



# The Effect of Medical Mask Use on Lower Extremity Endurance and Exercise Capacity in Beta Thalassemia Minor

## Beta Talasemi Minör Olgusunda Tıbbi Maske Kullanımının Alt Ekstremitte Enduransı ve Egzersiz Kapasitesi Üzerine Etkisi

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### Öz

**Giriş:** Beta talasemi minör kliniği hafif anemi tablosu ile genellikle asemptomatik seyreder. Bulaşıcı hastalıkların son yüzyılda pandemi boyutlarında seyretmesi tıbbi maske kullanımını hayatın bir parçası haline getirmiştir. Literatür maskenin koruyucu etkilerinin yanında maske kullanıma bağlı ortaya çıkabilecek olası problem ve olumsuzlukları da mercek altına almıştır. Bu olguda beta talasemi minör tanılı olguda maske kullanımının alt ekstremitte enduransı, egzersiz kapasitesi ve kişisel konfor düzeyi üzerine etkisi irdelenecektir.

**Olgu:** Kadın, 1,7 m boy ve 46 kg vücut ağırlığında 21 yaşındadır. Olgu 10 gün ara ile bir gün maskesiz ve bir gün maskeli olacak şekilde sırasıyla alt ekstremitte enduransını ölçmek için 30-sn otur kalk testi (30OKT), maksimal egzersiz kapasitesini ölçmek için artan hızda mekik yürüme testi (AHMYT) ve submaksimal egzersiz kapasitesini ölçmek için 6 dakika yürüme testini (6DYT) gerçekleştirdi. Testlerden önce ve sonra egzersize dair parametreler toplandı. Ayrıca olgunun maske konforu sorgulandı. Maske kullanımı ile 30OKT tekrar sayısı etkilenmezken AHMYT ve 6DYT mesafesi azaldı. Egzersize bağlı parametrelerde maskenin olumsuz etkisi ortaya çıkmazken olgunun maske konforuna dair rahatsızlık hissettiği belirlendi.

**Sonuç:** Sonuç olarak tıbbi maske kullanımı beta talasemi minörlü kişilerde alt ekstremitte enduransını etkilemezken egzersiz kapasitesini olumsuz yönde etkileyebilir. Bu kapsamda daha fazla katılımcıyı içeren çalışmaların tasarlanması faydalı olabilir.

**Anahtar Kelimeler:** Beta talasemi minör, egzersiz toleransı, endurans, maske, olgu raporu

### ABSTRACT

**Introduction:** The clinical course of beta thalassemia minor is usually asymptomatic with mild anemia. The pandemic proportions of infectious diseases in the last century have made the use of medical masks a part of life. In addition to the protective effects of the mask, the literature has also examined the possible problems and negativities that may arise due to mask use. In this case, the effect of mask use on lower extremity endurance, exercise capacity and personal comfort level in a patient diagnosed with beta thalassemia minor will be examined.

**Case:** She is 21 years old, 1.7 m tall and weighs 46 kg. She performed the 30-second sit to stand test (30STS) to measure lower extremity endurance, the incremental shuttle walk test (ISWT) to measure maximal exercise capacity, and the 6-minute walk test (6MWT) to measure submaximal exercise capacity at 10-day intervals, one day unmasked and one day masked, respectively. Exercise-related parameters were collected before and after the tests. The mask comfort of the patient was also questioned. While the number of 30STS repetitions was not affected by mask use, the ISWT and 6MWT distance decreased. While there was no negative effect of the mask on exercise-related parameters, it was determined that she felt discomfort related to the use of the mask.

**Conclusion:** The use of a medical mask does not affect lower extremity endurance but may adversely affect exercise capacity in people with beta-thalassemia minor. In this context, it may be useful to design studies involving more participants.

**Keywords:** Beta thalassemia minor, exercise tolerance, endurance, mask, case report

## 1. INTRODUCTION

Beta thalassemia is the general name for a group of inherited blood disorders caused by the beta chain of hemoglobin. It covers three main forms: thalassemia major, thalassemia intermedia and thalassemia minor. The beta thalassemia minor group is also known as thalassemia carriers. Although mild anemia may occur in these individuals, they are usually asymptomatic (Galanello & Origa, 2010). Beta thalassemia is known to be common in Southeast Asia, the Middle East and the Mediterranean region, but nowadays its prevalence is increasing in Northern Europe and North America due to increased immigration (Kattamis, Forni, Aydinok, & Viprakasit, 2020), making this clinical condition more global.

With the COVID-19 (coronavirus disease 19) pandemic, the use of masks was for a time a mandatory part of the public routine. Although the global threat of the pandemic is over, a segment of the population still wears masks in public places. The effect of the mask on exercise capacity has been discussed for healthy people and some disease groups (Hopkins et al., 2021), but no studies have been found in people with beta thalassemia minor.

