

# Influence of information source regarding COVID-19 knowledge among the undergraduate dental students during the early lockdown: a multi-national study

S.K. MALLINENI<sup>1,2,3</sup>, S. NUVVULA<sup>4</sup>, A.F. ISMAIL<sup>5</sup>, S. ALDHUWAYHI<sup>6</sup>,  
S.A. SHAIKH<sup>6</sup>, Y. DEEBAN<sup>6</sup>, V. KUMAR<sup>7</sup>, M.E. ALMAZ<sup>8</sup>

<sup>1</sup>Pediatric Dentistry, Dr. Sulaiman Al Habib Hospital, Ar Rayyan, Riyadh, Saudi Arabia

<sup>2</sup>Center for Transdisciplinary Research (CFTR), Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College, Saveetha University, Chennai, Tamil Nadu, India

<sup>3</sup>Division for Globalization Initiative, Liaison Center for Innovative Dentistry Graduate School of Dentistry, Tohoku University, Sendai, Japan

<sup>4</sup>Department of Pediatric and Preventive Dentistry, Narayana Dental College and Hospital, Nellore, Andhra Pradesh, India

<sup>5</sup>Department of Paediatric Dentistry and Dental Public Health, Kulliyah of Dentistry, International Islamic University Malaysia, Malaysia

<sup>6</sup>Department of Prosthodontics, College of Dentistry, Majmaah University, Al-Majmaah, Riyadh, Saudi Arabia

<sup>7</sup>Department of Public Health Dentistry, Terna Dental College, Mumbai, Maharashtra, India

<sup>8</sup>Department of Pediatric Dentistry, Faculty of Dentistry, Kirikkale University, Kirikkale, Turkey

**Abstract. – OBJECTIVE:** To assess the influence of information sources on the knowledge regarding COVID-19 among undergraduate dental students in India, Saudi Arabia, Malaysia, and Turkey.

**SUBJECTS AND METHODS:** An online questionnaire in a Google form link was circulated among the target population *via* various online platforms. It consisted of 14 close-ended questions assessing these students' knowledge and source of COVID-19-related information. SPSS software version 21.0 (IBM Corp., Armonk, NY, USA) was used to compute descriptive statistics, Chi-square test, independent *t*-test, and ANOVA tests for comparing various variables, and a *p*-value < 0.05 was considered statistically significant.

**RESULTS:** The study yielded 809 responses from dental undergraduate students from India, Saudi Arabia, Malaysia, and Turkey. Dental students from Turkey reported a higher mean knowledge score of  $7.91 \pm 1.34$  and  $7.88 \pm 0.58$  for Malaysian dental students. In contrast, the lower scores were achieved by Saudi Arabia ( $7.36 \pm 1.22$ ) and India ( $7.37 \pm 1.21$ ) dental students, and the findings were statistically significant ( $p < 0.05$ ). The study population used various sources to attain information regarding COVID-19. Most respondents (63.1%) utilized information regarding COVID-19 from multiple sources rather than single sources (36.9%).

**CONCLUSIONS:** Reliable and validated information sources resulted in higher knowledge scores. Turkey and Malaysia dental students reported a higher mean knowledge score and the lowest for Saudi Arabia and India dental students. There is increased popularity of social media platforms as information sources.

*Key Words:*

Knowledge, COVID-19, Cross-sectional study, Dental students, Social media, Information.

## Introduction

An epidemic spreading beyond a country's borders becomes a pandemic, the worst-case scenario in infectious diseases. A novel coronavirus caused the outbreak of COVID-19 in Wuhan, China, in December 2019<sup>1</sup>. Soon after, it barreled across 114 countries within the next three months, and the World Health Organization (WHO) declared a pandemic on March 11, 2020. However, it was not just the highly contagious virus that spread exponentially across the globe but also information, or often misinformation, that proliferated widely,

creating a milieu of confusion and leaving the layman misguided and misinformed. The WHO identified a growing surge of information as an “infodemic” that is an “overabundance” of information—some accurate and some not—that occurs during an epidemic<sup>2</sup>. A report<sup>3</sup> evaluating types, sources, and claims of COVID-19 misinformation stated that in response to the growth of misinformation in circulation, the number of fact-checks concerning COVID-19 had increased dramatically<sup>3,4</sup>. In an attempt to curb the “misinfodemic”, the WHO, along with the United Nations (UN) and other specialized agencies, has urged all the nations to implement action plans and disseminate scientifically proven information to the public<sup>2</sup>. Healthcare professionals are bestowed to provide only evidence-based information to the public in a simplified manner to avoid misinterpretation and misunderstanding, which requires inter-sectoral coordination between the medical and dental community, governments, and the mass media<sup>5,6</sup>. This coordination would help limit the dissemination of fake news and increase the general public adherence to correct guidelines. Healthcare professionals must access and be aware of accurate information to propagate correct information.

