

The effects of aerator masks and medical masks on oxygen saturation (SO₂) on mentally retarded athletes

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Abstract

The study purpose was investigated the effect of aerator masks on the oxygen saturation (SO₂) of mentally retarded athletes compared to medical masks. The researcher used a comparative study. Parametric test was used to test the difference in SO₂ percent and evaluate the questionnaire in the two groups. The results showed after undergoing exercise, SO₂ percent in participants was 94.60±0.55 for aerator masks and 96.60±0.55 for medical masks. The study also showed that there was no significant difference in SO₂ percent of participants wearing aerator masks and medical masks. However, the decrease in oxygen saturation percent of participants wearing aerator masks experienced a lower decrease, 1.60±0.55 compared to medical masks of 2.00±1.00. On the other hand, wearing an aerator mask is better because it does not prevent maximum performance, better comfort, the mask material feels better on the skin, does not experience difficulties breathable, and suitable for exercise. An aerator mask is a mask with an adequate supply of oxygen so that every breath is maintained even when used during sports activities.

Introduction

Covid-19 has disturbed the world and has become an emergency health problem.¹ Covid-19 is one of the pathogens that primarily target is human respiratory system.² In Indonesia, the spread of corona virus continues to increase. Due to its widespread, Covid 19 is classified as a pandemic. Due to the rapid transmission, the government urges the public to isolate and always wear a mask every time. In this case, the athlete experienced a big challenge because the hard work that has been done to prepare for various matches and championships has suddenly been stopped. Jukic *et*

al. (2020) stated that the existence of isolation caused competitions and training not to be carried out, unable to move freely, communication between coaches and athletes was limited, and unable to get enough sunlight.³ The recent Covid-19 pandemic has put pressure on athletes in all sports to stop competing but also in training sessions.⁴ These conditions are affects the physical and mental conditions of the athletes. During the pandemic, athletes are forced to remain in isolation to maintain physical performance with minimal facilities. A decrease in the athlete's physical condition will occur if routine training activities are stop.

Athletes are accustomed to high training portions in maintaining and improving their performance. One that supports the athlete's performance is VO_{2max} or a people maximum oxygen consumption during high-intensity activities. Currently, athletes do not get the same portion of training as they do during the match season. This causes the VO_{2max} to decrease. This reduction in the exercise portion also affects muscle performance. Maintenance of physical abilities is a basic requirement for athletes.⁵ In an athlete, there are many propulsion cells (motor neurons) that are activated during movement. If it is not stimulated by movement or physical exercise, muscle contraction will be reduced or absent at all, and the propulsion cells will die. Reduced contractions in a decreasing of exercise portion caused a decrease in muscle strength. So, if the athlete stops training, it means that the muscle ability, endurance and the power will decrease and when the power decreases, the agility and performance will decrease. There are three conditions needed by physical athletes, such as strength, endurance, and agility that need be trained to maintain the performance. When the three of them decrease, the athlete's playing ability automatically also decreases. The importance of aerator masks for Indonesian disabled athletes, especially mentally retarded athletes as a prevention of hypoxia during training in the Covid-19 pandemic. It can be seen from the athlete's medal gain data (Figure 1). Paralympic athletes cannot be underestimated. It has been proven that there is a GOLD record for the ASIAN PAMES championship, the largest party in Asia for people with disabilities, in Jakarta in 2018. This is an extraordinary achievement created by Paralympians with all their limitations trying to make people aware that the Paralympics can perform like normal human beings in general. The emergence of the Paralympics is the result of a well-planned and well-programmed special achievement sport development.

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During the pandemic, athletes' physical health needs to be considered by carrying out their usual exercises. When training, athletes must wear a mask. The purpose of wearing masks is to protect athletes from the corona virus. The masks worn are masks that are specifically for sports activities. Masks that can help breathe properly without letting pollutants into your nose and mouth. Mask that blocks air become short of breath when exercise. The use of masks that are not specifically for sports activities, generally in a health environment is often limited because of the relatively low ability to breathe and respiratory problems may

occur after using a mask for a long time.⁶ This is because exercise causes sweating and can make the mask wet. The use of a wet mask causes discomfort and secretions in the nose. In addition, wet masks are also not effective in preventing the transmission of the Covid-19 virus.

