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THE EFFECT OF WEARING A MASK ON OXYGEN SATURATION AND PULSE RATE DURING CLIMBING STAIR IN PUBLIC AREAS

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ABSTRACT
The wearing of masks is one of the mitigation strategies in preventing transmission and is the main protective tool in the Covid-19 pandemic. The wearing of masks for a long duration and long period of time influences the respiratory, vision, and communication systems. Purpose: The purpose of this study was to determine the effect of wearing a mask on climbing stairs on physiological responses measured through oxygen saturation and pulse rate. Method: Experimental research with crossover design. The research was conducted at the Bali International University in June – August 2022. The research subjects in this study were employees and lecturers for 40 people. Results: Based on the results of the analysis with the t-independent test, there was a significant difference in oxygen saturation and pulse rate between the two groups. The same result was also obtained in period II, there was a difference in oxygen saturation and pulse rate between the two groups meaningfully, with a range of values that were not much different from the results in the activity of climbing the ladder of period I. Overall, there was a significant difference in oxygen saturation and pulse rate between wearing a mask and not wearing a mask. Conclusion: Based on the results of this study, it has a high impact on physiological response, so the elderly is not recommended to use masks when climbing stairs that exceed 2 floors.

Keywords: oxygen saturation; pulse rate; wearing a mask climbing stair

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INTRODUCTION

The 2019 novel coronavirus has been identified as an infectious disease that first appeared in December 2019 in China(Yasri, 2020). The World Health Organization (WHO) calls this virus the novel coronavirus 2019 (2019-nCoV) (E. Wang, 2020). In February 2020, WHO announced the new name of the disease as Coronavirus Disease (COVID-19) caused by *Severe Acute Respiratory Syndrome Coronavirus-2* (SARS-CoV-2) (World Health Organization (WHO), 2020). The COVID-19 pandemic is a serious problem and challenge to world health. Until now, several countries have carried out COVID-19 vaccinations to their citizens and are still ongoing, but the scope is still very small, while COVID-19 cases are still occurring. Therefore, social distancing, wearing masks, and maintaining distance are effective ways to prevent the transmission of COVID-19 (Chu et al., 2020).

Wearing masks is one of the mitigation strategies in preventing transmission (Esposito et al., 2020). Wearing masks is the main protective tool in the Covid-19 pandemic (Chu et al.,

2020). Evidence suggests that wearing a mask can effectively prevent contraction and transmission of COVID-19 (Chu et al., 2020; Leung et al., n.d.; Y. Wang et al., 2020). WHO recommends and recommends wearing masks when carrying out activities outside the home, and governments in several countries have also announced policies for the use of face protection in open spaces (WHO, 2020). One type of mask recommended to prevent the transmission of COVID-19 is the N95 type mask. The code "N95" indicates that the mask can block at least 95% of the approximately 300 nm particle (M. Zhang et al., 2020).

In addition to the N95 mask type, there are many other types of masks that are used as face protection equipment. Masks during this pandemic are a necessity as protective equipment from the transmission of COVID-19. However, there are problems in wearing masks, especially in a fairly long duration and for a long period of time, such as shortness of breath, limited vision, heavy head and communication difficulties (Rebmann et al., 2013). The wearing of masks also affects the circulation of oxygen in the blood. In addition, wearing a mask can also spur heart rate in certain activities.

In addition to wearing a mask, the level of activity can also affect the oxygen saturation in the blood, one of which is the activity up and down the stairs. Moreover, in Bali the construction of buildings in public areas such as government buildings, markets, and schools has been designed to be multi-storey using stairs and elevators. Most high-rise buildings in Bali only use stairs for up and down activities. Universitas Bali Internasional is one of the educational institutions that has a high-rise building, where up and down activities are carried out through stairs. As an educational institution, the academic community must set an example in health protocols. Lecturers and employees at the University of Bali Internasional are required to wear masks while on campus, as well as students and other guests are required to strictly implement health protocols. This can increase the workload of employees in their activities because they go up and down stairs several times a day.

