on Filtration Efficiency, Breathability, and Fluid Resistance. Glob Chall. 2021 Jul 28;5(11):2100030. doi: 10.1002/gch2.202100030. PMID: 34754506; PMCID: PMC8562064.
9. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U; Lancet Physical Activity Series Working Group. Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet. 2012 Jul 21;380(9838):247-57. doi: 10.1016/S0140-6736(12)60646-1. PMID: 22818937.
10. Cacau LA, de Santana-Filho VJ, Maynard LG, Gomes M Neto, Fernandes M, Carvalho VO. Reference Values for the Six-Minute Walk Test in Healthy Children and Adolescents: a Systematic Review. Braz J Cardiovasc Surg. 2016 Sep-Oct;31(5):381-388. doi: 10.5935/1678-9741.20160081. PMID: 27982347; PMCID: PMC5144571.
11. Wege-Rost T. Medizinisch-ethische Entscheidungsfindung – Beitrag des Klinischen Ethik-Komitees durch Ethikberatung und Erstellung ethischer Leitlinien [Medical-ethical decision-making-contribution of the clinical ethics committee by ethics consultation and development of ethical guidelines]. Med Klin Intensivmed Notfmed. 2023 Apr;118(3):175-179. German. doi: 10.1007/s00063-022-00974-w. Epub 2022 Dec 7. PMID: 36477383.
12. Reneker JC, Latham L, McGlawn R, Reneker MR. Effectiveness of kinesiology tape on sports performance abilities in athletes: A systematic review. Phys Ther Sport. 2018 May; 31:83-98. doi: 10.1016/j.ptsp.2017.10.001. Epub 2017 Oct 9. PMID: 29248350.
13. Ayonrinde O. COVID-19 and the pulse oximeter's beep. CMAJ. 2024 Feb 11;196(5):E159-E160. doi: 10.1503/cmaj.230221. PMID: 38346783; PMCID: PMC10861268.
14. Lotfinejad N, Peters A, Tartari E, Fankhauser-Rodriguez C, Pires D, Pittet D. Hand hygiene in health care: 20 years of ongoing advances and perspectives. Lancet Infect Dis. 2021 Aug;21(8):e209-e221. doi: 10.1016/S1473-3099(21)00383-2. Erratum in: Lancet Infect Dis. 2021 Oct;21(10):e302. doi: 10.1016/S1473-3099(21)00476-X. PMID: 34331890.
15. Tracy Epton, Daniela Ghio, Lisa M Ballard, Sarah F Allen et.al. Interventions to promote physical distancing behaviour during infectious disease pandemics or epidemics: A systematic review 2022 Jun: 303:114946. doi: 10.1016/j.socscimed.2022.114946. Epub 2022 Mar 26.
16. Brüssow H, Zuber S. Can a combination of vaccination and face mask wearing contain the COVID-19 pandemic? Microb Biotechnol. 2022 Mar;15(3):721-737. doi: 10.1111/1751-7915.13997. Epub 2021 Dec 28. PMID: 34962710; PMCID: PMC8913850.
17. Chan CX, Zug KA. Diagnosis and Management of Dermatitis, Including Atopic, Contact, and Hand Eczemas. Med Clin North Am. 2021 Jul;105(4):611-626.

doi: 10.1016/j.mcna.2021.04.003. PMID: 34059241.

18. Ost LG. The claustrophobia scale: a psychometric evaluation. Behav Res Ther. 2007 May;45(5):1053-64. doi: 10.1016/j.brat.2004.10.004. Epub 2007 Feb 15. PMID: 17303070.
19. Bergmann KC, Kugler S, Zuberbier T, Becker S. Face masks suitable for preventing COVID-19 and pollen allergy. A study in the exposure chamber. Allergo J Int. 2021;30(5):176-182. doi: 10.1007/s40629-021-00180-8. Epub 2021 Jul 14. PMID: 34277327; PMCID: PMC8278371.
20. Kendrick KR, Baxi SC, Smith RM. J Emerg Nurs. Usefulness of the modified 0-10 Borg scale in assessing the degree of dyspnea in patients with COPD and asthma. 2000 Jun;26(3):216-22. doi: 10.1016/s0099-1767(00)90093-x. PMID: 10839848
21. Neil J. Rowan, Rafael A. Moral. Disposable face masks and reusable face coverings as non-pharmaceutical interventions (NPIs) to prevent transmission of SARS-CoV-2 variants that cause coronavirus disease (COVID-19): Role of new sustainable NPI design innovations and predictive mathematical modelling. Science of The Total Environment, Volume 772, 2021, 145530, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2021.145530.
22. Khair RM, Nwaneri C, Damico RL, et al. The minimal important difference in borg dyspnea score in pulmonary arterial hypertension. Ann Am Thorac Soc 2016; 13: 842–849.
23. de Freitas APVM, Belo LF, Martinez L, Hernandes NA, Pitta F. Use of the Borg dyspnea scale to identify dynamic hyperinflation during the 6-minute walking test in individuals with moderate-severe COPD: A pilot study. Pulmonology. 2023 Jul-Aug;29(4):335-337. doi: 10.1016/j.pulmoe.2023.02.003. Epub 2023 Mar 10. PMID: 36907815.

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