

Impact of COVID-19 Pandemic on Stress Level and its Association with Gingival and Periodontal Status of Nursing Staffs of an Institution: A Cross-sectional Study

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Abstract

Introduction: Coronavirus disease (COVID-19) has created an unprecedented situation worldwide and has set forth an array of challenges before us. Health-care workers especially nursing staffs have encountered a considerable degree of stress during the pandemic. A strong association exists between stress level and periodontal disease, hence creating a link between deterioration of periodontal status by COVID-19 pandemic-induced stress.

Aims and Objectives: The aim of the study is to estimate the impact of COVID-19 pandemic on stress levels and its correlation with gingival and periodontal status in nursing staff of an institution in Bangalore.

Materials and Methods: This is a cross-sectional questionnaire survey on 265 nursing staffs of the institution during the period of March and April 2022. Data for stress were obtained from social impact of COVID-19 and self-formulated questionnaire survey with demographic details. Diagnosis of gingival and periodontal status was given according to 2017 classification of periodontal and peri-implant disease and conditions by the American Academy of Periodontology and the European Federation of Periodontology.

Results: COVID-19 had a negative impact on stress level of nursing staffs. All age groups were found to be under moderate-to-severe stress.

Conclusion: A relatively high proportion of nursing staff experienced moderate-to-severe stress during the third wave of COVID-19 pandemic and a positive association was seen to exist between stress and periodontitis.

Key words: Coronavirus, Coronavirus diseases 19, Oral hygiene, Periodontitis, Stress

INTRODUCTION

In January 2020, the World Health Organization (WHO) declared the outbreak of novel coronavirus disease (COVID-19) as an international public health emergency.

It was stated that there was a high COVID-19 spread risk to various other countries across the world. COVID-19 was characterized as pandemic in March 2020 by the WHO.

COVID-19 is a severe acute respiratory infection which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which emerged in Wuhan, Hubei, China, with subsequent global spread.^[1] In most cases, the disease resulted in mild symptoms but in some cases, depending on patient age and the presence of comorbidities, the disease also presented multi-organ failure and severe pneumonia, leading to mortality.^[2] Although risk factors have been highlighted, such as age, sex, and comorbidities

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which increase the risk of mortality,^[3,4] there is still a large proportion of patients with no identified risk factors who suffer from severe COVID-19-related adverse effects and complications.^[5-7]

Periodontitis is a multifactorial chronic inflammatory disease associated with plaque biofilms and is characterized by the progressive destruction of the tooth-supporting structures.^[8] As the inflamed periodontal tissues release host-derived pro-inflammatory cytokines (such as tumor necrosis factor- α , interferon- γ , prostaglandin E2, interleukin (IL)-1 β , IL-4, IL-6, IL-10, ferritin, and C-reactive protein) and tissue destruction mediators into the circulatory system, therefore periodontitis increases the systemic inflammatory burden.^[9-12] This can activate an acute-phase response in the liver and can amplify systemic inflammation.^[11] Pathogenesis of respiratory diseases such as pneumonia and chronic obstructive pulmonary disease involves periodontopathic bacteria and holds relation with systemic diseases, including diabetes and cardiovascular disease.^[13-15] Periodontopathic bacteria were detected in the bronchoalveolar lavage fluid of patients with COVID-19. There are similarities between the cytokine storm in severe COVID-19 infections and the cytokine expression profile in periodontitis, suggesting a possible link between periodontitis and COVID-19 and its associated complications.^[16-19] The increased expression level of angiotensin-converting enzyme 2 in the oral cavity, promoted by periodontopathic bacteria, may increase the SARS-CoV-2 infection rate. An elevated IL-6 level is associated with excess inflammation, which contributes to increased mortality in patients with COVID-19.

The clinical course of COVID-19 and its systemic symptoms might be exacerbated by inflammatory response in patients with periodontal diseases. The potential association of COVID-19 severity and periodontitis can be explained by the alteration in the expression of cellular receptors enhancing the virulence of SARS-CoV-2 and by periodontal pockets acting as viral reservoirs. Very few studies have been conducted to identify the association between periodontitis and COVID-19.

