



## Aspect of sleep quality amid undergraduate medical students in correlation with BMI.

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### **Cover Page Footnote**

We are thankful to the JSS Academy of Higher Education and Research for providing us with the platform to carry out the study. We are deeply grateful to the study participants for providing their data for the study purpose.

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## ORIGINAL STUDY

# Aspect of Sleep Quality Amid Undergraduate Medical Students in Correlation with BMI

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### Abstract

**Purpose:** This study aimed to assess the quality of sleep among medical undergraduates from different phases of the medical program using the Pittsburgh Sleep Quality Index (PSQI) and to study the association of body mass index (BMI) with the quality of sleep among them.

**Materials and methods:** Sleep quality was assessed among 482 medical undergraduates using the PSQI. Students undergoing treatment for psychiatric illness, diabetes or hypertension, history of alcohol consumption, and smoking were excluded from the study. Obesity was ascertained by calculating the BMI and categorized into 2 groups of <22.9 and >23.0 according to the World Health Organization (WHO) guidelines for the Asian population. The chi-square test was utilized to compare seven components of PSQI and sleep quality for different phases and BMI groups and SPSS 24 was used to compare the components and the global score.

**Results:** Only 0.8% of the total sample classified their sleep as very bad whereas 69.5% classified themselves as fairly good sleepers. The study participants had an average sleep time of  $7.06 \pm 1.26$  h. The sleep duration ( $p < 0.05$ ), habitual sleep quality ( $p < 0.05$ ), sleep disturbance ( $p < 0.05$ ), and daytime dysfunction ( $p < 0.05$ ) were seen to be significantly different among the various phases. First-phase students reportedly had worse sleep quality when compared to other phases. Sleep quality is reported to be good in around 93.4% of people with BMI <22.9, and 86.9% of these students had very less sleep disturbances. Around 0.9% of the students with BMI >23 had daytime dysfunction every day.

**Conclusion:** It is necessary to create awareness among medical undergraduates about the importance of good sleep hygiene which will help them to improve their academic performance.

**Keywords:** Sleep quality, Body mass index, Surveys and questionnaire, Students, Medical

## 1. Introduction

From times immemorial, perhaps, ever since the animal and plant kingdom has taken shape, sleep has been one of the most vital, critical, indispensable, biological, physiological, and neurological processes that directly impact health and wellbeing. Pathological alterations, experimental manipulations, and medical observations have abounded in the study of human sleep-wake patterns. Sleep is essentially a systematic process characterized by decreased consciousness, changes in muscle tone, and autonomic changes required for the normal

functioning of the brain. Sleep requires a combination of various regulatory mechanisms, so interference with regular sleep patterns can be dangerous [1].

Sleep disturbances are the most common complaints that we may encounter, and different populations and age groups have a significant variation in sleep. Various studies have reported that sleep disturbance is more common among medical students than in the general population, which may have an adverse effect on their academics, physical and mental health, and quality of life. Poor sleep quality may be linked to heavy study workload (e.g., chaotic schedule, enormous syllabus, various

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clinical training, and substantial academic load), examination stress, clinical placements, emotional challenges (e.g., stress, depression, and anxiety symptoms), and significant economic pressures [2]. Global epidemiological data about sleep problems among medical students reported an extensive range of variation, ranging between 19% and 90% [3]. A study conducted among the medical students of Puducherry with a sample size of 125, reported that around 52% of them had poor quality of sleep [4]. A high prevalence of poor sleep quality (76%) was seen in a study conducted on medical students in Saudi Arabia as well [5]. Yet another study conducted on 504 medical students in Karachi, reported that 39.5% of medical students had global PSQI >5 and were classified as “poor sleepers” [6]. Out of 370 medical students in Brazil, 147 (39.5%) described that their sleep quality was either very or reasonably bad [7].

Disturbances in sleep may lead to obesity, diabetes, cardiovascular diseases, etc. Sleep-deprived people have been observed to have increased appetite, which stimulates the release of the hormone ghrelin and decreases the release of leptin. Sleep deprivation may also provide an individual with more than sufficient time to eat with reduced exercise, further disrupting sleep patterns and leading to obesity [8]. In the past 50 years, the prevalence of obesity is on the rise worldwide. It is a global health challenge because it can result in diseases like diabetes, hypertension, stroke, other cardiovascular diseases, and malignancies, contributing to the deterioration in both quality of life and life expectancy. It is also associated with unemployment, social disadvantages, and decreased socio-economic productivity, thus creating an economic burden for society [9].