The use of masks with poor air circulation can cause hypoxia. Hypoxia is a condition of limited oxygen in the tissues to maintain body functions.⁷ This condition makes a person experience problem in breathing in the form of shortness of breath or dyspnea. It should be noted that normal arterial oxygen tension is in the range of 75 to 100 millimeters of mercury or mm Hg. When the oxygen pressure is below 60 mm Hg, it indicated that the body needs additional oxygen. Meanwhile, when examined using pulse oximetry, the normal oxygen saturation is 90-100%, medium is 80-90%, and the low is below 80%.⁸ Below this value means that oxygen in the body is low. Hypoxia is a very dangerous condition. Without enough oxygen, the brain, kidneys and various organs in the body can be damaged within minutes of symptoms starting. If oxygen levels in the blood continue to decrease, these organs can die and this is life-threatening. Therefore, the selection of

masks for exercising must be the right one. To overcome this problem, it is necessary to develop a mask in the form of an aerator mask. An aerator mask is a mask with an adequate supply of oxygen so that every breath is maintained.

Materials and methods

Study Participants

The researcher used a comparative study. The 10 mentally retarded male athletes participated in a study to test the effectiveness of aerator masks compared to medical masks. The average age of participants was 25.50 years, weight 65.50 kg, height 1.57 m (Table 1). The criteria for participants are 1500 m run athletes and do not have a history of respiratory disease to prevent participants' endurance during exercise. Participants were randomly divided into two groups, namely (1) wearing an aerator mask during the exercise (Figure 2A); and (2) wearing a medical mask during exercise (Figure 2B). The materials used in the aerator masks are not much different from the medical masks to be compared. Both masks are made of Melt-blown fabric

(30%), Moon-Valley face mask non-woven fabric (70%). However, the aerator mask uses ABS plastic as the mask frame.

Study organization

Research Procedure

All participants underwent an oxygen saturation test at the initial of the study. Participants are undergoing training by running on a treadmill on three different days. In each meeting, participants underwent training for 2 hours with the recovery time between exercises being 24 hours. During the exercise, each participant wears a predetermined mask. The exercise was carried out with an initial load of 50 watts then the load increased by 25 watts every 3 minutes until the participants experienced fatigue.⁹

Measurement of Oxygen Saturation (SO₂)

Oxygen saturation levels were obtained from samples using blood gas analysis taken from punctures in the radial artery of the participant's left hand while still on the treadmill. Determination of blood gas analysis was carried out by co-oximetry using the ABL90 FLEX Blood Gas Analyzer.¹⁰ Determination of SO₂ is done at rest (before

Table 1. Age and anthropometry characteristics of participants.

Variable	All (n = 10)		Aerator Mask (n = 5)		Medical Mask (n = 5)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	25.50	2.84	26.60	1.95	24.40	3.36
Height (m)	1.57	0.04	1.55	0.01	1.58	0.06
Body weight (kg)	65.50	5.40	65.80	2.39	65.20	7.73
BMI (kg/m ²)	26.75	2.78	27.25	1.16	26.26	3.93

Table 2. Oxygen saturation data.

Oxygen Saturation (SO ₂) (%)	Aerator Mask (n = 5)		Medical Mask (n = 5)		t-test	
	Mean	SD	Mean	SD	t _{count}	p-value
Rest	97.00	1.22	96.60	0.55	0.667	0.524
Post Exercise	95.40	0.89	94.60	0.55	1.706	0.126
Decreased Oxygen Saturation	1.60	0.55	2.00	1.00	0.784	0.455

Table 3. Questionnaire assessment data.

Statement	Aerator Mask (n = 5)		Medical Mask (n = 5)		t-test	
	Mean	SD	Mean	SD	t _{count}	p-value
P1	3.80	0.45	2.60	0.55	3.795	0.005
P2	3.80	0.45	1.80	0.45	7.071	0.000
P3	3.60	0.55	1.40	0.55	6.351	0.000
P4	3.80	0.45	2.60	0.55	3.795	0.005
P5	3.40	0.55	2.00	0.00	1.633	0.141
P6	3.60	0.55	2.20	0.45	4.427	0.002

exercise) and when the exercise reaches its maximum (during the last 1-2 minutes). Singh et al (2013) explained that blood gas is used to monitor gas exchange and control breathing.¹¹ This is the best indicator of how well the warp is oxidizing.

Participant Response Questionnaire

The participant's response questionnaire was filled out after the participants finished the exercise. Each participant is free to give their response according to how the participants felt when wearing a mask during the exercise. The questionnaire contents were modified from the research of Ng et al. (2022).⁹ The questionnaire provides a quantitative assessment of participants' responses to the comfort of wearing a mask during exercise. The rating scale uses 4 scales (1 = strongly disagree; 2 = strongly agree; 3 = agree; 4 = strongly agree).

Statistical analysis

Basic descriptive statistics in the form of mean and SD were used for data analysis. Parametric tests were also used to test the difference in oxygen saturation (SO₂) percent and the questionnaire assessment in the two groups. Statistical significance at 0.05. All analyzes were performed using SPSS 16.

Results

Table 2 presents data on oxygen saturation percent before and after training. The results showed that there is no significant difference in the participants' oxygen saturation despite wearing different masks. However, participants with aerator masks showed a lower decrease in oxygen saturation compared to participants with medical masks after participants underwent training.