Gaikwad et al (2021) in their research on students who wear masks, it was found that there was a significant decrease in oxygen saturation by 0.96% (Gaikwad et al., 2021). A decrease in oxygen saturation spurs stimulation in the respiration and cardiovascular systems thus improving blood circulation characterized by an increased pulse rate and in the respiration, system increasing the frequency of breathing. In the process of breathing, gas exchange occurs when oxygen is inhaled and absorbed into the body and CO_2 is exhaled. The purpose of this study was to determine the effect of wearing masks on climbing stairs on oxygen saturation and pulse rate of lecturers and employees of the International University of Bali. The novelty of this research is to contribute to the science of the respiratory system and workload during activities with restrictions, especially the wearing of masks. The results of this study are expected to provide information about the effects of wearing masks on daily activities to the public. This research has an important role in providing information to the public in behaving healthily in accordance with the vision and mission of the institution which focuses on the study of the health sector.

METHOD

This research is experimental research carried out in the community (community trial) using a Cross-over design (Tunas, 2022). The research was conducted at the International University of Bali Campus for 3 months in June – August 2022. The research subjects in this study were employees and lecturers aged 27 years to 45 years with male and female. The number of samples in this study was 40 people, which was divided into 2 (two) groups in period I, namely the group of cursing masks as many as 20 people and the group not wearing masks as

many as 20 people. In period II, both groups changed attributes, which originally (in period I) wore masks, in period II became groups not wearing masks, and vice versa. The research subjects were selected using the Simple Random Sampling technique, which was selected from 74 lecturers and 40 employees at the International University of Bali.

The data were analyzed with the SPSS v. 22.0 with the following steps: 1) descriptive analysis using mean values and standard deviations against variables of age, weight, height, body mass index, oxygen saturation, and pulse rate. Proportion amounts and values for sex data; 2) t-independent test to determine the difference in average saturation and pulse rate between groups in each period; 3) t-paired test to determine the difference in mean values between not wearing a mask and wearing a mask; 4) the level of trust in this study was 95% ($\alpha = 0.05$).

RESULTS

In this research, using *a crossover* design, the technical implementation is divided into two periods, namely period I and period II. Between period I and period II are given washing *out* for 1 (one) week. In period I, the subjects of the study as many as 40 people were divided into 2 (two) intervention groups, namely the treatment group, the mask wearing group and the control group, the non-mask group on the stairs climbing activities. In period II, the subjects of the study exchanged interventions. The building at the research site has 4 floors, between floors connected by stairs, a two-level ladder model. Level 1 and level 2 rotate 180^o (rotation area 1.5 x 2.5 m 2).

Each level consists of 10 steps with a height of 25 cm and a width of 30 cm and a slope of 60^o stairs. In undergoing intervention in both period I and period II, both groups climbed the stairs from the 1st to the 4th floor. On the 1st floor, before going up the stairs, all the study subjects filled out a questionnaire on the characteristics of the study subjects and subsequently carried out measurements of oxygen saturation and pulse rate (pretest). Arriving at the 2nd floor, the 3rd floor and the 4th floor also carried out measurements of oxygen saturation and pulse rate (posttests 1, 2, and 3).

Characteristics of Respondents

In this research, 40 employees and lecturers at the International University of Bali were involved, consisting of 26 (65%) men and 14 (35%) women. The age of the study subjects was between 27-45 years, with an average age of 32.2±33.65 years. The average body weight of the study subjects was 66.13±12.68 kg. The average height is 1.67±0.07 m. The average body mass index (BMI) is 23.55±3.87 kg/m2. Comparison of respondents' characteristics in period I between the mask-wearing group and the mask-wearing group was analyzed by a t-independent test and presented in Table 1.

