

**RESEARCH  
ARTICLE**

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## Evaluation of Nasal Mucociliary Clearance in Recently Diagnosed Covid-19 Patients Before Treatment

### ABSTRACT

**Objective:** Our study aims to evaluate the nasal mucociliary clearance (NMC) in Covid-19 patients who have been recently diagnosed and not been treated yet and investigate how Covid-19 affects NMC.

**Methods:** A total of 120 participants, who applied to Düzce Atatürk State Hospital between September and November 2020, were included in our study. 60 of them were the participants, diagnosed with Covid-19. And 60 of them were the control group. The age range was 18 to 66. 60 participants, diagnosed with Covid-19 and not yet treated, were included in our study. Those with taste disorders were excluded from the study. The control group consisted of 60 healthy volunteers. NMC was evaluated using a saccharin test. The results were compared in the Statistical Package for Social Sciences (SPSS).

**Results:** The study group, which consisted of 60 Covid-19 participants of whom treatment was not yet started, and the 60-participant healthy control group were evaluated in our study. The average age of the study group was  $40,72 \pm 12,96$  and  $39,16$  in the control group. The average NMC was  $15,95 \pm 3,37$  in the study group, and  $8,38 \pm 1,03$  in the control group. When evaluated statistically, it was found higher in the study group ( $p < 0,001$ ).

**Conclusions:** NMC acts as a barrier for inhaled foreign bodies. It is a non-specific protection system against airborne pathogens. Consequently, NMC extends in Covid-19 patients.

**Keywords:** Covid- 19, Nasal Mucociliary Clearance, Smell Disorders.

## Yeni Tanı Almış Kovid-19 Hastalarında Tedavi Öncesi Nazal Mukosilyer Temizliğin Değerlendirilmesi

### ÖZET

**Amaç:** Çalışmamızın amacı yeni tanı almış ve henüz tedavi başlanmamış COVID 19 hastalarında nazal mucosilyer klirensi (NMC) değerlendirerek covid 19 un NMC yi nasıl etkilediğini araştırmaktır.

**Gereç ve Yöntem:** Çalışmamıza Düzce Atatürk Devlet Hastanesine 2020 yılı eylül-kasım ayları arasında başvuran toplam 120 kişi alındı. Bunların 60 tanesi covid 19 tanısı almış hastalardı. 60 tanesi de kontrol grubuydu. Yaş aralığı 18-66 ydı. Çalışmamıza covid 19 tanısı almış ve tedavi başlanmamış 60 kişi alındı. Tat bozukluğu olanlar çalışmaya alınmadı. Kontrol grubu olarak ta 60 sağlıklı gönüllü alındı. NMC sakkarin test ile değerlendirildi. Sonuçlar Statistical Package for Social Sciences (SPSS) te karşılaştırıldı.

**Bulgular:** Çalışmamızda 60 Covid 19 tanısı alan ve tedavi başlanmamış çalışma grubu ve 60 sağlıklı kontrol grubu değerlendirildi. Yaş ortalaması çalışma grubunda  $40,72 \pm 12,96$  kontrol grubunda  $39,16$  idi Ortalama NMC çalışma grubunda  $15,95 \pm 3,37$  idi, kontrol grubunda ise  $8,38 \pm 1,03$  idi. İstatiksel olarak değerlendirildiğinde çalışma grubunda daha yüksek bulundu ( $p < 0,001$ ).

**Sonuç:** Sonuç olarak NMC Covid 19+ hastalarında uzamaktadır.

**Anahtar Kelimeler:** Covid- 19, Nazal Mukosilyer Klirens, Koku Bozuklukları

## INTRODUCTION

Covid-19 is a disease that was first seen in Wuhan city, capital of Hubei province of China, and turned into a pandemic by spreading around the world (1). On January 30, 2020, the World Health Organization (WHO) Emergency Committee declared Covid-19 a global health emergency depending upon the increasing number of cases in China and other countries (2). The main symptoms of Covid-19 are fever, cough, fatigue, mild dyspnea, sore throat, headache, conjunctivitis, and gastrointestinal problems (3). Covid-19 can be overcome with asymptomatic or mild findings as well as severe that can cause the death of patients. The final diagnosis is made by evaluating the nasal and throat swabs by PCR test. There has yet been no proven effective treatment method (3). For this reason, most countries impose quarantines and curfews to reduce the number of cases. Besides the main symptoms, patients may also experience different symptoms. One of them is smell and taste disorder. Some Covid-19 patients apply with smell and taste disorder complaints. Its pathophysiology has not been yet fully elucidated. The most important transmission source of the disease is through the respiratory tract.