A great deal of stress, anxiety, and depression throughout the world was generated during the surge of the pandemic that left the world with uncertainty of living and restricted lifestyles.^[20] The psychological stress was an important associated factor that had an impact during COVID-19 situation among both health-care workers and non-health-care working professionals.^[21,22] Most commonly affected were the health-care professionals who were working as frontline warriors, especially the nursing staff.^[23-26] They suffered from severe psychological side-effects which may be attributed to extremely long working hours, heavy

workload, and socioeconomic status along with society pressure during the pandemic.^[27-29]

Various studies have shown a strong association between periodontal disease and stress.^[30,31] Health-care workers especially the nursing staffs who were the frontline warriors were the highly stressed community. The pandemic has almost being there for 2 years and there is a high possibility of the stress caused by pandemic to have a negative effect on periodontal health.^[32-34]

In a number of developed countries, mental health institutions and health authorities have widely deployed counseling services and psychological assistance to combat the stress and anxiety developed due to COVID-19 outbreak.

In most developing countries, these essential services are limited or absent, including India. Moreover, there are a limited number of mental health interventions and evaluations that have targeted health-care workers in frontline settings.^[35-37] Research is limited about stress and anxiety among health-care workers in the Indian context, particularly during the COVID-19 outbreak.

Hence, the aim of the present study was to evaluate the impact of COVID-19 (delta variant) pandemic on stress levels and to find its association with the gingival and periodontal status of nursing staff in an institution.

MATERIALS AND METHODS

Study Setting

This observational cross-sectional questionnaire-based study and clinical examination were carried out on 270 nursing staff of Vydehi Institute of Dental Science and Medical Science and Research Centre, Bangalore, Karnataka, from March 2 to April 30, 2022 (2 months). These nursing staff were working or were on call in the hospitals and wards specified for COVID-19 cases and quarantine centers.

Study Design and Participants

A self-administered survey questionnaire based on data for stress was obtained from the social impact of COVID-19 with demographic details.

10 questions were taken from the Perceived Stress Scale and 6 questions from the Social Impact of COVID-19 survey. Questionnaire was translated into local language (Kannada) for easy understanding for the participants. The participants included the nursing staff working in the institute hospital and who served at specialized COVID-19 centers during the pandemic.

Clinical examination was performed to assess the oral health status. For Gingival Health Status, bleeding on probing (BOP) was recorded and for periodontal health status, probing pocket depth (PPD) and clinical attachment level (CAL) were recorded.

Diagnosis of gingival and periodontal status was given according to the 2017 classification of periodontal and peri-implant disease and conditions by the American Academy of Periodontology and the European Federation of Periodontology.

The sample size was calculated using the Epi-info, assuming that the prevalence of stress among physicians in the COVID-19 pandemic context is 77.6% based on a previous study from the Iraqi Kurdistan Region.^[38]

Inclusion Criteria

- Female nursing staff (to avoid bias)^[39,40]
- Diploma in nursing
- Employed nursing staff during COVID-19 pandemic who have been working in the past 6 months (delta variant).

Exclusion Criteria

- Systemic diseases such as diabetes and hypertension
- External factors such as smoking
- Unemployed nursing staff during the COVID-19 pandemic or during the past 6 months (delta variant).

Study Tools

The survey questionnaire included two main parts. The first part of the questionnaire included questions on the participants' demographic and professional characteristics, including name, age, gender, highest education, qualification, marital status, total income, etc.

The second part of the questionnaire included 2 groups to measure the stress scale.

- Group-A included the 10 items from the perceived stress scale (precise measure of personal stress) to measure stress in the past 6 months (post-COVID-19)
- Group-B included 6 questions to measure psychosocial stress and had questions about thinking of the situation since the introduction of COVID-19 restrictions.

Part II –A of the questionnaire that included the 10 items from the Perceived Stress Scale measured the stress in the past 6-month post-COVID-19. The participants were asked to answer fairly quickly. That is, do not try to count up the number of times they felt a particular way [Table 1].

The nursing staff were asked about their thoughts and feelings over the past 6 months and during the COVID-19 time. The participants were asked to select the

Table 1: The questions asked in the perceived stress scale

S. No	Questions asked In the past 6-month (post-COVID-19), how often
1	Have you been upset because of something that happened unexpectedly?
2	Have you felt that you were unable to control the important things in your life?
3	Have you felt nervous and "stressed"?
4	Have you felt confident about your ability to handle your personal problems?
5	How often have you felt that things were going your way?
6	Have you found that you could not cope with all the things that you had to do?
7	Have you been able to control irritations in your life?
8	Have you felt that you were on top of things?
9	Have you been angered because of things that were outside of your control?
10	Have you felt difficulties were piling up so high that you could not overcome them?

frequency of feeling or thinking a certain way from never to very often.