Obesity is usually expressed by body mass index (BMI), which relates the body's weight to height. According to French International Obesity Task Force (IOTF), Asian individuals with a BMI of 18.5–22.9 are normal, 23–24.9 are overweight, while BMI  $\geq$ 30 are obese. In a study conducted in Lahore, 30.5% of males and 16% of females had BMI  $\geq$ 25.0 kg/m<sup>2</sup> overall affecting 21% of total medical students [10]. In another study conducted among medical students in Saudi Arabia, the frequency of obesity was reported to be 8.4% [7]. Reduced sleep patterns have been linked with obesity and vice versa in modern society [11].

The above studies show that medical students have been prone to erratic sleeping patterns. Therefore, it is crucial to understand these irregular sleep patterns and their relationship with BMI and seek solutions to reduce the risks of all the above-

mentioned health disasters. Keeping this in mind, we conducted a study among 482 undergraduate students of an Indian medical school to determine sleep quality using the Pittsburgh Sleep Quality Index (PSQI). The primary objective of this study was to explore the variations in sleep patterns among the respondents across the four phases of medical education and to correlate the sleep patterns with the respondent's BMI.

## 2. Materials and methods

A Cross-sectional study was carried out among medical undergraduates aged between 18 and 25 years. Students undergoing any treatment for psychiatric illness, presence of any diseases like diabetes or hypertension, and history of alcohol consumption and smoking were excluded from the study. Institutional Ethics Committee clearance was obtained before the commencement of the study via the letter number JSSMC/IEC/210421/06NCT/2021-22 dated 23-04-2021 and informed consent was taken from all the participants.

The general information and the quality of sleep among the medical undergraduates of different phases were checked by collecting data in a structured questionnaire using PSQI. This is a self-reported questionnaire that evaluates an individual's sleep quality over 1 month. It consists of 19 individual items, yielding seven components finally generating one global score. Each item was measured on a scale of 0–3 intervals. The seven component scores were added up to obtain the final global score ranging from 0 to 16, where a lower score denotes healthier sleep quality. Weight in kg, height in cm was taken and BMI was calculated using the formula weight in kilograms divided by height in meter<sup>2</sup>. The students were categorized into 2 groups of <22.9 and >23.0 according to the World Health Organization (WHO) guidelines for the Asian population.

### 2.1. Statistical analysis

The collected data from the filled questionnaires were entered into tables using Microsoft Excel. The data were categorized into 4 phases of the medical program: Group A consisting of the first phase, Group B having the second phase, Group C comprising the third phase, and Group D with the fourth phase and interns. The results were calculated for the total sample and comparisons among and in-between the groups were undertaken. SPSS software version 24 was used for statistical analysis. The association was tested using the chi-square test for among-group comparisons of the seven

components of the PSQI, and between-group comparisons of the components and global PSQI. The association was considered statistically significant when  $p < 0.05$ .

### 3. Results

A total of 482 undergraduate medical students with an average age of  $21.34 \pm 1.79$  years comprising 58.5% of females and 41.5% of males participated in this survey and were categorized into 4 groups based on the phase of the medical program they were studying. The number of students in different phases of the study were as follows: 107(22.2%) first phase, 134(27.8%) second phase, 111(23%) third phase, and 130(27%) fourth phase. The average BMI of the study population was  $24.23 \pm 3.64$ . Other demographic details are depicted in [Table 1].

The seven components of the PSQI were analyzed in all the study participants and the results are depicted in Table 2 and Table 3. Only 0.8% of the study participants classified their sleep as very bad whereas 69.5% classified themselves as fairly good sleepers. A good number of students i.e., 45% reported taking less than 15 min to fall asleep and almost equal number of students (41%) took 16–30 mins. Only 1% of them took more than 1 h to sleep. About 6.2% of students were sleeping for less than 5 h. The habitual sleep efficiency among 21.6% of the students was less than 65%. While analyzing sleep disturbances, it was found that around 69.9% of the participants have a score of 1–9, 6.6% of them have to use sleep medication less than once a week and 1.2% of the students have to use them for more than or equal to 3 times a week. The daytime dysfunction among 48.1% of the subjects is scored as 3–4. Sleep quality, sleep latency, sleep duration,

sleep medication, and daytime dysfunction were seen to be significant in the study groups [Table 2].