NMC acts as a barrier for inhaled foreign bodies. It is a non-specific protection system against airborne pathogens. The captured particles and microorganisms are transported in the mucus film to the pharynx and eliminated by coughing or swallowing. Therefore, it has a very important role in the protection of the upper and lower respiratory tracts, and the removal of inhaled foreign bodies (4). Disruption of NMC results in the stasis of secretions and leads to secondary infections (5). Deaths due to Covid-19 occur as the disease induces pneumonia, ARDS (acute respiratory distress syndrome), and multi-organ failure (6-8).

In this study, we aimed to investigate NMC, which acts as a protective barrier for the upper and lower respiratory tracts.

## MATERIAL AND METHODS

**Study Design:** Our study was carried out at Düzce Atatürk State Hospital between September and November 2020, after the Düzce University University (date 07.09.2020 and decision 2020/167) Ethics Committee approval was received. The written informed consent form was obtained from all the participants, participating in the study. In this study, under the 80% power and 5% Type I error conditions, the minimum sample size, required to determine the 1-unit difference between the healthy individuals and Covid-19 patients, was calculated as 52 individuals with an effect size of 0,558. Accordingly, it was planned to work with at least 104 individuals, 52 in each group. The power analysis was performed with the G\*Power v.3.1.9.4 package program.

**Study Population:** Our study was conducted between September and November 2020. 60 participants, who applied to Düzce Atatürk State hospital, had a PCR test, and were diagnosed with definite Covid 19, were included as the study group. NMC test was implemented on the participants before the treatment. 60 healthy people, applying to our hospital without any symptoms, were included in the study as the control group, who are smokers, had nasal surgeries before, are diagnosed with allergic rhinitis and/or asthma, have systemic diseases were not included in the study. Covid-19 patients who are smokers, had nasal surgeries before, are diagnosed with allergic rhinitis and/or asthma, have systemic diseases were not included in the study. The examinations and mucociliary clearance tests of all patients were performed by the same researcher. Before testing, each participant, included in the study, underwent an endoscopic examination. 0 degree 4mm Wolf brand telescope was used as the endoscope.

**Measurement of Nasal Mucociliary Clearance:** The saccharin test was used to evaluate NMC. Saccharin test is a frequently preferred method for the evaluation of NMC as it is inexpensive, practical, and reliable. It was first identified in 1974 and modified by Rutland and Cule in 1980 (9,10). Everyone, included in the control and study group, was evaluated by the same researcher. Before the test was performed, the participants were informed about how it was conducted. The participants watched an instructive video, showing how the test was performed. They were warned not to wipe their noses during the test. 1 mg saccharin was placed in the medial part of the concha, 1 cm ahead of the inferior concha head. The patients were informed that they should be in a sitting position during the test. When the sweet taste in their mouths was present, it was measured with a stopwatch and recorded as NMC time.

**Statistical Analysis:** The distribution of the data was examined with the Kolmogorov-Smirnov test. The group comparisons for variables with normal distribution were made with the Independent samples t-test and for the ones, not showing normal distribution, they were made with the Mann-Whitney U test. Pearson's chi-square test was used in the analysis of categorical variables. Statistical analyzes were made with the SPSS v.22 package program, and the significance level was considered 0,05.

## RESULTS

A total of 120 participant, 60 in the study and 60 in the control group, participated in our study. There were 28 men and 32 women in the study group. And there were 30 men and 30 women in the control group. The average age of the study group was  $40,72 \pm 12,96$  and that of the control group was  $39,16 \pm 7,83$  (Figure 1).

When we compared the average age of the groups, it was not statistically significant. While the average NMC was  $15,95 \pm 3,37$  in the study group, it was  $8,38 \pm 1,03$  in the control group (Figure 2).

The average NMC in the study group was found to be statistically higher than the control group ( $p < 0,001$ ) (Table 1).

