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ORIGINAL ARTICLE

# AMH and FSFI scores improved after recovery from COVID-19 pneumonia

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## ABSTRACT

**Objective:** The aim of this study was to investigate the effect of SARS-CoV-2 infection on female genitalia and sexual behavior.

**Material and Methods:** In this prospective cohort study in a COVID-19 pandemic clinic, women between 20 and 45 years of age with COVID-19 pneumonia but did not require intensive care were included. Serum anti-Müllerian hormone (AMH) measurements and female sexual function index (FSFI) scores were obtained during SARS-CoV-2 infection and 60–100 days after recovery.

**Results:** Mean serum AMH concentrations at and after COVID-19 pneumonia were 2.29±1.84 and 2.92±2.46, respectively (p=0.017). FSFI scores after COVID-19 pneumonia were higher than those before the infection in all domains (p<0.05).

**Conclusion:** SARS-CoV-2 infection seems to decrease AMH levels transiently in patients with pulmonary involvement, and recovery from the disease improves FSFI scores during the pandemics.

**Keywords:** AMH, COVID-19, FSFI, pneumonia, SARS-CoV-2.

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## INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is responsible for the current pandemics, is still spreading globally despite all attempts against it. The pathophysiology of how this virus causes coronavirus disease 2019 (COVID-19) has not been completely understood yet.[1]

COVID-19 has a broad clinical spectrum. The majority of the patients are asymptomatic or present with mild flu-like symptoms, but acute respiratory distress, respiratory failure, multiple organ failure, and even death are also seen, in particular in the elderly and in those with comorbidities.[1]

Although pneumonia is a common disease, many tissues apart from the lungs are affected including the gastrointestinal system, musculoskeletal system, bone marrow, liver, heart, and kidney. This multiorgan involvement of the disease has been attributed to the wide expression of angiotensin-converting enzyme-2 (ACE2) receptor, which is the route of entry of the virus into the cell. ACE2 is also expressed in the genital organs including the ovaries[1] suggesting an impact on reproductive tissues.[2]

Currently, there are also not enough data about the effect of COVID-19 on genital organs and sexual behavior. However, a few studies that differed from one country to another stated a change in sexual behavior. In some people, COVID-19 infection had positively affected their sex lives while others reported neutral or negative effects.[3]

In this study, as the sexual function is strongly related to the estrogenic activity and hence the ovarian function in sexually active, we aimed to illustrate the changes in both female sexual behavior and anti-Müllerian hormone (AMH) as a marker of ovarian activity in patients with SARS-CoV-2 infection.

## MATERIAL AND METHODS

This study was approved by the local ethics committee (approval number: 273). Written informed consent was obtained from all patients. Sexually active 55 women aged between 20 and 45 years with COVID-19 pneumonia who were hospitalized in the COVID-19 pandemic clinic of Şehit Prof. Dr. İlhan Varank Training and Research Hospital between April 1, 2020, and May 17, 2020, were investigated.

Those who needed intensive care unit admission or have ovarian cysts were excluded. A serum AMH measurement and a valid female sexual function index (FSFI) scores[4] were obtained from the patients at the time of hospitalization. All of these patients recovered from COVID-19 and then these measures were repeated 60–100 days after the first measurements.

Of the 55 patients, two refused to be involved in the study and 28 patients dropped out during follow-up. The data of the remaining 25 patients were obtained and used for comparisons in this study.

First FSFI scores were obtained at the time of hospitalization because COVID-19 pneumonia represented their sexual activity of the last one month before the infection. The second scores were obtained at their visits 60–100 days later represented the sexual activity following recovery from the disease.

**Table 1: Serum AMH levels and FSFI scores in 20–45 years old women with COVID-19 pneumonia who did not need intensive care unit admission. The first and second measurements were obtained at the hospital during COVID-19 pneumonia and 60–100 days after recovery (n=25)**

| | First measurements | Second measurements | p |
|---|---|---|---|
| AMH | 2.29±1.84 | 2.92±2.46 | 0.017 |
| Desire | 2.57±1.36 | 3.06±1.42 | 0.043 |
| Arousal | 1.56±1.56 | 2.14±1.73 | 0.043 |
| Lubrication | 1.39±1.76 | 2.88±1.90 | 0.001 |
| Orgasm | 1.12±1.66 | 2.24±1.97 | 0.005 |
| Satisfaction | 1.10±1.73 | 2.26±2.21 | 0.008 |
| Pain | 1.30±2.03 | 2.35±2.40 | 0.038 |
| Total | 9.04±8.90 | 14.92±10.24 | 0.003 |

AMH: Anti-Müllerian hormone; FSFI: Female sexual function index.