Table 1.
Comparison of Respondents' Characteristics in Period I between Wearing Masks and Non-Mask-Wearing Groups

Variable	Wearing a Mask (n=20)	Not Wearing a Mask (n = 20)	P*
Age (year)	32.50±4.30	31.95±2.95	0.640
Weight (kg)	65.75±14.25	66.50±11.26	0.854
Height (m)	1.66±0.07	1.69±0.08	0.264
BMI (kg/m^2)	23.73±4.22	23.38±3.57	0.776

Based on Table 1, there were no differences in respondents' characteristics including age, weight, height, and BMI between the group that wore masks and the group that did not wear masks in period I ($p>0.05$).

Period Effects

Period effects are calculated based on the value of the difference between the measurements in period I and period II and are analyzed using a t-independent test. The results of the analysis are presented in Table 2.

Table 2.
Analysis of the Effect of Oxygen Saturation and Pulse Rate Period between Sequence Wearing a Mask-Not Wearing a Mask and Sequence Not Wearing a Mask-Wearing a Mask

Floor	Variable	Order of Activity of Period I and II		P*
		Wearing a Mask - Not Wearing a Mask (n=20)	Not Wearing a Mask - Wearing a Mask (n = 20)	
1	Oxygen Saturation	0.90±0.72	0.55±0.69	0.123
	Pulse	1.55±4.84	0.00±0.00	0.160
2	Oxygen Saturation	1.75±1.83	1.95±2.28	0.762
	Pulse	12.55±17.83	12.40±8.93	0.973
3	Oxygen Saturation	1.45±1.19	1.35±1.23	0.795
	Pulse	14.10±11.68	16.40±10.04	0.508
4	Oxygen Saturation	1.40±1.05	1.55±0.69	0.595
	Pulse	10.75±9.91	16.65±10.41	0.074

Table 2, it is shown that there is no difference in the average difference in oxygen saturation period I and period II between squence wearing a mask-not wearing a mask and squence not wearing a mask-wearing mask on all four floors ($p>0.05$). This suggests that there was no period effect on this research.

Residual Effects

The residual effect was calculated based on the average value of the number of measurement results in period I with period II and analyzed using a t-independent test. The results of the analysis are presented in Table 3.

Table 3.
Analysis of the Effect of Residual Oxygen Saturation and Pulse Rate between Sequence Wearing a Mask-Not wearing a Mask and Sequence Not Wearing a Mask-Wearing a Mask

Floor	Variable	Order of Activity of Period I and II		P*
		Wearing a Mask - Not Wearing a Mask (n=20)	Not Wearing a Mask - Wearing a Mask (n = 20)	
1	Oxygen Saturation	98.15±0.40	98.28±0.41	0.337
	Pulse	85.23±11.74	84.15±7.53	0.720
2	Oxygen Saturation	97.33±1.10	97.23±1.41	0.804
	Pulse	92,735±9.70	89.95±6.07	0.285
3	Oxygen Saturation	97.33±0.83	97.18±0.71	0.544
	Pulse	103.35±7.51	103.30±6.18	0.982
4	Oxygen Saturation	96.60±0.68	96.48±0.,68	0.564
	Pulse	111.08±6.80	111.98±3.59	0.604

Table 3, it is shown that there is no difference in the average amount of oxygen saturation period I and period II between sequence wearing a mask-not wearing a mask and sequence not wearing a mask-wearing mask on all four floors ($p>0.05$). This suggests that there was no residual effect on the research.

Analysis of Mask Wearing in Each Period

The effect of mask wearing on oxygen saturation and pulse rate in period I and period II was analyzed using a t-independent test and presented in Table 4 and Table 5.

