




A Study on the Assessment of Impact of COVID-19 Pandemic on Depression: An Observational Study among the Pregnant Women

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Received: 27 July 2021 / Accepted: 5 August 2021 / Published online: 1 September 2021
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Abstract

Background COVID-19 pandemic has affected the pregnant women both physically and mentally. This study is conducted to assess, the impact on COVID-19 pandemic on psychiatric symptoms among pregnancy and to compare them with non-pregnant women.

Methods An observational study was conducted at Govt. Medical College & Hospital, Ooty (Udhagamandalam). A validated Edinburgh Depression Scale was used to screen the mental health status. Categorical variables were analysed using Chi-square test and continuous variables by independent *t* test. A Pearson's correlation analysis was performed to check the association of Edinburgh postnatal depression scores with the demographic characteristics. Paired *t* test was conducted to find the difference in EPDS scores at baseline and study conclusion visit. Regression analysis was conducted to predict the outcome variables.

Results The Edinburgh Depression scores were significantly higher in the pregnant women group, (12.48 ± 3.753 vs. 8.00 ± 2.436 ; p value = 0.001; 95% CI 3.340–5.627), when compared to non-pregnant women (12.90 ± 3.731 vs. 9.20 ± 2.973 ; p value = 0.001; 95% CI 2.480–4.920). The Edinburgh Depression scores at the study conclusion visit was statistically significant, (11.05 ± 3.839 vs. 10.24 ± 3.872 ; p value = 0.008; 95% CI –1.40 to –0.213). Education, income, duration of marriage, body mass index, and suicidal ideation are some of the predictors identified in this study to cause depression among pregnant women.

Conclusion The findings of the study indicate a clinically significant increase of depressive symptoms among pregnant women. It is recommended to include routine psychological screenings and interventions during pregnancy.

Keywords COVID-19 pandemic · Depression in pregnancy · Edinburgh postnatal depression scale · Non-pregnant women

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Introduction

In December 2019, an outbreak of a novel virus causing pneumonia was reported in the city of Wuhan, China [1]. World Health Organization (WHO) named the disease as Coronavirus Disease 2019 (COVID-19) [2, 3]. On 11 March 2020, it was eventually upgraded to the classification of global pandemic [4].

The pandemic was swiftly advancing globally. The health-care services were affected as the pandemic unfolded. Most of the countries started to impose restrictions and lockdown as a part of infection containment strategies [5].

The impact of social isolation, loneliness along with the distress about the risk of getting infection has affected mental health [6].

According to the preliminary data, women have demonstrated significant psychological impact [7, 8]. Pregnant women are having, the higher risk for severe complications

because of their suppressed immune system [8]. Pregnant women are more concerned about vertical transmission to their fetus [10–12]. Health-care system had collapsed during the pandemic. Patients were categorized and prioritized based on their health conditions for immediate and delayed access to the hospitals. These uncertainties and changes in the health-care practice had caused depression and anxiety among pregnant women [13]. It is mainly dependent on the conditions and living environment [14, 15], especially in the second and third trimesters of pregnancy. Depression among pregnant women can adversely affect their fetus, like pre-term labor and low birth weight [16]. The depressive symptom among the pregnant women is about 26% to 34.2% during COVID-19 pandemic [17]. Thus, this study is conducted to assess the impact of COVID-19 pandemic on psychiatric symptoms among pregnant women and to compare them with non-pregnant women using the Edinburgh Postnatal Depression Scale (EPDS).

Materials and Methods

Study Design and Participants

The single centered, observational study was conducted at Obstetrics and Gynecology Department, Govt. Medical College & Hospital, Ooty (Udhagamandalam). The baseline visit of the study participants was in the month of May 2021, and study conclusion visit of the last participant was on 30th of June 2021. The study was carried out on pregnant women with a gestational age of 34–36 weeks (baseline visit) and study conclusion visit at 7 days after delivery, while in the non-pregnant women the baseline visit was at the time of enrollment and study conclusion visit was at 4–5 weeks after the baseline visit. A total number of 120 women were recruited and allotted to their respective groups, pregnant women (60) and non-pregnant women (60).

Inclusion and Exclusion Criteria

Women of reproducible age 18–45 years at the time of consent were included. Women with chronic diseases, a history of high-risk pregnancy, autoimmune diseases, and who had mental health concerns and on any anti-depressants were excluded from the study.