### Statistical Analysis

Statistical Package for the Social Sciences (SPSS) 15.0 (SPSS, Inc., Chicago, IL, USA) software was used for statistical analyses. Paired t-test and Wilcoxon signed-rank test were used for comparisons as appropriate. Continuous data were given as mean ± standard deviation (SD) and minimum–maximum (min–max). p=0.05 was accepted as the degree of significance.

## RESULTS

Of the initially assessed 55 patients, 23 patients (41.82%) had comorbidities (5 had type II diabetes, 5 had hypothyroidism – 1 together with ankylosing spondylitis, 5 had allergic asthma – 1 together with familial Mediterranean fever, 2 had hypertension – one together with hepatitis B, 1 had rheumatoid arthritis, 1 had hyperaldosteronism, 1 had Wilson's disease, 1 had ulcerative colitis, 1 had Wegener's granulomatosis, and 1 had gastritis with migraine). The mean age of the patients was 34.09±7.87 (20–45) years. Mean gravidity and parity of the patients were 2.53±2.45 (0–10) and 1.86±1.69 (0–7), respectively.

AMH measurements and FSFI scores were obtained from 25 patients. Statistically significant differences were observed between the AMH measures and FSFI scores obtained at the hospital and 60–100 days after the first measurements ($p<0.05$, Table 1).

## DISCUSSION

Results of the studies on the effect of COVID-19 pandemics on sexual behavior are contradictory. This might not only be a result of different socioeconomic states of the reports from different countries but also reflect the differential influence of the pandemics on human psychological states,[3] for example, staying out of work and resulting economic burden, restrictions forcing to stay at home without activities, and fear of being infected causes stress, depression, and anxiety. On the other hand,

it has also been shown that overall stressful conditions such as wars and disasters might increase people's libido and increase sexuality.[5]

In the present study, the first obtained FSFI scores represented the women's sexual behavior under generalized public restrictions for COVID-19 pandemics (during partial lockdown including weekend curfew) while they were not yet infected. The second FSFI scores obtained 60–100 days later represented the sexual behavior after their recovery from the SARS-CoV-2 infection while the intensity of the first wave of the pandemics relieved in the country and the public restrictions were not in place. The second FSFI scores were higher than the first scores in all parameters (desire, arousal, lubrication, orgasm, satisfaction, pain, and total, $p<0.05$; Table 1). This finding might suggest a positive effect of recovery from the SARS-CoV-2 infection because of getting rid of the fear of being infected or relief of the restrictions and a consequent improvement in psychological wellness. Regarding the overall FSFI scores observed in the literature, one may find our scores low, but unfortunately it was not possible to make a comparison with the scores before the pandemics. That is why according to the results of this study, we cannot conclude a negative effect of the pandemics on female sexual functions.

In an extensive review of the literature conducted by Segars et al., the possible effect of SARS-CoV-2 infection on human genital organs and pregnancy has been argued. It has been suggested that SARS-CoV-2 virus enters human cells by using ACE2 receptors, which express various tissues and organs in the human body, including female genitalia. In addition, differential expression of these receptors has been argued as a possible explanation for the wide range of clinical severity of the disease. It is not known whether the SARS-CoV-2 virus uses ACE2 receptors in the reproductive system and the effect of this virus on the ovaries has not been investigated yet.[6,7]

In the present study, it was observed that the AMH levels of women in the reproductive period measured during SARS-CoV-2 infection with pulmonary involvement were lower than those measured after recovery from the infection (Table 1). It is not known whether this finding was a result of direct infection and suppression of the ovaries by the SARS-CoV-2 virus or secondarily as a result of the systemic effects of the illness.

## CONCLUSION

The SARS-CoV-2 infection seems to decrease AMH levels transiently in patients with pulmonary involvement, and recovery from the disease improves FSFI scores during the pandemics.

## Statement

**Ethics Committee Approval:** The Şehit Prof. Dr. İlhan Varank Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 25.06.2020, number: 273).

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

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**Conflict of Interest:** The authors have no conflict of interest to declare.

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