The Global PSQI is  $< 5$  in around 62% of the participants, which is significant. The mean Global scores for groups A, B, C, and D are  $5.81 \pm 2.38$ ,  $4.24 \pm 2.91$ ,  $5.23 \pm 2.82$  and  $4.73 \pm 2.89$  respectively. Around 37.4% of the students were found to be poor sleepers (global PSQI more than 5) [Table 3].

On analyzing the relation between sleep quality and BMI, BMI  $>23$  was found among 65.1% of respondents. Sleep duration has been seen to be on the lower side in 15.9% of students with BMI  $>23$ . Sleep quality is reported to be good in around 93.4% of people with BMI  $<22.9$ . Very less sleep disturbance was noticed in 86.9% of the students with a BMI  $<22.9$ . Around 0.9% of the students with BMI  $>23$  have daytime dysfunction every day. Sleep quality, sleep duration and sleep disturbances, and daytime dysfunction are seen to be significant. No other significant difference among the other PSQI components could be found between the 2 groups based on BMI [Table 4].

In addition, on comparing the scores of PSQI among the groups we found out that sleep duration was significantly different between A and C ( $p \leq 0.001$ ); A and B ( $p = 0.039$ ). The habitual sleep quality was significantly different when we compare groups C and D ( $p = < 0.001$ ). The sleep disturbances were significantly affected in groups A and D ( $p \leq 0.001$ ); B and D ( $p = 0.010$ ); C and D ( $p \leq 0.001$ ). The daytime dysfunction was significantly different between A and D ( $p \leq 0.001$ ); B and C ( $p \leq 0.001$ ); A and C ( $p = 0.032$ ). The global PSQI was significantly different between B and C ( $p \leq 0.001$ ); C and D ( $p \leq 0.001$ ) [Table 5].

### 4. Discussion

Sleep disorders like hypersomnia and insomnia are often found among medical students. Such disorders have a very high potential to negatively impact the academic performance of students. Besides, numerous populations based epidemiological studies have commonly associated adverse health outcomes like cardiovascular diseases, diabetes, and weight gain with sleep deprivation. However, truth be told, the clinical construct of sleep poses a very complex area of study. The complexity emerges from the diversity of variables, both quantitative, like duration of sleep, the number of sleep breaks during sleep time, etc., and qualitative, like satisfaction from sleep, depth of sleep, etc., that needs to be examined to measure the quality of sleep. Fortunately, the Pittsburgh Sleep Quality Index provides us with a highly reliable, valid, and standardized measuring tool to measure sleep quality.

Table 1. Represents the demographic details of the study subjects.

Study Parameters	N	%
Age in years (Mean $\pm$ S.D.)	$21.34 \pm 1.79$	
Gender		
Male	200	41.5
Female	282	58.5
Year of study		
I	107	22.2
II	134	27.8
III	111	23.0
IV	130	27.0
BMI (Mean $\pm$ S.D.)	$24.23 \pm 3.64$	
Religion		
Hindu	368	76.4
Muslim	32	6.6
Christian	18	3.7
Others	64	13.3

(S.D.: Standard deviation).

Table 2. Pittsburg sleep quality index (PSQI) components in students of the different years of study.