Dentistry has been flagged as a high-risk profession due to the close patient-dentist proximity during treatment, violating physical (social) distancing and aerosols production during several procedures, increasing the risk of transmission<sup>5,8</sup>. This risk further necessitates awareness and proper knowledge among oral healthcare practitioners and under-training undergraduate dental students regarding this airborne, highly contagious, infectious disease. The source of information is a crucial factor in reaching the correct information. Health authorities, television, the internet (Google, YouTube, etc.), and social media are the most sought sources of information. Thus, healthcare providers and practitioners need to recognize the importance, severity and awareness of this infectious disease. The majority of the published studies focused on knowledge, attitudes, and preventive practices among dental students regarding COVID-19<sup>9-11</sup>. None of the studies reported the source of information utilized among the dental undergraduate students regarding COVID-19 and its influence on their knowledge. Therefore, the study aimed to assess the source of information utilized by dental undergraduate students and its impact on the knowledge regarding COVID-19 among undergraduate dental students in India, Saudi Arabia, Malaysia, and Turkey.

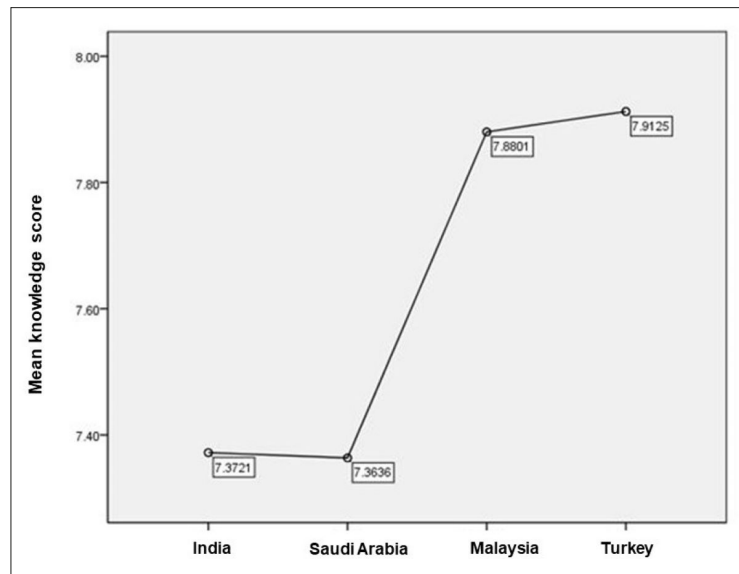
## Subjects and Methods

A descriptive-analytical cross-sectional study was conducted among dental undergraduate students from 4 countries (India, Saudi Arabia, Malaysia, and Turkey) to evaluate their knowledge regarding COVID-19 following the STROBE guidelines<sup>12</sup>. The Institutional Ethics Committee of Majmaah University, Saudi Arabia, approved the study. The study tool in the form of a validated and pre-tested (tested for face and content validity and reliability) online questionnaire was curated and circulated among the target population *via* various social media platforms and emails as a Google forms link. A convenience sampling technique was used to obtain the required sample size. Only dental undergraduate students agreeable to contribute and given informed consent were included in the study. The students unwilling to give their consent or who could not be reached *via* an online platform were excluded from the study. The questionnaire consists of three sections, including 14 close-ended questions [Demographic-3; Source of information-1; Knowledge-10]. The correct answer was “1,” and the incorrect answer was “0” for knowledge questions. The scores were given in agreement among the researchers (MSK, NSK, MEA, and AIF). More than one source is considered to be multiple sources. Means and standard deviations were used to describe the continuous variables, and percentages were used to describe the categorical data. The influence of the information source on mean knowledge scores regarding COVID-19 was also compared.