0 = never

1 = almost never

2 = sometimes

3 = fairly often

4 = very often.

The total perceived stress scale score was calculated by summation of the scores of each question. The higher the scores meaning, the greater the levels of stress. For the four positively stated items (items 4, 5, 7, and 8), the perceived stress scale scores were obtained by reverse scoring the responses (i.e., 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0). The total sum score of the perceived stress scale can range from 0 to 40.

The total scores of this measurement were interpreted as follows:

- 0–13 scores were considered low stress,
- 14–26 scores were considered moderate stress
- 27–40 scores were considered high perceived stress.

Part –II B included 6 questions to measure psychosocial stress and included questions about thinking of the situation since the introduction of COVID-19 restrictions. It included 6 questions [Table 2].

As most of the questions in the survey were set as required questions in the two scales, we did not have partial or incomplete responses.

Clinical evaluation for gingival and periodontal health status was done by measuring:

- BOP for gingival health status
- PPD, CAL for periodontal health status.

Table 2: The questionnaire in psychosocial stress**S. No Questions asked**

1	Have you been employment status during COVID-19 pandemic time?
2	Have you been employed in COVID-19 ward during the pandemic?
3	Has the stipulated leaves been canceled in the past 6 months (during the delta wave)?
4	Has the working hours increased during the COVID-19 pandemic time?
5	Were the neighbors supportive of their stay while working during the COVID-19 pandemic time?
6	Were you able to go home during COVID-19 pandemic time?

Diagnosis was made according to the 2017 classification of periodontal and peri-implant disease and conditions.

Before data collection, official written ethical approval was obtained from the Institutional Research Ethics Committee (Reference Number-VIDS-IEC/PG/APP/2022/012). The participants were requested to provide a written, informed consent before completing the survey. The survey was anonymous, and confidentiality of information was maintained.

RESULTS

A total sample of 265 nursing staff in the study were given the questionnaire to check the perceived stress scale and psychosocial stress components out of which 260 nursing staff responded with a completely filled questionnaire survey and opted for clinical examination.

Association between Age Group and Periodontitis

The study population age ranged from 25 to 60 years, where participants in age group of <35 years were 38.5% (100), in age group between 35 and 44 years were 46.9% (122), and in age group more than 44 years were 38% (14.6).

Among the study population, age group of <35 years showed that maximum of 55% (44) of the study subject was found to be possessing generalized gingivitis whereas 42.7% (35) presented with localized periodontitis stage-II, 14.9% (10) of study population also presented with localized periodontitis stage-I, and 47.8% (11) presented with gingival health. In the age group between 35 and 44 years, 85.1% (57) showed localized periodontitis stage-I, 52.2% (12) showed gingival health, 45% (36) with generalized gingivitis, and 11% (9) with localized periodontitis Stage-II and 10% (8) with localized periodontitis Stage-III. The age group comprising more than 45 years showed 46.3% (38) with localized periodontitis stage-II [Table 3 and Graph 1].

An association between age group and periodontitis has been observed in the study conducted; the prevalence of moderate and severe stress was found with $P < 0.05$.

Pearson Chi-square value for the cross-table analysis was found to be 1.502.

Spearman correlation value for the descriptive parameters analysis was found to be +0.334.

Association between Age Group and Stress Level

Among the study population of 260 nursing staff in the institution, the association between age group and stress level had a $P < 0.05$ which was statistically significant [Table 4].

Among those who responded to the completely filled questionnaire, under age group of <35 years, 38.5% (100) of the study population were found to be under some form of stress, 40.9% (88) of them showed to have moderate stress, and 26.7% (12) presented with severe stress.

In age group between 35 and 44 years, 46.9% (122) were found to be under some form of stress, where 48.4% (104) presented with moderate stress and 40% (18) severe stress was found to prevail. In the age group of more than 44 years, 14.6% (38) were shown to be under some form of stress. Among them, 10.7% (23) presented moderate stress while 33.3% (15) showed severe stress [Graph 2].

Pearson Chi-square value for cross table analysis was found to be 15.57.