Data Collection

A team of research staff visited the hospital daily to screen the subjects. Pregnant and non-pregnant women who met the eligibility criteria were invited to participate in the study. The participants and the caretakers were explained the objectives and procedure of the study. The informed

consent was obtained in their native or preferred language (Tamil and English).

The inclusion and exclusion criteria were checked after obtaining the consent. The data were collected in a specially designed data collection form to collect the socio-demographic details, medical and medication history, supplement intake, obstetric details, anthropometric measurements, physical examination, and vital parameters at both visits. The maternal and neonatal outcome details were documented at the study conclusion visit for pregnant women who had given birth. The psychiatric symptoms were assessed by administering the self-administered validated Tamil version of Edinburg Postnatal Depression Scale.

Main Outcome Variable

- The primary outcome variable observed in this study is EPDS scores. The secondary outcome variables considered were maternal and neonatal complications.

Registration and Ethical Considerations

Ethics Committee approval was obtained from Institutional Review Board. The study was also registered under Clinical Trial Registry of India (CTRI).

Statistical Analysis

The sample size was calculated by using G-power 3.1 software. The effect size was calculated as $d = 0.28$, level of significance $\alpha = 0.05$ and power as 90%. A sample of 120 subjects was obtained after the calculation. Sample size was adjusted for dropout rate of 20%.

Descriptive analysis was performed for demographic characteristics. Categorical variables were expressed as percentages and continuous variables as unadjusted means with standard deviations. As the data were normally distributed data, parametric tests were used to measure the differences in variables among the groups. Chi-square test was used for categorical variables, and independent t test for continuous variables was used. Paired t test was used to compare the difference in EPDS score between the baseline and study conclusion visit. A Pearson's correlation analysis was performed to check the association of EPDS scores with participant's demographic characteristics. Regression analysis was conducted to predict the outcome variable. A p value of <0.05 was considered as statistically significant. Variation in EPDS scores due to the confounders was measured using R^2 values. Prediction modeling of EPDS scores was done using binary logistic regression. All analysis was conducted using the IBM SPSS statistical software (V.22.0; SPSS Inc, Chicago, Illinois, US).

Results

Participant Recruitment Status

A total of 150 pregnant women and non-pregnant women were screened. A total of 120 participants fulfilled the eligibility criteria. A total of 30 participants were excluded, as illustrated in (Fig. 1).

Demographic Characteristics

The demographic characteristics of the study participants are listed in (Table 1). The factors like education, depression, and suicidal ideation showed significant difference between the groups, while the other variables were equally distributed. The psychiatric symptoms of depression were higher among the pregnant women (86.7 vs. 38.3; p value = 0.001; 95% CI 0.039–0.243) at the baseline visit and at the study conclusion visit (86.7 vs. 43.3; p value = 0.001; 95% CI 0.049–0.297). The ideas of self-harm, i.e., suicidal ideation was more prominent among the pregnant women (33.3 vs. 15.0; p value = 0.019; 95% CI 0.152–0.834).

Physical and Vital Sign Examination

The results of physical examination and vital signs are listed in (Table 2). The participants in the study had a mean age of 24.83 ± 3.316 years. No statistically significant differences were seen in physical examination and vital signs between the groups.

Baseline Obstetrics Parameters

The details of obstetrics parameters were collected at the baseline visit for both groups. Among the non-pregnant women, three participants were of 19 years and did not have obstetric details. Parameters like duration of marriage and type of delivery were statistically significant, while the other parameters like gravida, live, abortion, type of delivery, episiotomy, and type of labor were not statistically significant.

Effect of COVID-19 Pandemic on Psychiatric Symptoms among Pregnant and Non-Pregnant Women

Independent sample t test was used to compare the means of EPDS between the groups at the visits. The results of the test are represented in (Table 3). The EPDS scores were higher among the pregnant women at the baseline visit (12.48 ± 3.753 vs. 8.00 ± 2.436 ; p value = 0.001; 95% CI 3.340–5.627) and at study conclusion visit of (12.90 ± 3.731 vs. 9.20 ± 2.973 ; p value = 0.001; 95% CI 2.480–4.920).