### Statistical Analysis

Descriptive and chi-square statistics were carried out to analyze the data. The comparison of COVID-19 knowledge scores was made based on country of education of the student. The mean knowledge scores regarding COVID-19 were compared based on gender and country of education of the student. Association between the information source and the dental undergraduate students’ knowledge mean scores using the multivariate linear regression analysis was done. An independent *t*-test, a one-way analysis of variance (ANOVA), and Bonferroni were used for multiple comparisons, and a *p*-value less than 0.05 was considered statistically significant. Data were analysed using SPSS version 21.0 (IBM Corp, Version 21.0. Armonk, NY, USA).

**Figure 1.** The mean knowledge scores among undergraduate dental students from India, Saudi Arabia, Turkey, and Malaysia.



## Results

A total of 809 respondents completed the questionnaire constituting 591 (73%) female and 218 (27%) male dental students with ages ranging from 19 years to 22 years. The participants resided in India (258), Saudi Arabia (99), Malaysia (292), and Turkey (160), respectively. The sources of information to gain knowledge about COVID-19 were Google, Instagram, the WHO website, News Channels, Health authorities, Telegram, Facebook, WhatsApp, University news, YouTube, and Twitter. The higher mean knowledge scores were reported by undergraduate dental students from Turkey and Malaysia,  $7.88 \pm 0.58$  and  $7.91 \pm 1.34$ , respectively, while lower scores of  $7.36 \pm 1.22$  by Saudi Arabia and  $7.37 \pm 1.21$  by India. A statistically significant difference in the mean knowledge scores was reported when comparing participants among the countries (Figure 1). Bonferroni correction of knowledge means scores among the undergraduate students based on country showed statistical significance among countries. There was no statistically significant difference in the dental students' mean knowledge scores from India, Saudi Arabia, Malaysia, and Turkey (Table I).

Among Turkish undergraduate dental students, the highest mean knowledge scores were observed to be on WhatsApp ( $8.33 \pm 0.87$ ), the WHO website ( $8.08 \pm 0.67$ ), Google ( $8.03 \pm 0.92$ ), and Twitter ( $8.03 \pm 0.92$ ). Those scoring more had

obtained information from Instagram ( $7.74 \pm 2.02$ ) and YouTube ( $7.00 \pm 0.00$ ) (Table II). At the same time, Malaysian undergraduate dental students achieved similar mean knowledge scores of approximately 7.9 with Telegram, Twitter, and University News with slightly higher scores. (Table II). Arabian undergraduate dental students, those obtaining information from Instagram ( $8.00 \pm 1.41$ ) and University News ( $7.8 \pm 0.92$ ) scored the highest mean knowledge scores, while those seeking information from YouTube scored the least ( $6.83 \pm 1.47$ ). Indian dental undergraduate students showed similar mean knowledge scores of approximately 7.5 when information was obtained from all the different sources. Those seeking inputs from the WHO website scored the highest at  $7.64 \pm 0.70$  (Table II).

The majority of the respondents utilized a single source for information on COVID-19 (Figure 2). The most popular sources used for information regarding COVID-19 were found to be social media handles such as Facebook (78%), Twitter (73%), Telegram (67%) as well as university news (69%), among the Turkish undergraduate dental students (Figure 2). Among the Malaysian undergraduate dental students, the most popular information sources were News Channels (12%) and Google (12.5%). The most popular sources for information were Twitter (21%) and Telegram (20%) among Arabian undergraduate dental students (Figure 2). The most popular information sources regarding COVID-19 turned out to be News Channels (37.9%) and YouTube (37.1%),

**Table I.** Comparison of overall knowledge mean scores among the undergraduate dental students based on the country.

Country	Country	Mean Difference	Std. Error	95% Confidence Interval		p-value*
				Lower Bound	Upper Bound	
India	Saudi Arabia	0.01	0.12	-0.32	0.34	1.00
	Malaysia	-0.51	0.09	-0.75	-0.27	0.001*
	Turkey	-0.54	0.11	-0.82	-0.26	0.001*
Saudi Arabia	Malaysia	-0.52	0.12	-0.84	-0.19	0.001*
	Turkey	-0.55	0.13	-0.90	-0.19	0.001*
Malaysia	Turkey	-0.03	0.10	-0.31	0.24	1.00

\*p-value<0.05 is considered statistically significant; knowledge score (Bonferroni) multiple comparisons.