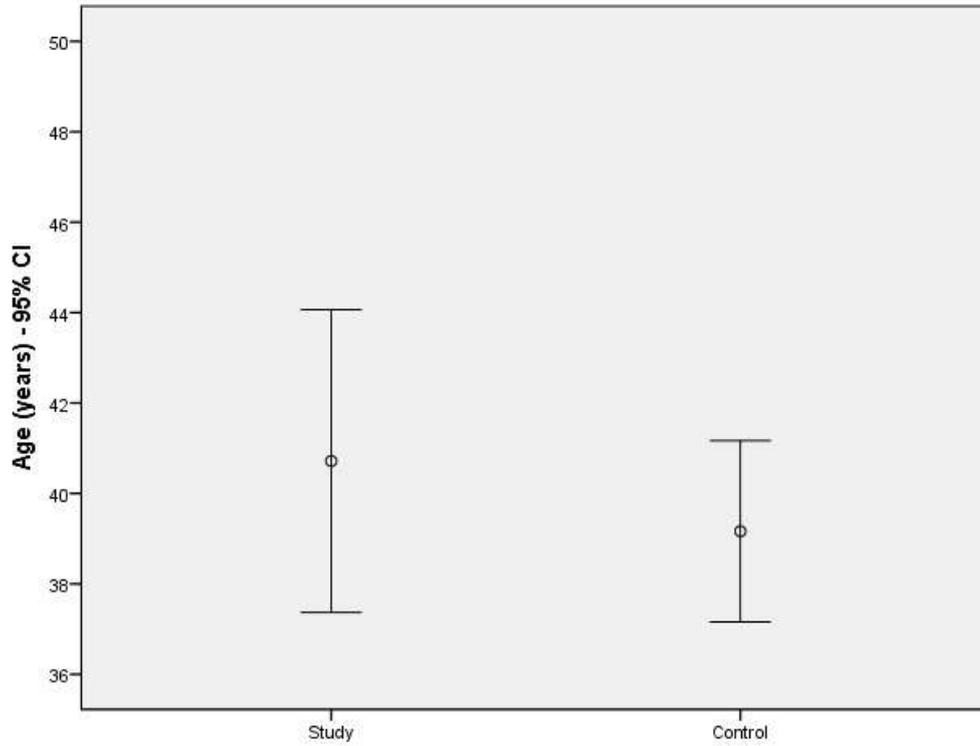


Figure 1. Age distribution of control and study groups

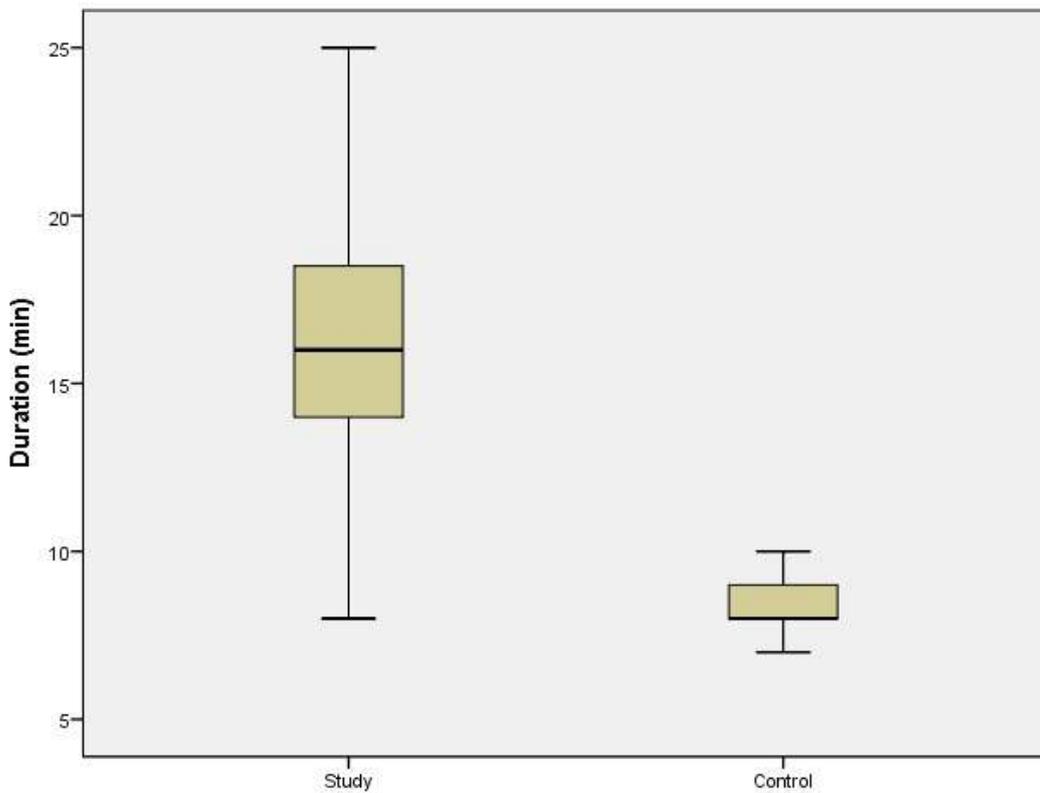


Figure 2. NMC time of study and control groups

**Table 1.** Mean age, mean NMC time and gender distribution of control and study groups

	Study (n=60)	Control (n=60)	p
Gender, n (%)			
Male	28 (46.7)	30 (50.0%)	0.648
Female	32 (53.3)	31 (50.0%)	
Age (years), mean±SD	40.72±12.96	39.16±7.83	0.428
Duration (min), mean±SD	15.95±3.37	8.38±1.03	<0.001
median (IQR) [min-max]	16 (5) [8-25]	8 (1) [6-10]	