EPDS scores between both the visits were compared by using paired t test, while COVID-19 pandemic was

considered as the intervention, as the number of reported positive cases of COVID-19 was more during the study conclusion visit. The EPDS scores were higher during the study conclusion visit, and the test results were statistically significant (11.05 ± 3.839 vs. 10.24 ± 3.872 ; p value = 0.008; 95% CI -1.404 – (-0.213)), showing that EPDS scores varied between the two visits as mentioned in (Table 4).

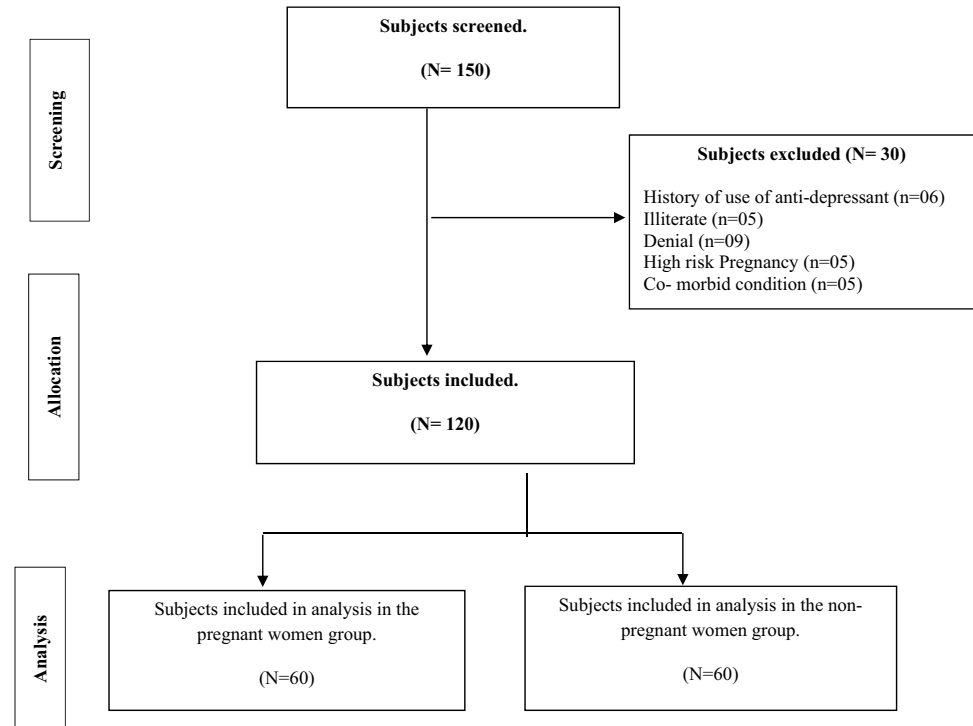
Pearson's correlation was performed against EPDS scores and variables like income, Body Mass Index (BMI), and age. The correlation coefficient for age was -0.106 , and p value was statistically insignificant ($p = 0.249$) in baseline visit; similarly, in the study conclusion visit, the correlation coefficient was -0.110 with insignificant p value of 0.0234. The correlation coefficient for BMI was 0.234 with p value of 0.010 at baseline visit and was 0.214 with p value of 0.019 at the study conclusion visit. The correlation coefficient of income in baseline visit was 0.210 with p value of 0.021 and this increased to 0.382 with p value of 0.001 in the study conclusion visit.

The strength of association between the age and EPDS was found to be a weak negative correlation at both visits. Statistical significance was not found between age and EPDS scores, while income and BMI, was statistically significant. The strength of association between income and EPDS scores had a weak positive correlation on baseline visit, while on study conclusion visit, a moderate positive correlation was found. BMI and EPDS scores were found to have a weak positive correlation at both the baseline and study conclusion visit.

Multiple linear regression was performed, and it showed that BMI and income correlated best with the EPDS scores. The r value of BMI was 0.234 with p value of 0.016 at baseline visit and r value of 0.214 with p value of 0.035 at study conclusion visit. Similarly, the r value of income was 0.210 and 0.382 with p value of 0.034 and 0.001 at baseline visit and conclusion visit, respectively.

Binary logistic regression was performed between two groups. The logistic regression model was statistically significant, $p = 0.001$ at both visits. The model explained 31.7% (Nagelkerke R^2) of the variance in depression and correctly classified 74.2% of cases at the baseline visit, while 27% (Nagelkerke R^2) of variance in depression and 71.7% of cases were correctly classified at the study conclusion visit.

