



Comparison of Six Minutes Walk Distances of Cloth, Surgical, and KN95 Mask in Healthy Young Adults

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Abstract. Wearing a face mask is recommended to prevent contracting or being exposed to COVID-19, including when exercising. Exercise itself is effective for preventing obesity, diabetes, and hypertension, all of which are major risk factors for complications if a person contracts COVID-19. However, there is controversy that the use of a face mask during exercise can affect exercise capacity. The six-minute walk test is a test with a simple method to assess the status of a person's cardiorespiratory function. Independent studies have shown that the six-minute walk test is predictive of morbidity and mortality, and an equation linking the six-minute walk test to maximal oxygen consumption (VO_{2max}) was recently developed for patients with cardiopulmonary impairment. The purpose of this study was to determine the difference between Cloth, Surgical and KN95 Masks on The Six Minute Walk Distance (6MWD) in Healthy Young Adults. This study used an experimental method with consecutive sampling technique. The data analysis technique used a Annona test to assess the effect of wearing a mask on 6MWD in healthy young adults. There are no difference in 6MWD, heart rate, or oxygen saturation between group of masks and without ($p \leq 0.001$). Masks does not reduce exercise capacity in young adults.

Keywords: 6MWD · Exercise capacity · Face Masks

1 Introduction

The six-minute walk (6MWT) test is a common and reproducible test of exercise capacity used in the initial assessment and monitoring of many cardiopulmonary conditions [1]. 6MWT has prognostic value as part of the initial patient assessment, and changes in 6MWT over time are also of prognostic importance. The SARS-CoV-2 pandemic has changed the way we perform cardiopulmonary testing in clinics and hospitals [2].

Since the beginning of the pandemic, the Ministry of Health of the Republic of Indonesia has recommended that masks be worn in public places [3]. The importance of wearing a face mask is increasing in those with underlying lung disease, especially in healthcare settings. As 6MWT is carried out routinely in health facilities, the impact of wearing a face mask at a 6-min walking distance (6MWD) should be better understood [4].

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The ATS 2002 or ERS/ATS 2014 statements on 6MWT do not provide guidance on how to perform or adapt walks performed with a face covering. As a first step to understanding this, we evaluated the impact of face masks on 6MWT performance in healthy volunteers, as well as the differences between various face masks available in the community [5].

2 Method

This study uses a cross-sectional design that aims to assess the comparison between the distance of the Six-Minute Walk Test without a mask with a cloth mask, surgical mask and KN95 mask. The research sample was part of the subject from the population who met the acceptance criteria, namely sedentary subjects of young adult age, able to follow instructions and willing to participate in the study. While the criteria for rejection are having balance disorders, history of heart, lung disease, uncontrolled metabolism, using walking aids, having differences in leg length and obesity gr II [6]. We sampled 23 healthy young adult subjects, and the study was carried out by following safety protocols in the form of physical distancing and antiseptics. The research sample in writing stated that they were willing to participate in the research [7] (Figs. 1 and 2).

Subjects were assessed for the distance on a six-minute walk test without a mask, cloth mask, surgical mask and then a KN95 mask, with each test for each sample of were spaced 2 weeks to avoid bias. The data analysis technique used the one-way ANOVA test to compare the effects of using various masks on exercise capacity as assessed by the six-minute walking test distance.



Fig. 1. Young adults doing Six Minute Walk Distance (6MWD) in light clothing, wearing sports shoes and masks.



Fig. 2. Young adults doing the Six Minute Walk Distance (6MWD) with thick clothing, using sandals and masks.

3 Results and Discussion

In this study, the average distance traveled without a mask was 574.57m (470-720m), the average distance traveled using a cloth mask was 609.96m (520-890m), the average distance traveled using a surgical mask was 602.35m (508-790m), and the average distance traveled using a KN95 mask is 600.43m (495-900m). It can be seen in Table 1 that the largest average distance is the 6MWT using of a cloth mask (609.96m) and the shortest was without a mask (574.57m).

Descriptives

Based on the results of the ANOVA test above a significance result of 0.539 ($p > 0,05$) was obtained, which means that there were no significant difference between the four distance averages.

From Table 2, we can see that all multiple comparisons have a significance of $p > 0.05$. So, it can be concluded that in each comparison there is no significant difference either without or with any of the three masks.

This study investigated the comparison of 6MWT mileage in healthy young adults without a mask, with cloth masks, surgical masks and KN95 masks. The results show

Table 1. 95% Confidence Interval For Mean

	N	Mean	Std. Deviation	Minimum	Maximum
No Mask	23	574.57	68.997	470	720
Cloth Mask	23	609.96	89.981	520	890
Surgical Mask	23	602.35	79.558	508	790
KN95 Mask	23	600.43	104.187	495	900
Total	92	596.83	86.271	470	900

Table 2. Anova

	Sum of squares	Mean Squares	F	Sg.
Between Groups	16363.739	5454.580	.726	.539
Within Groups	660913.478	7510.380		
Total	67277.217			

that there is no significant difference between 6MWT mileage without a mask or using a mask. The results of this study are in line with the results of similar studies comparing 6MWT distance and cardiorespiratory functional capacity between subjects with and without a mask studied by Swiatek et al. and Radtke et al. (in healthy subjects), and Just et al. (in patients with advanced lung disease).

Our study results are also similar to those of Roberge et al., Shaw et al. and Epstein et al. They evaluated the effects of not wearing masks compared to wearing an N95 mask among health care workers. The participants in Roberge’s study performed two testing conditions that were equivalent to realistic clinical work rates. Roberge also found no significant difference in HR, RR, or SpO2 while wearing a mask. Other studies evaluated the effects of wearing a mask when performing maximal exercise. They found no significant difference in HR, RR, BP, RPE, SpO2, and time to exhaustion between mask conditions. Shaw et al. and Epstein et al. studies were performed on young healthy adults.^{15–17}

Fikenzer et al. performed one of the first studies to evaluate the effects of wearing a mask on pulmonary function measurements and maximal exercise capacity. In contrast to the current study results, the N95 group had a 13% reduction in VO2max and a 23% reduction in maximal ventilation compared to the non-masked group. The changes are consistent with the results of Lee and Wang, who demonstrated increased airway resistance and work of breathing from mask usage. When comparing the N95 to the non-mask condition, Fikenzer et al. found a non-significant increase in cardiac workload, suggesting the myocardium compensates for the decreased pulmonary measurements.^{18,19}

4 Conclusion

From the results of this study, it can be concluded that there was no significant difference in the distance of the six-minute walking test between the groups of subjects who did not use masks and subjects with cloth, surgical or KN95 masks. Further studies with larger samples with repeated tests are needed to ensure a comparison of the 6-min walk test without a mask with subjects with a cloth, surgical or KN95 mask. A larger test can also determine the reliability and validity of the difference in the value of both VO2max and the distance traveled between the 6-min walk test without a mask and subjects with cloth, surgical or KN95 masks.

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