followed by Google (31.8%), Instagram (31%), and the WHO website (31.2%) among the Indian undergraduate dental students (Figure 2). The majority of the respondents (63.1%) utilized information regarding COVID-19 from multiple sources than single sources (36.9%), with knowledge scores for multiple and single information sources of  $7.62 \pm 1.14$  and  $7.73 \pm 0.96$ , respectively, and findings were not significant ( $p > 0.05$ ) (Table III). Among the countries and utilization of sources for information regarding COVID-19, the majority of the Malaysian (49.1%) undergraduate dental students utilized multiple sources, followed by Indian (25%), Turkish (15.9%), and Arabian (10%) undergraduate dental stu-

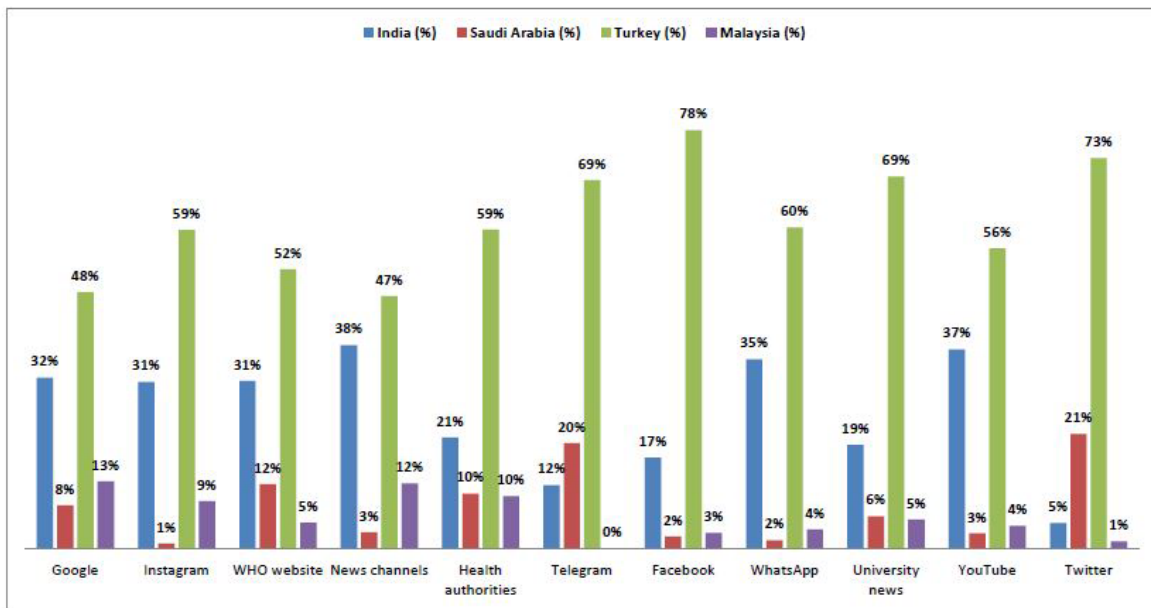
dents (Table IV). The majority of Indian undergraduate dental students (43%) utilized a single source of information regarding COVID-19, followed by undergraduate dental students from Turkey (26.5%), Saudi Arabia (16.1%), and Malaysia (13.8%) (Table IV).

### Discussion

The surge in various information sources increased the concern among countries worldwide regarding misinformation. Addressing this threat of “misinfodemic” without infringing on one’s right to free speech proves challenging. Vari-

**Table II.** Comparison of knowledge scores based on the source of information among the undergraduate dental students based on country.

Source of Information	India		Saudi Arabia		Malaysia		Turkey	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Google	7.54	0.84	7.19	1.35	7.91	0.44	8.03	0.92
Instagram	7.45	0.99	8.00	1.41	7.90	0.45	7.74	2.02
WHO website	7.64	0.70	7.37	1.07	7.92	0.46	8.08	0.67
News channels	7.48	0.80	7.64	0.74	7.90	0.51	7.87	1.38
Health authorities	7.33	1.62	7.62	0.94	7.90	0.44	7.92	1.52
Telegram	7.42	0.79	7.20	1.36	7.96	0.32	7.75	0.50
Facebook	7.48	0.73	7.67	0.58	7.90	0.39	8.00	0.82
WhatsApp	7.37	0.84	7.67	0.58	7.91	0.45	8.33	0.87
University news	7.59	0.67	7.80	0.92	7.94	0.38	8.00	0.71
YouTube	7.58	0.73	6.83	1.47	7.87	0.46	7.00	0.00
Twitter	7.43	0.53	7.25	1.48	7.96	0.54	8.03	0.92