Binary logistic regression was performed to find the other predictor variable of depression. The results are listed in (Table 5). Education, income, duration of marriage, BMI, and suicidal ideation were statistically significant, $p < 0.05$ at the study conclusion visit. The model explained 54.5% (Nagelkerke R^2) of variance in depression, and it was correctly classified 79.2% of cases.

Fig. 1 Flow chart of screening, allocation, and analysis

Maternal and Neonatal Outcome

Maternal and neonatal outcomes of the pregnant women group were analyzed. Mean and SD were computed for the continuous variables, while numbers and percentage were calculated for the categorical variables. About 13.3 % of women were given antenatal steroids because of the risk of preterm delivery. About 13.3% had stained amniotic fluid, which could have led to the newborn intensive care unit (NICU) admission. About 40% of pregnant women had Lower (uterine) segment Caesarean section (LSCS). Episiotomy was performed in 51.7% of pregnant women. And, considering the NICU admission among the neonates, 8.33% were admitted for level 2 and 3.33% were admitted for level 3 treatments. Only descriptive statistics were performed for both maternal and neonatal outcome due to the lack of maternal and neonatal data from the non-pregnant women.

Discussion

COVID-19 pandemic has caused a substantial burden, among the vulnerable population including pregnant women [18]. Studies investigating the impact of COVID-19 pandemic on psychiatric symptoms among pregnant women in comparison with a control group (non-pregnant women) during the pandemic are limited; hence, we conducted this study including both the groups [19]. The baseline visit of the study participants was during the period, when the numbers of registered

COVID-19-positive cases were relatively less and there was no imposition of lockdown. While at the study conclusion visit, it was during the period when the number of cases infected with COVID-19 was high.

The inferential statistics using Pearson's correlation test yielded a moderate positive correlation between income of household and depressive outcomes. The finding of this study was different from the study conducted by Wu Y et al [20], in our study the participants, income was substantially constant, and the participants have been at increased risk of getting depressed.

The correlation test also yielded a positive correlation between BMI and depressive outcomes. These findings were dissimilar to the study Wu Y et al [21], while in our study, women who were obese had reported the higher depressive scores. Based on the linear regression in our study, the parameters like income of the household and BMI showed to have a significant impact on EDPS scores. These findings of our study were similar to the study conducted in China by Liu X et al [22]. Pandemic has increased the work from home culture, a sedentary lifestyle, there was no option to go for gym, walk and to jog. This is the reason for being overweight. Increased weight during pregnancy is worrisome.

In this study, 85.7% of pregnant women had their EPDS scores more than 8, which is a similar finding reported in the study conducted by Liu X et al [20] and Shradha Khatri et al [21]. which is due to worries of vertical transmission, contacting infection while visiting the hospital, and their antenatal and postnatal care visits were reduced [22, 23]. Surprisingly, about