Table 4.
Differences in Oxygen Saturation and Pulse Rate between Wearing Masks and Non-Mask Wearing Groups in Period I

Period	Floor	Variable	Wearing a Mask (n=20)	Not Wearing a Mask (n = 20)	P*
I	1	Oxygen Saturation	98.05±0.76	98.15±0.49	0.623
		Pulse	86.05±11.66	84.15±7.53	0.544
	2	Oxygen Saturation	96.75±2.12	98.05±0.69	0.013
		Pulse	98.5±16.33	84.40±7.09	0.001
	3	Oxygen Saturation	97.05±1.64	97.70±0.47	0.096
		Pulse	110.05±11.74	96.40±8.,40	0.001
	4	Oxygen Saturation	95.95±1.15	97.25±0.,72	0.001
		Pulse	116.45±9.71	103.85±7.35	0.001

Table 5.
Differences in Oxygen Saturation and Pulse Rate between Who Wear Masks and Groups Who Do Not Wear Masks in Period II

Period	Floor	Variable	Wearing a Mask (n=20)	Not Wearing a Mask (n = 20)	P*
II	1	Oxygen Saturation	98.40±0.68	98.25±0.64	0.477
		Pulse	84.15±7.53	84.50±12.31	0.914
	2	Oxygen Saturation	96.40±2.58	97.90±0.72	0.017
		Pulse	95.50±8.91	86.95±9.65	0.006
	3	Oxygen Saturation	96.65±1.39	97.60±0.60	0.008
		Pulse	110.20±9.87	96.65±7.46	0.001
	4	Oxygen Saturation	95.70±0.80	97.25±0.55	0.001
		Pulse	120.10±5.78	105.70±6.88	0.001

Table 4 and Table 5, it was shown that there was no difference in the average oxygen saturation and pulse rate on the 1st floor (pretest) between the group wearing masks and the group not wearing masks ($p>0.05$). While on the 2nd floor, 3rd floor, and 4th floor (posttest) there are differences in average saturation and pulse between the group wearing masks and the group not wearing masks meaningfully ($p<0.05$). This shows that in both period I and period II there is a difference in oxygen saturation and pulse rate after climbing stairs.

The Effect of Mask Wearing on Stairs Climbing Activities in Public Areas

The effect of mask wearing on the overall climbing of stairs is a combination of the measurement results in period I with period II. In this section, the effects of wearing masks were analyzed based on individual differences in oxygen saturation and pulse rate between wearing a mask and not wearing a mask and analyzed with a t-paired test. The use of t-paired tests indicates that there is an individual analysis (control by subject). The results of the analysis are presented in Table 6.

Table 6 shows that overall, there is a difference in oxygen saturation and pulse rate between when wearing a mask and when not wearing a mask at stairs (floors 2-4) meaningfully ($p<0.05$). Furthermore, it was found that when wearing a mask, the average value of oxygen saturation was lower than when not wearing a mask after doing activities up the stairs (floors 2-4).

Tabel 6.
Perbedaan Saturasi Oksigen dan Denyut Nadi antara Memakai Masker dan Tidak Memakai Masker

Variable	Floor	Wearing a Mask (n=40)	Not Wearing a Mask (n = 40)	P*
Oxygen Saturation	1	98.23±0.73	98.20±0.56	0.878
	2	96.58±2.34	97.98±0.70	0.001
	3	96.85±1.51	97.65±0.53	0.004
	4	95.83±0.98	97.25±0.63	0.001
Pulse	1	85.10±9.73	84.33±10.07	0.165
	2	97.00±13.07	85.68±8.45	0.001
	3	110.12±10.71	96.53±7.84	0.001
	4	118.28±8.10	104.78±7.07	0.001

Meanwhile, the average pulse rate when wearing a mask is higher than when not wearing a mask after doing activities up the stairs (floors 2-4).