Components	Group A n = 107	Group B n = 134	Group C n = 111	Group D n = 130	Students, n (%)	P value
<i>Subjective Sleep Quality</i>						
Very Good	18(16.8)	42(31.3)	24(21.6)	46(35.4)	130(27)	0.044
Fairly Good	85(79.4)	87(64.9)	86(77.5)	77(59.2)	335(69.5)	
Fairly Bad	4(3.7)	4(3.1)	0(0)	5(3.8)	13(2.7)	
Very Bad	0(0)	1(0.7)	1(0.9)	2(1.5)	4(0.8)	
<i>Sleep Latency</i>						
≤15 min	55(51.4)	66(49.2)	43(38.7)	53(40.8)	217(45)	0.023
16–30 min	36(33.6)	57(42.57)	44(39.6)	61(46.9)	198(41)	
31–60 min	16(14.9)	10(7.4)	22(19.8)	13(10)	61(12.6)	
>60 min	0(0)	1(0.7)	2(1.8)	3(5)	5(1)	
<i>Sleep Duration</i>						
>7h	9(8.4)	89(66.4)	32(28.8)	91(70)	221(45.8)	<0.001
6–7h	63(58.9)	28(20.9)	69(62.2)	24(18.5)	184(38.2)	
5–6h	20(18.7)	9(6.7)	7(6.3)	11(8.5)	47(9.7)	
<5 h	15(14)	8(6)	3(2.1)	4(3)	30(6.2)	
<i>Habitual Sleep Quality</i>						
>85	73(68.2)	86(64.1)	68(61.3)	65(50)	227(47.1)	0.162
75 to 84	8(7.4)	18(13.4)	13(11.7)	27(20.8)	66(13.7)	
65 to 74	2(1.9)	6(4.4)	4(3.6)	8(6.2)	20(41.5)	
<65	24(22.4)	24(18)	26(23.4)	30(23.1)	104(21.6)	
<i>Sleep Disturbances</i>						
0	22(20.6)	22(16.4)	25(22.5)	28(21.5)	97(20.1)	0.175
1 to 9	71(66.3)	104(77.6)	77(69.4)	85(65.4)	337(69.9)	
10 to 18	14(13.1)	8(6)	8(7.2)	14(10.8)	44(9.1)	
19 to 27	0(0)	0(0)	1(0.9)	3(2.3)	4(0.8)	
<i>Use of sleeping medication</i>						
Not during past month	105(98.1)	121(90.3)	106(95.5)	108(83.1)	440(91.3)	0.009
Less than once a week	0(0)	11(8.2)	2(1.8)	19(14.6)	32(6.6)	
Once or twice a week	1(0.9)	1(0.7)	1(0.9)	1(0.77)	4(0.8)	
Three or more times of week	1(0.9)	1(0.7)	2(1.8)	2(1.5)	6(1.2)	
<i>Daytime Dysfunction</i>						
1 to 2	18(7.4)	70(52.2)	30(27)	53(40.8)	171(35.5)	<0.001
3 to 4	55(51.4)	48(35.8)	61(54.9)	68(52.3)	232(48.1)	
5 to 6	32(29.9)	14(10.4)	20(18)	8(6.1)	74(15.3)	
Everyday	2(1.9)	2(1.5)	0(0)	1(0.7)	5(1)	

The PSQI instrument is a self-reported questionnaire validated worldwide and also allows quantification [12]. Nineteen individual items generate seven “component” scores: “subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction”. The global score is calculated by taking the sum of the scores for the above seven components [13]. A global PSQI score <5 is considered as good sleep quality and a global PSQI score >5 is considered as bad sleep quality. Thus, the PSQI results help plan steps to raise awareness of sleep disorder problems.

Table 3. The Global Pittsburg sleep quality index (PSQI) in students of the different years of study.

Global PSQI	Group A	Group B	Group C	Group D	%	P-value
<5	51	102	65	81	62	0.001
5–8	41	19	35	40	28.1	
9–16	15	12	10	8	9.3	

In the current study, 74% of the students returned the filled questionnaire which is consistent with the adherence rate reported in the literature for this type of questionnaire (70%) [7]. In terms of involvement by gender, we found that females participated more actively in the study i.e., 58.5%, which is consistent with other studies that have reported 59.2% [14], and 66.62% [7]. We would also like to mention that the predominance of female participation was not consistent with a few studies that used this instrument with medical students. One particular study had a high proportion of male participation (66.0%) [15]. But the study by Barger et al. has reported that the quality of sleep is poor among females when compared to males because women are seen to have psychological stress and hormonal changes and are also involved in multiple tasks [16].

The number of students in different phases in our study were consistent with a study carried out in a medical school from Haryana with first-phase

Table 4. Pittsburg sleep quality index (PSQI) components in two groups of study participants classified based on their BMI (BMI &lt;22.9 and BMI &gt;23).