Association between COVID-19-induced Perceived Stress and Periodontal Health Status

A positive association between COVID-19-induced perceived stress and periodontal health status was seen with $P < 0.05$ which was statistically significant [Table 5].

The study presents strong association between moderate stress and generalized gingivitis among 62.5% (50) of study population. Association between moderate stress and localized periodontitis stage-I was found to be 100% (67) and also localized periodontitis stage-II showed association with moderate stress with 81.7% (67) [Graph 3] apart from this severe stress showed association of 45.0% (30) generalized gingivitis and 11.0% (15) with localized periodontitis stage-II [Graph 4].

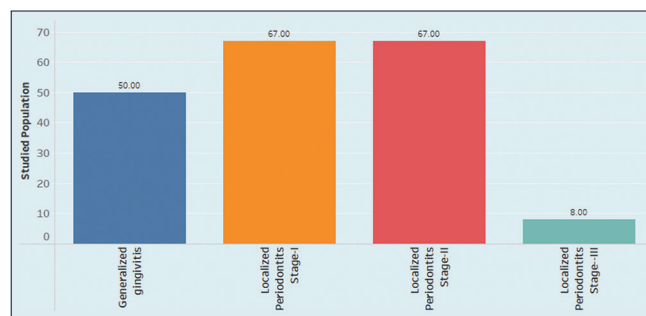
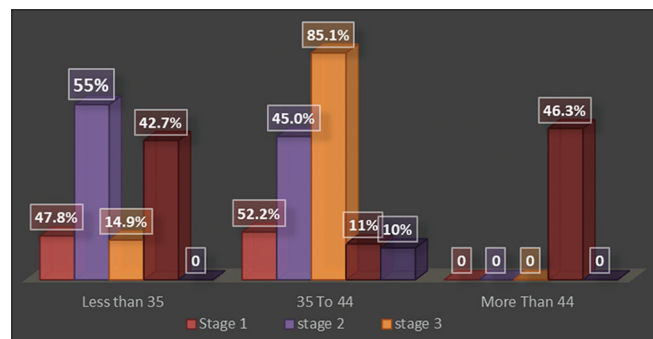
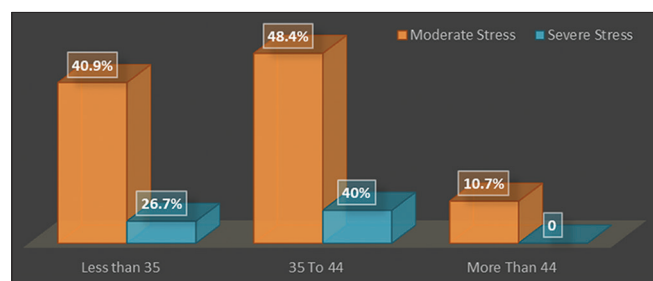
In this study, 82.7% (215) of study population was seen to present with moderate stress and 17.3% (45) presented with severe stress.

Table 3: Association between age group and periodontitis

Age group	Periodontal condition						Pearson Chi-square	P-value	Spearman correlation
	Gingival health	Gen. gingi vitis	Loc. Perio-I	Loc Perio-II	Loc Perio-III	Total			
<35 years	11 47.8%	44 55%	10 14.9%	35 42.7%	0	100 38.5%	1.502	0.000	+0.334
35–44 years	12 52.2%	36 45%	57 85.1%	9 11.0%	8 10%	122 46.9%			
>44 years	0	0	0	38 46.3%	0	38 14.6%			

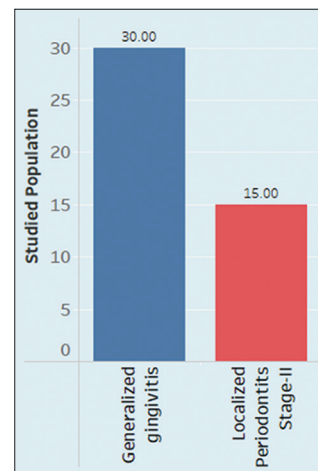
Table 4: Association between age group and stress level

Age group	Stress level classification			Pearson Chi-square	P-value
	Moderate stress	Severe stress	Total		
<35 years	88 40.9%	12 26.7%	100 38.5%	15.57	0.000
35–44 years	104 48.4%	18 40.0%	122 46.9%		
>44 years	23 10.7%	15 33.3%	38 14.6%		

**Graph 3: Association between moderate stress and periodontitis****Graph 1: Association between age group and periodontitis.**
 $P < 0.05$ therefore statistically significant**Graph 2: Association between age group and stress level**

Pearson Chi-square cross-table analysis was found to be 43.35.