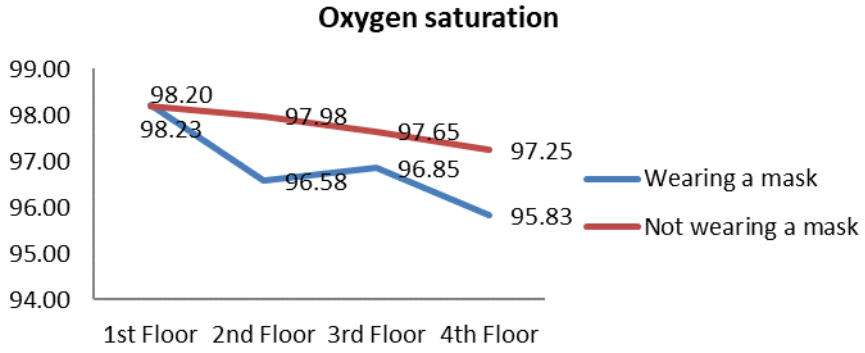

Figure 2. Comparison of decreased oxygen saturation in climbing stairs between wearing a mask and not wearing a mask

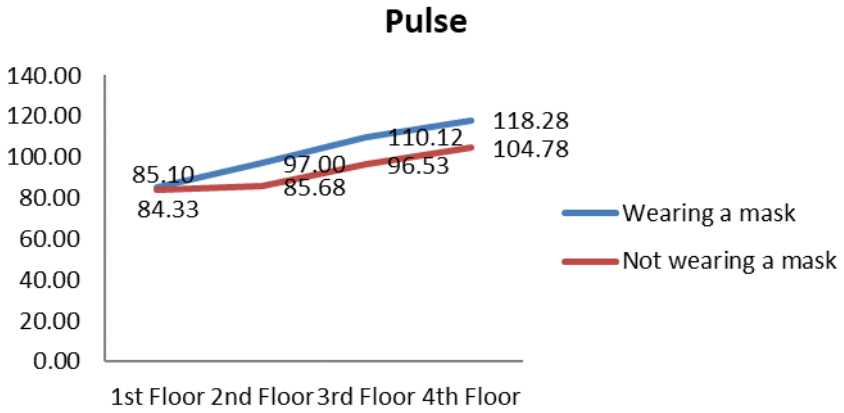

Figure 3. Comparison of pulse rate increase in climbing stairs between wearing a mask and not wearing a mask

DISCUSSION

Physical Activity up the Ladder and Role of Research Subject Characteristics

To support physical fitness and health, sufficient physical activity is needed. One of the physical activities that can be done is to go up the stairs. Regular physical activity helps improve overall health and wellness, as well as reduce the risk for various chronic diseases. Some studies have shown that physical activity has a positive impact on health (Guthold, 2018; Södergren, 2008). Physical activity can prevent diseases associated with cardiovascular

(Bassuk, 2005), and may reduce mortality (Sundquist K et al., 2004). Further Schmidt (Schmidt, 2017) states that there is a positive relationship between physical activity, fitness, and health.

However, as a person ages, the frequency and duration of physical activity also decreases. The normal aging process is characterized by a decrease in muscle and bone mass and an increase in adipose (Amarya et al., 2018; Basu R et al., 2001), which can also have an impact on decreasing physical activity. Decreased muscle mass and muscle strength are at risk of fractures, weakness, and decreased quality of life and increased dependence on others (Faulkner, 2007). This can also be a cause of fear of doing activities that should be needed to maintain health. Changes in the musculoskeletal system result from the aging process which results in a decrease in physical activity.

The ability to function good physiology is still maintained until the age of 35 years and after that the physiological function begins to decline (McPhee, 2016). The required physical exercise is adapted to the condition of the body. In excellent or excellent health conditions, the purpose of physical activity is to maintain physical and mental health. However, when there begins to be a decrease in the body's ability, a physical activity is needed that can restore health conditions. Meanwhile, in conditions of disability or experiencing weakness in body functions, physical activity is carried out with the aim of increasing mobility. The intensity of physical activity carried out continuously over a long period of time related to the aging process also affects aerobic capacity.