Components	BMI <22.9 n = 168	BMI >23 n = 314	P value
<i>Subjective Sleep Quality</i>			
Very Good	36(21.4)	94(29.9)	0.016
Fairly Good	121(72)	214(68.1)	
Fairly Bad	9(5.3)	4(1.3)	
Very Bad	2(1.2)	2(0.6)	
<i>Sleep Latency</i>			
≤15 min	63(37.5)	154(49)	0.111
16–30 min	79(47)	119(37.9)	
31–60 min	24(14.3)	37(11.8)	
>60 min	2(1.2)	4(1.3)	
<i>Sleep Duration</i>			
>7h	62(37)	159(50.6)	0.016
6–7h	79(47)	105(33.4)	
5–6h	18(10.7)	29(9.2)	
<5 h	9(1.2)	21(6.7)	
<i>Habitual Sleep Quality</i>			
>85	94(56)	198(63)	0.289
75 to 84	22(13.1)	44(14)	
65 to 74	8(23.8)	12(3.8)	
<65	44(26.2)	60(19.1)	
<i>Sleep Disturbances</i>			
0	27(16.1)	70(22.3)	0.033
1 to 9	119(70.8)	218(69.4)	
10 to 18	22(13.1)	22(7)	
19 to 27	0(0)	4(0.1)	
<i>Use of sleeping medication</i>			
Not during past month	154(91.6)	286(91.1)	0.294
Less than once a week	12(7.1)	20(6.3)	
Once or twice a week	2(1.2)	2(0.6)	
Three or more times of the week	0(0)	6(1.9)	
<i>Daytime Dysfunction</i>			
1 to 2	41(24.4)	130(41.4)	0.001
3 to 4	90(53.6)	142(45.2)	
5 to 6	35(20.8)	39(12.4)	
Everyday	2(1.2)	3(0.9)	
<i>Global PSQI</i>			
<5	88(52.4)	211(67.2)	0.005
5–8	58(34.5)	77(24.5)	
9–16	21(12.5)	24(7.6)	

students showing maximum participation [14]. The average BMI of the study population as seen in our study has been found in other studies too, (22.74 ± 3.71) [8]. About 0.8% of the total study participants classified their sleep as very bad. This finding was inconsistent with another study where 72.7% of the students were classified as bad sleepers

[14]. Yet another study reported that 40% of the students had poor sleep quality. The literature review suggested that a significant percentage of medical students suffer from bad quality of sleep. Surprisingly, the current study does not validate the insights from similar other research studies. In fact, 69.5% of the respondents of this study classified

Table 5. Depicts the p-value when various components of PSQI and the global PSQI were compared among the different groups.

Groups	Components							PSQI
	1st	2nd	3rd	4th	5th	6th	7th	
A vs B	1	1	0.039	1	1	1	1	0.345
A vs C	1	0.887	<0.001	1	1	1	0.032	1
A vs D	1	0.121	0.843	0.245	<0.001	0.509	<0.001	1
B vs C	1	1	1	1	1	1	<0.001	<0.001
B vs D	1	0.573	1	1	0.010	1	1	1
C vs D	0.784	1	1	<0.001	<0.001	1	1	<0.001

themselves as having a fairly good sleep. The poor sleep quality which was observed in group A is seen to be consistent with reports from other studies [2,3,6,7]. These studies under reference found poor sleep quality in new students. In yet another study, it was found that first-year undergraduates suffer from poor sleep hygiene habits. The researchers have attributed their findings to Internet surfing at night, poor social life, bad eating habits, etc. among first-year undergraduates [14]. The percentage of students with very bad sleep quality is seen to be increasing with each successive year of study.

Around 12.6% of the students reported taking >30 min to fall asleep, 41% reported taking 16–30 min to fall asleep. In some studies, it has been reported that 31.1% [14], and 20.4% [17] of the students are taking >30 min to fall asleep. There are still 1% of the students who are taking more than 1 h to sleep. Around 14% of group A students have been seen to have less than 5 h of sleep which again explains the theory of lower sleep duration in first year undergraduates [14]. The average sleep duration among the students in this study was  $7.06 \pm 1.26$  h. A similar result was reported in another study where the sleep duration among students was  $7.1 \pm 1.21$  h [14]. While analyzing sleep disturbances, it was found that majority (90%) of the people have scored 0 or 1–9 which suggests that they don't snore, wake up in the middle of the night for washroom, bad dreams, etc.