## 2. CASE

She was informed in detail about the study and written informed consent was obtained. A 21-year-old woman with a height of 1.7 m and a body weight of 46 kg, her mother and father were not related and the disease was present on the paternal side. The patient was a non-smoker, drank 4 glasses of alcohol per month and had no exercise habits. There was no known additional chronic disease. According to recent biochemistry results, hemoglobin level was 11.3 g/dL. In her daily life, she got tired very quickly and had dyspnea while doing activities such as fast walking, climbing stairs and running, and she also stated that when she did these activities with a medical mask, she got more tired and felt the need to remove the mask. She had been using a medical mask for 15

months due to the COVID-19 pandemic, and stated that she used a mask for an average of 12 hours a week when she came for evaluation within the scope of the study.

She was made to attract a paper and it was determined that the first tests would be performed without a mask. The 30 second sit to stand test (30STS) to measure lower extremity endurance, the incremental shuttle walk test (ISWT) to measure maximal exercise capacity, and the 6-minute walk test (6MWT) to measure submaximal exercise capacity were performed with a rest interval, respectively. ISWT and 6MWT tests were performed according to the technical standards of the European Respiratory Society/American Thoracic Society (Holland et al., 2014). As the primary outcome measure of the tests, the number of standing up for 30 seconds was recorded in the 30STS, and the distance walked was recorded in the ISWT and 6MWT. Secondary, measures of exercise-related parameters such as blood pressure, heart rate, respiratory frequency, oxygen saturation (SpO<sub>2</sub>), dyspnea and fatigue assessed by modified borg scale (MBS) and visual analog scale (VAS) were collected immediately before, immediately after and 15 minutes after the test in all three tests. In addition, a 10-item mask comfort questionnaire (Li et al., 2005) was filled out for resting, activities of daily living (ADL) and ISWT to measure the mask comfort of her. In this table, each item was evaluated using a 0-10 point VAS, with "0=no" and "10=most severe". Wearing a Type I medical mask, the tests were repeated in the same order 10 days later (Figure 1).

While there was no difference between masked and unmasked 30STS results (both 12 repetitions), she walked less distance in masked ISWT (masked=548,3 m, unmasked=576,6 m) and 6MWT (masked=584,7 m, unmasked=614,75 m) than unmasked. No significant results were observed in the exercise-related parameters of her, indicating that the mask may have had a negative effect (Table 1). It was observed that she had significant discomfort in terms of mask comfort items, including at rest, in ADL and ISWT (Supplement 1).