In this research, the age of the research subjects was in the prime age range, so they were able to carry out climbing activities properly. In addition, weight and BMI which can also affect the physiological response when doing climbing stairs activities are also under normal conditions. This means that the research subjects did not experience obstacles and restrictions in this research process. The decrease in oxygen saturation and an increase in pulse both when wearing a mask and not wearing a mask are physiological responses due to climbing stairs. In this research, characteristics of subjects which include age, weight, height, and BMI have been comparable between the group of wearing masks and the group of not wearing masks in periods I and II. Because it is comparative, the changes that occur in the research variables are not caused by the characteristics of the research subject.

Analysis of Period Effects and Residual Effects

The period of intervention in the design of the crossover depends largely on the conditions during the implementation of the study. Period effects can occur when the effects of interventions are not constant in each period, resulting in the interaction between the intervention and the period (Senn, 2002). Period effects are more likely to occur when the time of administration of the intervention is long enough. Period effects can also occur when the subject's condition in receiving the intervention is unstable. The occurrence of inconsistency in surveillance and the presence of missing data, usually has a greater impact on crossover designs than parallel designs. Data loss at one period may hinder the pace of comparison on-all individuals in the research (Feingold, 1996). The design of the crossover becomes incompatible when facing conditions of inconsistency in the implementation of interventions or the presence of strong factors when providing interventions at the beginning of the period (Wellek, 2012).

In this research, as shown in Table 2, there was no period effect either after the activity of climbing stairs to the 2nd floor, 3rd floor, or 4th floor. This suggests that the application of

crossover designs to assess the effects of interventions in both period I and period II is in line with each other. We know that the design of the crossover still has serious weaknesses, although in the final analysis it focuses on self-control in each research subject, The potential problem that often arises is the presence of carryover effects, namely the bias of the interventions provided. Carryover (residual) effect is an effect derived from interventions in previous periods on the response of subjects in the ongoing period. Carryover effects can arise because of intervention-period interactions. This effect is a crucial issue in the analysis of crossover designs. The application of washout in the design can reduce the impact of residual effects. Washout is the lag time between periods of intervention. In a research activity, the length of time of washout is determined based on multiples of the length of the intervention effect given. The residual effect will cause a difference between the two interventions in both time periods, resulting in significant intervention-period interactions. In this research, based on the results in Table 3, there was no residual effect. Therefore, interventions in period I have no effect on period II interventions. This means that there is no interaction between interventions-periods.

Wearing Masks on Stairs Climbing Activities

Masks are one of the most efficient ways to reduce the risk of transmitting droplets (aerosols) produced by breathing, sneezing, coughing, and when talking between individuals (Anfinrud, 2020; Stadnytskyi, 2020) masks are not only for health workers, but also for the public (Chu et al., 2020). The main characteristic of the mask is efficiency in the filtration of particles when inhaling air. Masks are widely used to provide protection against particles and aerosols that can cause harm to the respiratory system faced by people who do not wear personal protective equipment, the danger of particles and aerosols of different sizes and chemical properties can harm humans. Climbing stairs is physical activity carried out when climbing stairs in a high-rise building. A ladder is a construction designed to contact two vertical levels that have a distance from each other. A ladder is a connection that can be passed between the levels of a building, and the height of the level ranges from 15 - 18 cm, the width of the flat steps is 28 cm. It is better if the ratio is 15/20 cm in height/step.

Side Effects and Potential Dangers of Using Masks

The impact of using masks physiologically can be seen from changes in the respiratory system. The closure of the space around the nose and mouth causes obstruction of free air flow into the respiratory tract. Reduced inhaled air leads to a decrease in the percentage of oxygen in the blood. In this research in general, there were no moderate risk or high-risk side effects of wearing masks. It can further be submitted that the use of masks in a short duration does not have a serious potential danger. This means that the use of masks as one of the mitigations for preventing Covid-19 is still safe for all age groups. However, wearing a mask for a long duration is likely to have an impact on respiratory physiology, such as the following study results. Kisielinski in his research on side effects and potential dangers of mask use found that there were changes in respiratory physiology, where mask wearing correlated with decreased O2 and fatigue. In addition, there is also an increase in CO2 and headaches, respiratory problems, and a rise in temperature (Kisielinski et al., 2021).