Table 1 Demographic characteristics of study participants at baseline visit

Characteristics	Categories	Total (<i>N</i> = 120) n (%)	Non- pregnant women (<i>N</i> =60) n(%)	Pregnant women (<i>N</i> =60) n(%)	95%CI	<i>p</i> value
Education level	Primary	30(25.0)	23(38.3)	7.0(11.7)	0.001–0.025	0.001
	Secondary	48(40.0)	27(45.0)	21(35.0)		
	Undergraduate	23(19.2)	3.0(5.0)	20(33.3)		
	Postgraduate	19(15.8)	7(11.7)	12(20.0)		
Occupation	Employed	30(25.0)	18(30.0)	12(20.0)	0.7664–3.787	0.206
	Housewife	90(75.0)	42(70.0)	48(80.0)		
Consanguinity	Present	28(23.3)	15(25.0)	13(21.7)	0.5157–2.924	0.666
	Absent	92(76.7)	45(75.0)	47(78.3)		
Consanguinity degree	First degree	5.0(4.2)	3.0(5.0)	2.0(3.3)	0.046–0.154	0.179
	Second degree	11(9.2)	8(13.3)	3.0(5.0)		
	Third degree	5.0(4.2)	3.0(5.0)	2.0(3.3)		
	Fourth degree	7.0(5.8)	1.0(1.7)	6(10.0)		
	None	92(76.7)	45(75.0)	47(78.3)		
Diet	Vegetarian	23(19.2)	10(16.7)	13(21.7)	0.2786–1.721	0.487
	Non-vegetarian	97(80.8)	50(83.3)	47(78.3)		
Income (INR)	> 9999	75(62.5)	41(68.3)	34(56.7)	–0.059–0.292	0.190
	10,000–15,000	45(37.5)	19(31.7)	26(43.3)		
Marital status	Married	119(99.2)	59(98.3)	60(100)	0.000–9.000	0.315
	Divorced	1.0(0.8)	1.0(1.7)	0		
Suicidal ideation	Present	29(24.2)	9.0(15.0)	20(33.3)	0.1524–0.8341	0.019
	Absent	91(75.8)	51(85.0)	40(66.7)		
Depression (At baseline visit)	Present	75(62.5)	23(38.3)	52(86.7)	0.03950–0.2436	0.001
	Absent	45(37.5)	37(61.7)	8.0(13.3)		
Depression (study conclusion visit)	Present	78(65.0)	26(43.3)	52(86.7)	0.04908–0.2971	0.001
	Absent	42(35.0)	34(56.7)	8.0(13.3)		
EPDS Subscale analysis (At baseline visit)	Not likely	42(35.0)	0	5.0(8.3)	0.001–0.025	0.001
	Possible	41(34.2)	37(61.7)	20(33.3)		
	Fairly possible	16(13.3)	21(35.0)	14(23.3)		
	Probable depression	21(17.5)	2.0(3.3)	21(35.0)		
EPDS Subscale analysis (At study conclusion visit)	Not likely	42(35.0)	0	8.0(13.3)	0.001–0.025	0.001
	Possible	19(15.8)	34(56.7)	12(20.0)		
	Fairly possible	39(32.5)	7.0(11.7)	20(33.3)		
	Probable depression	20(16.7)	19(31.7)	20(33.3)		

N=total number of subjects. *n*=number of subjects in a given category. %=*n*/Number of subjects with available results×100. SD=standard deviation. INR–Indian Rupees. *p* value: Pearson's Chi-square or Fisher's exact test (for counts <5). *p* value: Comparison of group means using independent-sample *t* test

33.3% of pregnant women had thoughts of suicidal ideation, which was a significant finding this study. In this study, about 25% of pregnant women had EPDS score > 13, which was similar to the finding conducted by Durankus F et al [18] and Shahid A et al [24]. COVID-19 pandemic and lockdown restrictions to travel have shut everyone inside their residences. Fear of getting infected and losing their loved ones due to infection have increased mental pressure among the population. Based

on binary logistic regression, education, duration of the marriage, menstrual history, BMI, and suicidal ideation were found to be the predictors of depression and statistically significant. The study participants who were illiterate and completed primary schooling reported higher depressive scores. This may be because of the lack of knowledge about the infection which was similar to the study conducted by Effati-Daryani et al [25]. Women who were married recently showed more psychiatric

Table 2 Physical and vital sign examination at the base line visit of study participants in both the groups

Characteristics	Total participants (N= 120) Mean ± SD	Pregnant women (N=60) Mean ± SD	Non-pregnant women (N=60) Mean ± SD	95%CI	p value
Age (Years)	24.83 ± 3.316	24.27 ± 3.379	25.40 ± 3.179	0.053–2.320	0.061
Height (m)	153.21 ± 6.086	152.87 ± 4.564	153.55 ± 7.324	–2.890–1.523	0.541
Weight (Kg)	62.48 ± 9.226	62.83 ± 8.559	62.13 ± 9.907	–2.644–4.050	0.678
BMI (Kg/m ²)	26.70 ± (4.234)	26.94 ± (3.890)	26.46 ± (4.572)	–1.053–2.016	0.535
SBP (mmHg)	121.05 ± 9.441	120.18 ± 10.344	121.92 ± 8.442	1.680–5.147	0.317
DBP (mmHg)	79.54 ± 9.636	78.75 ± 9.416	80.33 ± 9.866	1.903–5.070	0.370
Pulse Rate (BPM)	79.55 ± 4.522	79.97 ± 4.5	79.13 ± 4.497	2.468–0.802	0.315
Respiratory rate (BPM)	19.48 ± 3.138	19.78 ± 2.675	19.17 ± 3.538	1.750–0.517	0.284