**Figure 2.** The utilization of sources of information among undergraduate dental students from India, Saudi Arabia, Turkey, and Malaysia.

ous governments have taken different actions to curb the spread of misinformation during the COVID-19 pandemic. A myriad of measures such as prison sentences, laws, internet shut-downs, and investigations. Dissemination of correct measures, information, and guidelines has been carried out with the help of public health promotion and education programs regarding the COVID-19 pandemic<sup>13</sup>. The study was conducted among dental undergraduate students from India, Saudi Arabia, Malaysia, and Turkey.

Dentistry has been identified as a high-risk profession during the infectious respiratory disease pandemic demanding social distancing. Af-

ter its initial suspension, there was a resumption of dental practices with several restrictions and regulations in these countries. This resumption necessitated dental professionals to be updated with infection control measures and the disease. Health professionals are considered the most reliable source of information by the general public. As established in prior studies<sup>14-16</sup>, lack of awareness negatively impacts infection control and the positive attitude required to deal with the disease. Sufficient knowledge is vital in reducing disease spreading during pandemics. The under-training students and the near future of the country's health system are vulnerable to misin-

**Table III.** Overall knowledge mean scores among the undergraduate dental students' based on utilization of a number of sources.

Parameter	Number Source	N	Mean	Std. Deviation	Mean Difference	95% Confidence Interval of the Difference		p-value*
						Lower	Upper	
Knowledge	Single source	298	7.73	0.96	0.11	-0.05	0.26	0.179
	Multiple sources	511	7.62	1.14				

\*p-value<0.05 is considered statistically significant.

**Table IV.** Details of the number of sources for information regarding among the dental undergraduates based on country.

Country	Number of sources			
	Single source		Multiple sources	
	Count	Column N %	Count	Column N %
India	130	43.6%	128	25.0%
Saudi Arabia	48	16.1%	51	10.0%
Malaysia	41	13.8%	251	49.1%
Turkey	79	26.5%	81	15.9%

formation and should be targeted with appropriate guidance and knowledge about such infectious diseases. Hence, assessing their knowledge and awareness about the pandemic is essential to undertake necessary measures. In the present study, the participants' mean knowledge scores from all four countries were above 7, where the highest possible score was 10, indicating satisfactory awareness among them of COVID-19. Previous studies<sup>15-19</sup> conducted in Saudi Arabia, UAE, Uganda, and Vietnam, among healthcare providers had indicated a moderate level of awareness among their participants. It could be attributed to increased awareness about the seriousness of the global pandemic and increased initiatives adopted by the local government authorities, daily updates from public health agencies, and faculty educating the students participating in this study which would have prompted learning and acquiring knowledge on COVID-19.

Reliable sources of information have the power to influence people's decision-making and attitudes<sup>20,21</sup>. The pheaval from traditional journalism sources onto social media platforms has gained popularity, especially among youth, as the primary sources of information. It was reported that 59% of adult Americans had assessed health-related information online<sup>22</sup>. Though a substantial number of participants in the present study chose the WHO website, news channels, and health authorities to seek information related to COVID-19, social media platforms such as Facebook, Twitter, Telegram, Instagram, and Google have been the most popular information sources<sup>5,6,17</sup>. These findings highlight the importance of targeting information sources used and trusted by the public to ensure that COVID-19-related information reaches a diverse audience<sup>23</sup>. In tandem with this, several previous studies<sup>17,24-26,27</sup> conducted on various population groups have noted social media as one of the

significant sources of information during pandemics. A study<sup>27</sup> conducted among university students in Jordan showed that most opted for social media and the internet as their information sources, while medical students preferred scientific websites. However, another study<sup>28</sup> among dentists reported the WHO (73.7%), Ministry of Public Health (52.8%), and Television (TV) (44.7%) respectively as the primary information sources. It might indicate that the newer generation of dentists represented by dental undergraduate students relied heavily on social media platforms for their source of information. This study demonstrated a lower mean knowledge score among respondents utilizing YouTube as their source of information. A Canadian study<sup>29</sup> analyzing the credibility of COVID-19-related information on YouTube reported that one-quarter of the most viewed videos related to COVID-19 contained misleading information. Another study<sup>30</sup> analyzing YouTube content related to the pandemic found it to contain suboptimal medical content and an underrepresentation of International Health agencies on this platform with a high viewership was observed. These are the possible reasons for lower knowledge scores in this study.