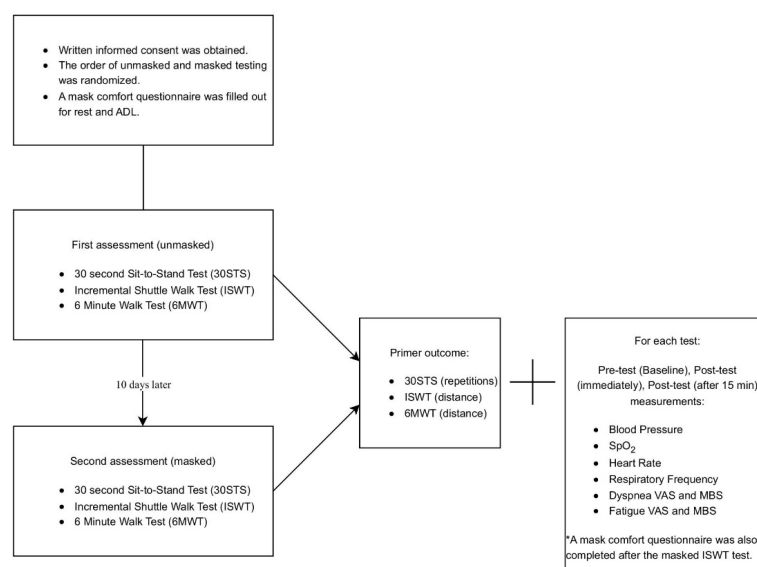


Figure 1. Study flow chart

**Table 1:** Changes in exercise-related parameters in unmasked and masked tests

Mask Status of Test	Test Name	Measurement Time	Blood Pressure (mmHg)	SpO <sub>2</sub> (%)	Heart Rate (beats/min)	Respiratory Frequency (breaths/min)	Dyspnea VAS	Dyspnea MBS	Fatigue VAS	Fatigue MBS
Unmasked	30STS	Pre-test (Baseline)	89/61	%99	74	18	0,8	0,5	0,7	2
Unmasked	30STS	Post-test (immediately)	84/60	%98	64	14	1,5	2	0,8	2
Unmasked	30STS	Post-test (after 15 min)	89/61	%99	70	14	0,7	0,5	0,7	1
Unmasked	ISWT	Pre-test	95/51	%99	74	12	0,6	0,5	0,6	1
Unmasked	ISWT	Post-test (immediately)	122/76	%99	107	24	6,5	7	7,5	8
Unmasked	ISWT	Post-test (after 15 min)	89/59	%99	69	17	0,4	0,5	0,5	0,5
Unmasked	6MWT	Pre-test	80/56	%99	63	16	0,5	0,5	0,5	0,5
Unmasked	6MWT	Post-test (immediately)	96/59	%99	87	29	4,9	5	4,8	6
Unmasked	6MWT	Post-test (after 15 min)	80/54	%99	70	16	0	0	0,4	0,5
Masked	30STS	Pre-test (Baseline)	85/55	%99	79	15	0,6	0,5	4,6	3
Masked	30STS	Post-test (immediately)	91/52	%99	72	17	1,4	2	4,1	3
Masked	30STS	Post-test (after 15 min)	91/58	%99	78	17	0,5	0,5	4,2	3
Masked	ISWT	Pre-test	89/59	%99	76	17	0,4	0,5	3,4	2
Masked	ISWT	Post-test (immediately)	119/68	%99	96	25	5,8	5	5,7	4
Masked	ISWT	Post-test (after 15 min)	78/58	%99	72	19	0	0	1,9	1
Masked	6MWT	Pre-test	90/56	%99	74	18	0	0	1,4	1
Masked	6MWT	Post-test (immediately)	104/57	%99	80	21	2,3	3	4,7	4
Masked	6MWT	Post-test (after 15 min)	87/58	%99	79	18	0	0	1,2	1

30STS: 30 second sit to stand test; ISWT: Incremental shuttle walk test; 6MWT: 6-minute walk test; VAS: Visual analog scale; MBS: Modified borg scale

### 3. DISCUSSIONS

In our study, we found that wearing a medical mask did not affect lower extremity endurance in our case but negatively affected ISWT and 6MWT distances in terms of exercise capacity.

For the lower extremity, the only existing study by Ramos-Campo et al. (2021) reported that a medical mask did not affect the performance in a strength program including half squat exercise in people with sarcopenia. The 30-second sit-to-stand test is a field measurement frequently used for various conditions, including recent studies, and its validity and reliability have been reported (Alotaibi et al., 2023; Barrios-Fernández et al., 2020; Jones et al., 1999). The evaluation process was conducted under pandemic conditions, and although the tests were performed in a closed area with a good ventilation system, there were several limitations, such as the absence of more objective measurement systems like isokinetic devices in our unit.

Above all, the fact that no prior evaluation had been performed for this purpose on a thalassemia patient led us to use field tests, which are commonly used in physiotherapy. These tests require minimal equipment, can be completed in a short time, are valid, reliable, and can easily be repeated by other researchers when evaluating similar cases. We can conclude that the use of a medical mask did not significantly affect the patient's response to the test, due to factors such as the short duration of the test and the manageable level of effort required. However, to our knowledge, this is the first study to evaluate the effect of mask use on thalassemia, and we believe that future studies will further refine our methodology.

The effect of medical mask on maximal exercise capacity has been reported in the literature with cardiopulmonary exercise test. In these studies, which were generally conducted in healthy participants, conflicting results have been reported on whether the medical mask affects maximal exercise capacity (Jesus et al., 2022; Shaw, Butcher, Ko,

Zello, & Chilibeck, 2020). Similar to our study, De la Escosura Muñoz et al. (2022) found a statistically significant decrease in walking distance (approximately 9-10 m) after 6MWT with and without a medical mask in a mixed group of cardiac and pulmonary patients, but since this decrease was not clinically significant, they concluded that the medical mask did not affect the test result but only increased the perceived dyspnea. It can be thought that the use of masks negatively affects exercise capacity due to physiological and mechanical reasons such as increasing airway resistance and creating an additional dead space around the mouth and nose leading to re-inhalation of CO<sub>2</sub> (Kisielinski et al., 2021; Lässig et al., 2020). Recent review, similar to our study, emphasized that masks do not significantly affect physiological parameters (Hopkins et al., 2021).

Similar to our study, high discomfort associated with medical mask use has been previously reported. (Li et al., 2005). This discomfort may be the result of a microclimate created by the medical mask, which indicates a more humid and warmer environment under the mask (Roberge, Kim, & Benson, 2012).

According to the World Health Organization ICF model, people with thalassemia minor have no impairment in terms of body structure and function or experience a mild form of anemia. However, the carrier status of the disease, as indicated by our case, may cause fatigue in daily life and may affect people in terms of the activities and participation sub-heading of the ICF model. Wearing a medical mask has the potential to create additional fatigue, as mentioned in our case, and to make activity and participation even more negative. In addition, considering the negative scores, our case gave to the mask comfort items, it seems important to conduct further studies on medical masks in this population and, as a general recommendation, to increase studies to increase mask comfort.

As a limitation, subjective assessments may have been affected by the recall factor because of the 10 days between tests. A strong aspect of our study is that, to our knowledge, it is the first study on the use of masks in people with thalassemia minor.

#### 4. CONCLUSION

In conclusion, the use of a medical mask did not affect lower extremity endurance but negatively affected exercise capacity in this case with beta thalassemia minor. In this context, it may be useful to design studies with more participants to determine whether the decrease in exercise capacity is statistically and clinically significant.

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