Excessive daytime sleepiness is often associated with poor sleep quality. In this study, daytime dysfunction was seen among 48.1% of the subjects, but students also have reported having good sleep quality. These discrepancies could be because the responses are individual's opinion. Hence, unreliable answers could be the reason behind this. In the study done among the Haryana students, it was seen that 17.9% of the participants, had trouble staying awake during the day at least once a week. It may be noted that a wide variation was seen in several other studies which reported daytime dysfunction, ranging from 37.7% [18], and 42.1% [19] to as high as 63% [20]. Global PSQI of <5 was observed in 62% of the study participants, which is inconsistent with many other similar studies that reported the same among 27.3% [14] and 12.9% [7] of respondents of the respective studies.

However, high BMI scores were found among 65.1% of respondents in this study which is in line with the results reported from a study conducted in Puducherry which found that 43% of respondents had high BMI [4]. This confirms the fact that diseases like obesity is prevalent among medical students. It may be noted that our analysis for the relation between sleep quality and BMI, found that

the use of sleeping pills more than three times a week was seen among 1.9% of the students with BMI >23. However, the overall use of the sleeping pill was seen in 8.6% of the participants of the present study. This percentage is consistent with what has been reported in other studies where 8.4% of students used medication for inducing sleep [14] and 2.7% of students used sleeping pills to sleep [5]. Sleep duration has been seen to be on the lower side in 15.9% of students with BMI >23. Sleep quality is reported to be good in around 93.4% of people with BMI <22.9 which explains that students with good health are able to have a good sleep. There are very few students who have BMI <22.9 and poor sleep quality. Around 86.9% of the students with lower BMI had very less sleep disturbances. Students with low BMI are observed to have less daytime dysfunction on an everyday basis. This rightly explains the correlation between higher BMI and poor sleep quality. Global PSQI is seen to be significant ( $p = 0.005$ ) in the two groups of students divided by their BMI values, which means PSQI values are affected by their corresponding BMI values which implies BMI affects the quality of sleep.

Moving on to sleep duration, sleep disturbances and daytime dysfunction, group A students experience more harmful effects than the students in other groups. This is probably because of the fact that students who just join the medical course experience a sudden switch from high school to a professional course like the medical program which involves loads of classes, assignments, shifts, and study periods. For the subsequent phases, the students begin to get adapted to this routine.

There was a significant difference in sleep duration between A and C ( $p < 0.001$ ); A and B ( $p = 0.039$ ). The habitual sleep quality was significantly different when we compare group C and D ( $p \leq 0.001$ ). The sleep disturbances were significantly affected in groups A and D ( $p \leq 0.001$ ); B and D ( $p = 0.010$ ); C and D ( $p \leq 0.001$ ). The daytime dysfunction was significantly different between A and D ( $p \leq 0.001$ ), B and C ( $p \leq 0.001$ ); and A and C ( $p \leq 0.032$ ). The global PSQI was significantly different between B and C ( $p \leq 0.001$ ); C and D ( $p \leq 0.001$ ), whereas in another study it was significantly different between A and C [14].

To summarize, we found impairments in certain PSQI components after studying the quality of sleep among students at a medical college in India. This highlights that research needs to continue in different parts of the country and the world so that we can use our findings to improve the quality of health of our medical students. Our findings were in concordance with other literatures, on sleep



duration, sleep disturbances and daytime dysfunction. For better results, daytime dysfunction could have been studied more using Epworth Sleepiness Scale. But other than that, we saw a varied response. The limitation to this study was that specific protocols could have been used to assess the sleep quality in all the phases so as to compare the behavior of students in different phases.

So, to conclude, the current study found that the students of all the phases in undergraduate medical school have poor subjective sleep quality, high sleep disturbances and daytime dysfunction. While comparing sleep quality across all the phases of the course, the first years (group A) reportedly had worse sleep quality than other phases. It is necessary to create awareness among medical undergraduates about the importance of good sleep hygiene so that the students adopt them early in their academic year to improve their academic performance.

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### Authors contribution

PP & SCR performed the study and wrote the manuscript, SN critically reviewed the manuscript and gave intellectual inputs, AG performed the statistical analysis and interpreted the data, PV performed the literature review and edited the manuscript, and AP designed the study, performed literature review, edited the manuscript and gave the final approval.

### Ethics approval and consent to participate

JSS Medical College ethical committee clearance was obtained before the commencement of the study via the letter number JSSMC/IEC/210421/06NCT/2021-22 dated 23-04-2021 and informed consent was taken from all the participants.

### Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The authors declare that the manuscript represents original and honest work.

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