Psychosocial stress was also studied by questionnaire study in part-II-B of the questionnaire in the present study.

**Graph 4: Association between severe stress and periodontitis**

Employment Status during COVID-19 Pandemic Time

The first parameters were included to analyze if the nursing staff were employed during COVID-19 pandemic time.

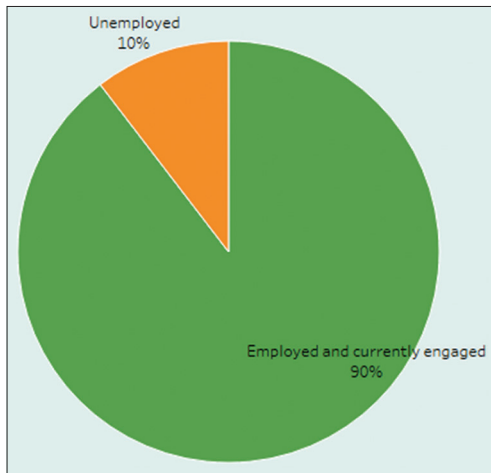
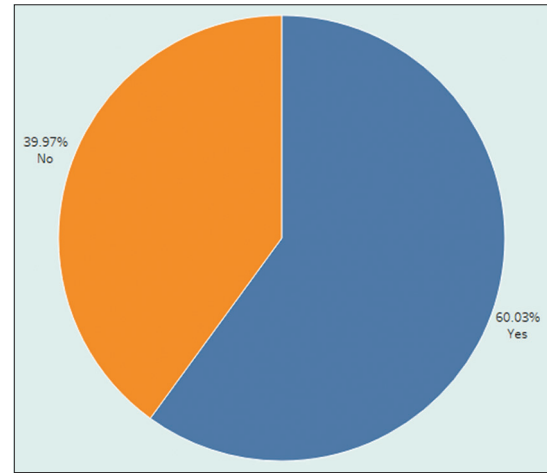
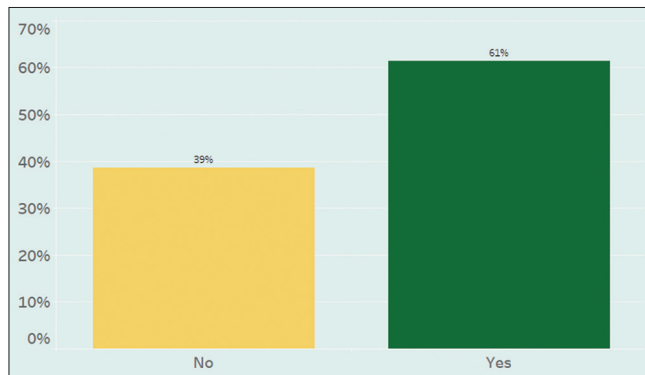
The study found that 10% (26) of total staff under study were unemployed and 90% (234) were employed during COVID-19 [Graph 5].

Employed in COVID-19 Ward

The second parameter checked in psychosocial analysis was if the nursing staff were employed in COVID-19 ward during the pandemic.

Table 5: Association between stress and periodontitis

Stress level	Periodontal condition					Pearson Chi-square	P-value
	Gingival health	Gen. gingivitis	Loc. perio-I	Loc. perio-II	Loc. perio-III	Total	
Moderate stress	23 100%	50 62.5%	67 100%	67 81.7%	8 100%	215 82.7%	43.35 0.000
Severe stress	0	30 45.0%	0	15 11.0%	0	45 17.3%	

**Graph 5: Employment status during COVID-19 pandemic time****Graph 7: Cancelled leaves****Graph 6: Employed in COVID-19 ward**

The response from the questionnaire showed that 61% (158) were having COVID-19 ward duty and 39% (100) did not have COVID-19 ward duty [Graph 6].

Stipulated Leaves that Were Cancelled in the past 6 Months-during the Delta Wave of COVID-19 Pandemic

The third parameter checked in psychosocial analysis was if the stipulated leave was canceled in the past 6 months (during the delta wave of COVID-19 pandemic) for the nursing staff.