Despite the controversy about the benefits and risks of wearing masks in public spaces, mask-wearing is becoming a new social appearance in everyday life in many countries. The obligation to wear masks in public spaces must be obeyed by all parties, except for certain people with the permission of doctors who have authority in this matter. A careful analysis of risks and benefits is becoming increasingly relevant to the public regarding the potential long-term effects of mask wearing. Nwosu in his research involving seventy-six health workers

who wore masks for 68-480 minutes. The discomfort experienced with the use of N95 masks, is greater than that of surgical masks. There was no significant change in arterial oxygen saturation in the use of either type of mask. The tight binding of N95 masks is felt to be a contributor to the discomfort experienced in the use of masks (Nwosu et al., 2021).

Effect of Masks on Oxygen Saturation

Oxygen saturation is the percentage of hemoglobin that binds to oxygen in the arteries. Oxygen saturation is a measure of how much hemoglobin is currently bound to oxygen compared to how much hemoglobin remains unbound (Hafen B B & Sharma S, 2022). Normal oxygen saturation is between 95 – 100%. Oxygen saturation is an important element in the body's metabolism. Oxygen is strictly regulated in the body because hypoxemia can cause many acute side effects on human organ systems. Including oxygen that goes to the brain, heart, and kidneys. At the molecular level, hemoglobin consists of four globular protein subunits. Each subunit is associated with a heme group. Each hemoglobin molecule further has four heme binding sites available to bind oxygen. Therefore, during the transport of oxygen in the blood, hemoglobin can carry up to four oxygen molecules. Due to the critical nature of the oxygen consumption of tissues in the body, it is very important to be able to monitor the current oxygen saturation. Oxygen saturation can be measured with a pulse oximeter.

In this research, wearing a mask on stairs had an impact on reducing oxygen saturation compared to not wearing a mask. On the one hand, the activity of climbing stairs already influences reducing oxygen saturation, and plus wearing a mask, the decrease is even greater. The wearing of masks in activities up the stairs from the 1st floor to the 2nd floor, from the 1st floor to the 3rd floor, and from the 1st floor to the 4th floor respectively decreased oxygen saturation by 1.65%, 1.38%, and 2.40%. Meanwhile, the activity of climbing stairs that do not wear a mask decreases oxygen saturation by 0.22%, 0.55%, and 0.95% from the 1st floor to the 2nd, 3rd, and 4th floors, respectively. Compared to climbing stairs without wearing a mask, wearing a mask can magnify the decrease in oxygen saturation.

The results of this research are in line with the results of his research Engerof et al. in 2021 Masks caused a decrease in SpO2 during vigorous intensity exercise and an increase in SpO2 during rest, there was no general effect of wearing masks on SpO2. The wearing of masks leads to a decrease in general oxygen absorption to a slower respiratory rate and a decrease in air circulation. The combined effect of mask wearing and the intensity of heavy physical activity on the circulation of gas exchange suggests that a greater detrimental effect occurs during exhausting physical exertion. Oxygen saturation increases during rest periods despite still wearing a mask, while wearing a mask during tiring exercise leads to a decrease in oxygen saturation. Breathing frequency is not related to exercise intensity (Engeroff et al., 2021).