N=total number of subjects. SD=standard deviation. BPM=Beats per minute. p value: Comparison of group means using independent-sample t test

Table 3 Comparison of the means of EPDS results between pregnant and non-pregnant women

Characteristics	Total (N= 120) Mean ± SD	Pregnant women (N=60) Mean ± SD	Non-pregnant women (N=60) Mean ± SD	95% CI	p value
EPDS Scores Baseline visit	10.24 ± 3.872	12.48 ± 3.753	8.00 ± 2.436	3.340–5.627	0.001
Study conclusion visit	11.05 ± 3.839	12.90 ± 3.731	9.20 ± 2.973	2.480–4.920	0.001

N=total number of subjects. SD=standard deviation. p value: Comparison of group means using independent-sample t test

Table 4 Comparison of the EPDS results between the baseline visit and study conclusion visit

Characteristics	Paired differences between two groups Total(N= 120) Mean ± SD	95% CI	p value
EPDS Scores Baseline visit	10.24 ± 3.872	–1.404-(+0.213)	0.008
Study conclusion visit	11.05 ± 3.839		

N=total number of subjects. SD=standard deviation. p value: Comparison of group means using paired t test

Table 5 Binary logistic regression analyses showing independent variables associated with EPDS results as the dependent variable in study population (Study conclusion visit)

Variables	B	S.E	Wald	p value	Exp (B)	95% CI	
						Lower	Upper
Education			9.284	0.026			
Primary	1.389	0.815	2.905	0.088	4.009	0.812	19.795
Secondary	–0.188	0.765	0.061	0.806	0.828	0.185	3.707
UG	–1.243	1.022	1.478	0.224	0.289	0.039	2.140
Duration of marriage			6.633	0.036			
< 1 year	–2.073	0.806	6.619	0.010	0.126	0.026	0.610
1–4 years	–1.058	0.678	2.432	0.119	0.347	0.092	1.312
Menstrual history	3.681	1.193	9.523	0.002	39.681	3.831	411.036
BMI	–0.655	0.320	4.185	0.041	0.520	0.277	0.973
Suicidal ideation	–2.228	0.896	6.189	0.013	0.108	0.019	0.623
Constant	–0.765	1.475	0.269	0.604	0.465		

symptoms as they may not be comfortable with the new family and atmosphere.

This study is the first to investigate the mental health status of pregnant women in comparison to non-pregnant women during COVID-19 pandemic in South India. In this study, the odds ratio was measured which is one of the strengths of this study. As the health-care workers, we had opportunity to self-administer the EPDS scale to all study participants, as most of the similar studies conducted globally had administered the EPDS scale in an online mode and this has reduced the bias in our study. This study has several limitations, as this is an observational study, we were not able to confirm a causal relationship between the COVID-19 pandemic and psychiatric symptoms. Statistical analysis could not be performed for maternal and neonatal complications.

Conclusion

Recently, COVID-19 has become a global pandemic and many countries are experiencing their second wave of disease. Our study indicates that there was a significant increase in the prevalence of psychiatric symptoms especially during the lockdown period when compared to before lockdown period. Education, income, duration of marriage, BMI, and suicidal ideation are some of the predictors found in the study to cause depression. Psychological health of the pregnant women is of utmost importance under current situation. It is recommended to include routine psychological screening and interventions during pregnancy.

Acknowledgments We thank and acknowledge the support provided by the Government Medical College and Hospital, Ooty. Express our gratitude to all the study participants. We extend our thanks to JSS College of Pharmacy, JSS Academy of Higher Education & Research, Rocklands, Ooty, The Nilgiris, Tamilnadu, India.

Author Contributions All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by [SS], [MJS], [OS], and [GR]. The first draft of the manuscript was written by [SS], [OS], [RSB] [NR], [BV], and [PS], and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures undertaken in this study involving human participants were in accordance with the ethical standards of Institutional Review Board, JSS College of Pharmacy, Ooty (JSSCP/IRB/07/2020–21). The study is registered under CTRI with registration number: CTRI/2021/05/033545.

Informed Consent Informed consent was obtained from all study participants.

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