Table 3 presents the questionnaire assessment data during practice wear masks. There are differences felt by the participants in terms of maximum performance, comfort, mask material, difficulty breathing, and suitable for exercise. But the heat felt when wearing masks, both aerator masks and medical masks, is no different.

Discussion

During the Covid-19 pandemic, athletes experienced a decline in performance due to the cessation of routine training activities. Athletes' performance needs to be maintained by continuing to exercise. Covid-19 which attacks the respiratory system and transmission of Covid-19 through the air causes athletes wear masks during training. However, long-term use of masks in sports

activities can cause negative impacts such as a lack of oxygen supply in the body and excess carbon dioxide. Oxygenation is a process to get O₂ and remove CO₂, which is a basic human need. If the need for oxygen is not met, hypoxia will occur. Oxygen plays an important role in all functional body processes. The absence of oxygen will cause the body to functionally decline and even cause death. Blood is responsible for carrying oxygen to the cells in the body so that they can work properly. Fulfilling this need for oxygen cannot be separated from the condition of the functional respiratory system. Breathing is the process of taking in

oxygen from the air and expelling carbon dioxide and water vapour. The ability to breathe during exercise results in a rate of CO₂ emission that does not provide an other atmosphere than the gas mixture inhaled by the athlete, and an increased level of oxygen consumption associated with oxygen supply and increased muscle work and oxygen demand of skeletal and respiratory muscles.¹² If there is a disturbance in one of the organs of the respiratory system, the need for oxygen will be disturbed.

In this conditions, if the athlete continues to exercise using the wrong mask will pose a danger, but if the athlete does not use




		Indonesia			
Pos	Sport				Total
1	Chess	11	5	6	22
2	Para Athletics	6	12	10	28
3	Lawn Bowl	5	4	6	15
4	Table Tennis	4	4	9	17
5	Para Swimming	3	4	5	12
6	Badminton	2	1	1	4
7	Cycling	1	7	8	16
8	Tenpin Bowling	1	1	0	2
9	Para Powerlifting	0	4	2	6
10	Wheelchair Fencing	0	0	1	1

Figure 1. Asian medals achievement at paragames.

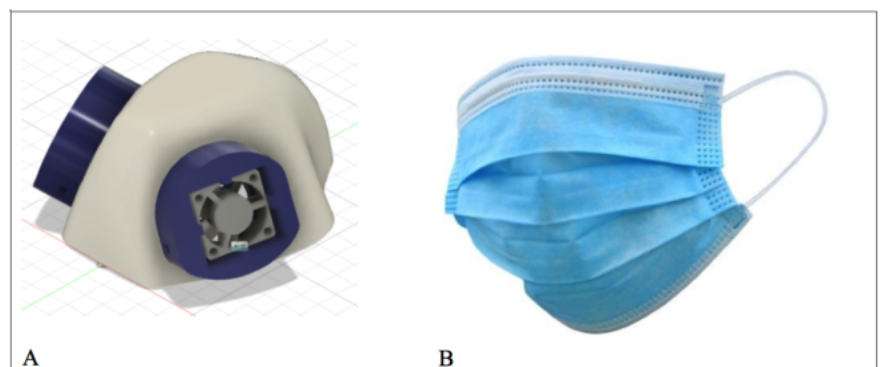


Figure 2. Masks worn by participants: (A) Aerator masks; (B) Medical masks.

a mask during training, the athlete will be easily exposed to Covid-19. This requires that masks that are used for hours must lead to personal safety to health hazards.¹³ In this case, the researchers introduced aerator masks that can help solve athlete problems and increase safety for athletes, especially when undergoing training. The development of this mask connects to the mask to a high performance filter system which is developed into a mask that can be used for a long time and is safer during training than using ordinary masks in general. The filter system on this mask has the ability to minimize the entry of viruses and bacteria, but the oxygen supply when using the aerator mask is also maintained. The results of the study have proven that aerator masks and medical masks do not differ significantly in oxygen saturation percent, but during training with masks, participants experience a decrease in oxygen saturation percent where the aerator masks have a lower decrease in oxygen saturation percent compared to medical masks. This shown that wearing an aerator mask, the decrease in the percentage of hemoglobin in the blood does not decrease drastically, so participants can still breathe well.

Conclusions

The use of masks is intended to minimize the corona virus and lack of oxygen during training. The masks worn are masks that are specifically for sports activities. Masks that can help breathe properly without letting pollutants into your nose and mouth. Mask that blocks air become short of breath when exercise. The use of masks with poor air circulation can cause hypoxia.

This study concluded that aerator mask is a mask with an adequate supply of oxygen so that every breath is maintained even though it is used during exercise activities.

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