Effect of Mask on Pulse Rate

The pulse is a picture of the heart rate that is at the location of the arteries under the skin and is palpable on the wrists and neck. Contraction of the heart muscle in the process of pumping blood produces a pulse. Under normal circumstances, the pulse has a contraction period of 0.40 of the heart cycle. In this study, wearing a mask on stairs had an impact on increasing the pulse rate compared to not wearing a mask. On the one hand, the activity of climbing stairs already influences increasing the pulse, and plus wearing a mask, the increase is even greater. The wearing of masks on stairs from the 1st floor to the 2nd floor, from the 1st floor to the 3rd floor, and from the 1st floor to the 4th floor respectively increased the pulse rate by 11.90

beats/minute, 25.02 beats/minute, and 33.18 beats/minute. Meanwhile, the activity of climbing stairs that do not wear a mask increases the pulse rate by 1.35 beats / minute, 12.20 beats / minute, and 20.45 beats / minute respectively from the 1st floor to the 2nd, 3rd, and 4th floors. Compared to climbing stairs without wearing a mask, wearing a mask can increase the pulse rate.

The results of this research are in line with the results of his research G. Zhang *et al*, wearing a surgical mask during aerobic exercise shows some negative impact on cardiopulmonary function, especially during high-intensity exercise. These results provide important recommendations for wearing masks during this pandemic during exercises of varying intensity. The study also presented suggestions that future research should focus on the response of mask wearing in patients with cardiopulmonary disease. In people in a healthy state who breathe at a normal pace, the frequency of the heart may change according to the respiratory phase. The pulse is calculated by units of repetition (times/minute). In people with regular activity, the normal pulse ranges from 60-100 times/minute. In addition, there is also a pulse of recovery. A recovery pulse is a pulse that is measured after a 5-minute break from an exercise activity. Recovery pulse measurements are used to observe how quickly the body can perform strenuous activity to perform recovery.

Some studies have shown that wearing a mask can have an impact on physiological functions, especially cardiopulmonary function, such as increased respiratory resistance, hypoxia, carbon dioxide retention, and other changes in lung function, leading to increased heart load, insufficient coronary perfusion, decreased aerobic muscle metabolism, increased anaerobic metabolism, and even affect kidney function and immune function (Chandrasekaran, 2020). Wearing a mask also increases temperature, humidity, and discomfort on the face (Scarano et al., 2021) Wearing a mask also increases temperature, humidity, and discomfort on the face (Driver et al., 2022). The type of mask, the time of wearing the mask, the type and intensity of activities, and the environment will have different effects. One study showed that wearing a surgical mask or filter mask (such as N95) is relatively safe in daily activities and short-term low intensity exercise. The type of mask, the time of wearing the mask, the type and intensity of activities, and the environment will have different effects. One study showed that wearing a surgical mask or filter mask (such as N95) is relatively safe in daily activities and short-term low-intensity exercise (Goh, 2019). There are several reports of physiological changes in the human body when wearing masks for medium and high intensity exercises. Egger in his study of 16 athletes showed that after wearing a mask, VO2 uptake decreased (Shaw et al., 2020). However, Shaw's research shows that wearing a mask for strenuous exercise has no obvious effect in exercise in healthy young people, such as oxygen saturation, maximum load, and perceived exertion (Shaw et al., 2020). In this research, wearing a mask on stairs had an impact on increasing the pulse rate compared to not wearing a mask. On the one hand, the activity of going up stairs already influences increasing the pulse, and plus wearing a mask, the increase is even greater.

CONCLUSION

Based on the results of the research, it can be concluded that there was no difference in respondents' characteristics between the group that wore masks and the group that did not wear masks in period I. There were no period effects and residual effects in the study on climbing activities. There is an effect of wearing a mask on decreasing oxygen saturation in the activity of going up the stairs from the 1st floor to the 2nd, 3rd, and 4th floors. There is an effect of wearing a mask on increasing the pulse rate in the activity of going up the stairs from the 1st floor to the 2nd, 3rd, and 4th floors of employees and lecturers at the International

University of Bali who are aged 27-45 years. The results of this study have a high impact on the physiological response of the study subjects, so for adults who are over 45 years old, it is not recommended to use a mask when climbing stairs that exceed 2 floors.

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