SD: standard deviation, IQR: interquartile range

## DISCUSSION

When the control and study groups were compared in our study, it was determined that NMC was statistically found higher in the study group. When the men and women in the study group were compared, there was no statistical difference. When the male and female individuals were separately compared between the study and control groups, there was a statistically significant difference. In the study of Koparal et al., NMC was found to be high in Covid-19 patients (11). Our study's difference from this study is NMC was performed immediately after the patients were diagnosed to reveal if Covid-19 objectively affects NMC. Another study by Ozturk et al. showed that the nasal defense mechanism was weakened in the early period after Covid 19 infection (12). Pezato et al. found in their study that NMC increased in dyspneic Covid 19 patients (13).

The nose forms the beginning of the respiratory tract. NMC in the nasal mucosa is a protective barrier of the respiratory tract. It is a non-nonspecific defense mechanism. It enables the removal of harmful substances by holding the particles in the nasally taken air. Normal NMC time in humans is considered to be 12-15 minutes (14). Disruption of NMC leads to stasis of secretions and infections. Many factors such as chronic rhinosinusitis, nasal polyps, septum deviation, allergic rhinitis, smoking, moisture, temperature affect NMC (15-17). There are different methods for evaluating NMC; however, we preferred the saccharin test in our study as it is cheap, easy to apply, and gives reliable results. This test is a practical and reliable test that has been widely used for many years (18).

Covid-19 is a viral air-borne disease that is transmitted by air. The incubation period is between 3 and 14 days (19). Patients apply to hospitals with nonspecific symptoms such as fever, cough, dyspnea myalgia, and/or diarrhea (20). The disease can be asymptomatic or fatal in some people. Especially in older people, it can result in severe pneumonia and death by leading to lower respiratory tract infection. NMC time extends with age (21). Petrov VV determined in his study that the nasal cavity mucous membrane underwent specific changes with age (22). This change in the nasal mucosa may be causing an increase in NMC.

We found that NMC extended with age in our study as well. Another reason why these people suffer from severe pneumonia may be that the pathogens cannot be removed sufficiently due to the extension of NMC time with age. Anosmia is a distinct sign of covid 19 (23). Covid-19 may be affecting neural cells in the olfactory epithelium or the developed inflammation may be leading to anosmia and loss of taste by affecting the non-neuronal cells (24,25). Covid-19 patients can apply with a sudden loss of smell without any other symptoms (23,26). The disease's pathophysiology and how it affects the nose have not been fully elucidated. Goblet cells and ciliated epithelial cells in the nasal mucosa might be the first regions of Covid-19 (27). People with pathologies that cause NMC extension such as chronic rhinosinusitis, nasal polyp, septum deviation, may be undergoing a more severe disease. Extended NMC may ease the incubation of the virus in the nose. This can be a reason why some young people have a severe illness. Other studies are needed regarding this. For the first time in 2007, Suzuki et al. detected rhinovirus, coronavirus, parainfluenza virus, and Epstein-Barr virus in the nasal secretions of patients with post-viral smell disorder (28,29). We found out in our study that the NMC time statistically extended in covid 19 patients compared to the control group. There may be a relation between the NMC extension and that some patients undergo severe pneumonia and some get off lightly. Other studies which evaluate the relation between pneumonia severity and NMC time are needed.

The conducted studies showed that the first transmission place of Covid-19 is nose and throat. In addition, it was detected that the viral load was higher in the nasal cavity in both symptomatic and asymptomatic Covid-19 patients. Chinnapaiyan et al reported in their study that HIV (human immunodeficiency virus) infection disrupted tracheobronchial mucociliary clearance, and caused recurrent pneumonia and tracheobronchitis (30).

## CONCLUSION

As a conclusion, our study shows that NMC has extended in Covid-19 patients compared to healthy individuals. We hope that our study will contribute to other studies in understanding the pathophysiology of the disease.

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