The response in the questionnaire showed that stipulated leaves were canceled for 60.03% (156) of total study population whereas for 39.97% (104) of study population, the stipulated leaves were not canceled [Graph 7].

Working duration for Nursing Staff during Pandemic Time

The fourth parameter checked in psychosocial analysis was if the working hours were increased during the COVID-19 pandemic time.

The response in the questionnaire showed that for 63% (164) of the nursing staff, the working hours were increased; for 21% (54), there was no change; for 10% (26), there was a decrease in duration of working hour, and 6% (16) of them did not work during the pandemic [Graph 8].

Neighbor's Support for Nursing Staff While Working during Pandemic Time

The fifth parameter checked in the psychosocial analysis was if their neighbors were supportive of their stay while working during the COVID-19 pandemic time.

The response in the questionnaire study reported that 83.52% (217) did not have any impact while 16.48% (43) reported major negative impact [Graph 9].

Percentage of Nursing Staff Able to go Home during COVID-19 Pandemic Time

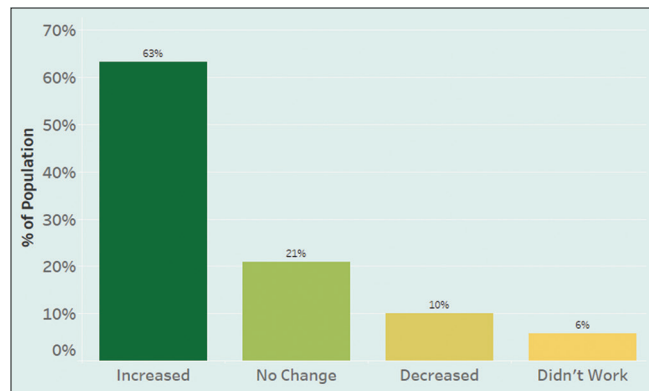
The sixth parameter checked in psychosocial analysis was if the nursing staff were able to go home during COVID-19 pandemic time.

The response to the questionnaire reported that 41.92% (109) of the nursing staff were unable to go back home

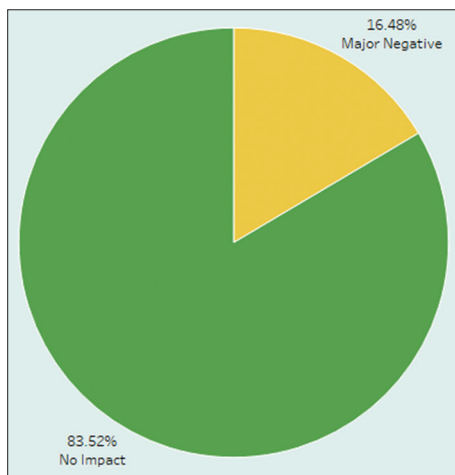
during the pandemic time and were staying in hospital. 38.85% (101) of the nursing staff were able to go back home and 19.23% (50) of nursing staff did not respond [Graph 10].

DISCUSSION

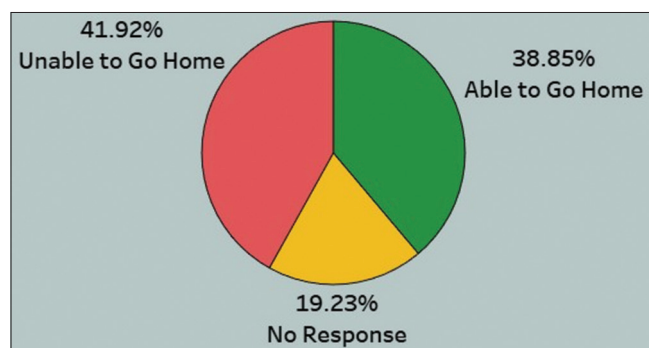
This study assessed the impact of COVID-19 (omicron variant) pandemic on stress levels and the association



Graph 8: Working duration during pandemic time



Graph 9: Neighbor's support while working during pandemic time



Graph 10: Percentage of nursing staff able to go home during COVID-19 pandemic time

between COVID-19 (third wave)-related stress with gingival and periodontal health status in nursing staff. The results revealed that COVID-19 had a negative impact on stress level of nursing staff on all age groups.

According to a study done by Mathieu Gunepin in the year 2018, he concluded that there is a high possibility of the stress caused by pandemic to have a negative effect on periodontal health. Hence, our study aimed to check and correlate the COVID-19-induced stress on periodontal health.^[33]

Most of the studies done by Campisi, Coelho *et al.*, by Anand *et al.* have checked the stress level and correlated the same with the periodontal status during the first and second waves. In our study, we have attempted to check the same during the third wave.^[34,42]

Among the various health-care workers, nurses could be at greater stress as they work closely and more frequently with the patients and for longer hours as stated by Anand *et al.* in his study.^[42] Hence, we chose them as the subjects for the present study.

The psychological stress was an important associated factor that had an impact during COVID-19 situation among both health-care workers and non-health-care working professionals. Mostly affected were the health-care professionals who were working as the frontline warriors, especially the nursing staff. A study done by Spoorthy *et al.* in 2020 found that health-care workers suffered from severe psychological sideeffects which may be attributed to extremely long working hours, heavy workload, and socioeconomic status along with society pressure during the pandemic.^[20]

The present study states the prevalence of moderate and severe stress in the study population. In age group <35 years, (40.9%) moderate stress and (26.7%) severe stress were found to exist while in age group 35–44 years, (48.4%) moderate stress and (40%) severe stress were found to prevail, and the age group >44 years showed (10.7%) moderate stress. A similar study done by Raj *et al.* in 2020 showed overall psychological issues to affect 43.51%, 41.9%, 28.3%, and 45% of the physicians, nurses, technical persons, and non-healthcare associated or general population and also during the SARS epidemic, approximately 25–30% health-care professionals were found to suffer from high levels of emotional distress.^[41]

In the present study, we find that in the age group <35 years, maximum of (55%) were found to be possessing generalized gingivitis whereas (42.7%) possessed localized periodontitis stage-II. In the age group between 35 and

44 years, 85.1% showed localized periodontitis stage-I and the age group >45 years showed (46.2%) localized periodontitis stage-II. According to a similar study done by Coelho *et al.* in 2020, 23.92% of study population had the diagnosis with periodontitis. Another similar study conducted by Anand *et al.* in 2021 presented the presence of (52.37%) gingivitis and (20.63%) severe periodontitis in total study population.^[42]

In this study, a positive association between COVID-19-induced perceived stress and periodontal health status was seen. The study presents a strong association between moderate stress and generalized gingivitis with 62.5% of study population and localized periodontitis stage-I and II (81.7%) is found to be present and also severe stress showed an association of 45.0% gen gingivitis and (11.0%) with localized periodontitis stage -II. Various other studies also presented correlation of physiological stress with periodontal status. A similar study done by Anand *et al.* in 2021 showed gingivitis (odds ratio [OR], 17.65; 95% CI, 5.95–52.37), mean CAL ≥ 2 mm (OR, 8.46; 95% CI, 3.47–20.63), and severe periodontitis (OR, 11.75; 95% CI, 3.89–35.49) with COVID-19; these findings were more prevalent in the COVID-19-infected group stating an association between periodontitis severity and COVID-19.^[42]

A similar study conducted by Coelho JMF in 2020 presented association measurements between stress and probing depth ≥ 4 mm (PR adjusted = 1.28, 95% CI [1.04 to 1.58]), stress and CAL ≥ 5 mm (PR adjusted = 1.15, 95% CI [1.01–1.31]), and stress and periodontitis (PR adjusted = 1.36, 95% CI [1.01–1.83]) showed that the frequency of these outcomes among those exposed to stress was 15–36% higher than those without the condition of stress.^[34]

CONCLUSION

A relatively high proportion of nursing staff experienced moderate-to-severe stress during the third wave of COVID-19 pandemic and a positive association was seen to exist between stress and periodontitis.

In the current study, an attempt has been made to find the impact of the third wave of this pandemic situation (omicron variant) on psychological well-being of nursing staff and its possible association with the periodontal status. Our study has reported identical findings to those reported by numerous investigators working across the globe reaffirming the need to prevent and control stress.

This study attempts at creating awareness about the importance of mental health and well-being in nursing sector which remained ignorant during the pandemic chaos.

Our experience may serve as a valuable reference while designing mental health interventions for nursing staff in future large-scale public health emergencies.

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