Public health agencies and health authorities must focus on platforms delivering misleading information, and government agencies and other international health agencies should consider increasing their online presence on such platforms. The recent advances<sup>31-36</sup> in the medical field using telemedicine have also significantly impacted the healthcare industry. Policymakers must ensure stricter laws against misleading information sources and create awareness about reliable sources of information<sup>33,37,38</sup>. This study grants valuable insight regarding the source of information utilized among undergraduate dental students from various countries. With their in-

creasing popularity among the youth, health professionals can adopt social media platforms to equalize healthcare-related details to those who previously did not have access to them<sup>29-31,39,40</sup>.

The present study revealed that most respondents (63.1%) sought information from multiple sources instead of relying on one. It corroborates with a study from New York University, wherein participants were found to obtain COVID-19-related information from an average of six information sources<sup>31</sup>. The cross-sectional nature of this study is the reason behind its limitations. Since the novel coronavirus pandemic outbreak, it has been noted that the entire landscape has been undergoing constant and rapid change. Cross-sectional studies<sup>9-14,40-43</sup> present data at a single point in time, proving a limitation in this situation that can be overcome by undertaking subsequent surveys. The pandemic has triggered a change in dental protocols and practices that need to penetrate the dentists-in-training. The online and self-administered study tool questionnaire could have allowed certain biases such as sampling bias, nonresponse bias, and response bias. The participants of education were not involved in data collection and evaluation, which is also considered a potential limitation of the study. In the present study, participants were asked to choose multiple sources they used to gain knowledge on COVID-19; this may not allow them to identify the exact source participants used to get information regarding COVID-19. Despite these limitations, our study design's methodological strengths, distinct population distribution, large sample size, and the generalizability of this multi-national study make its findings valuable. The present study findings are pivotal in structuring public health education programs and dealing with such pandemics in the future. The results of this study would allow health authorities, policymakers, and public health professionals to adapt communication strategies to ensure trustworthy targeted information propagation.

This multi-national questionnaire-based study targeting budding young dentists and evaluating their knowledge about the COVID-19 pandemic has reported satisfactory awareness. It has been highlighted in the present study that knowledge can be associated with the Information sources from which information is obtained. Reliable sources positively impact the understanding of the participants. Disseminating correct, credible, and validated information is of utmost importance in a pandemic, as misinformation may

create chaos. Numerous sources of information are being opted for by dental students to have knowledge regarding COVID-19 during the pandemic. Dental students of the participating countries have reported adequate knowledge about the pandemic. The popular sources of information among dental students were various social media platforms, university news, news channels, and the WHO website. The increasing popularity of social media as a source of information necessitates monitoring the credibility and validity of these platforms' information. Government agencies, health authorities, and policymakers should maximize these sources for correct knowledge dissemination.

## Conclusions

Based on the study findings, it was evident that knowledge regarding COVID-19 can be associated with the sources of information obtained. Sources of information can influence the knowledge about COVID-19 among dental undergraduates. Reliable and validated information sources result in higher knowledge scores. Undergraduate dental students from Turkey and Malaysia reported the highest mean knowledge score and the lowest in Saudi Arabia and India. There is increased popularity of social media platforms as information sources. Initiatives to disseminate information to a diverse population using these sources and the government agencies must focus on these platforms delivering misleading information.

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## Conflicts of Interest

The authors declare that they have no conflict of interest.

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## Ethical Approval

The study was approved by the Institutional Ethical Committee of Majmaah University, Saudi Arabia, under the No. MURE-July.22/COM-2020/36-3.

### Informed Consent

Participants gave their consent to participate in the study.

### Authors' Contributions

Conceptualization, MSK and NSK; methodology, YD, AFI and MSK; software, SAS and MEA; validation, VA and MEA; formal analysis, SA and SAS; investigation, MSK, NSK, AFI and MEA resources, NSK; data curation, MSK, NSK, AFI and MEA; writing and original draft preparation, MSK, NSK, AFI, VK and MEA; writing and editing, MSK, NSK, AFI, YD, VK, and MEA; visualization, SA, YD, and SAS; supervision, MSAK and NSK; project administration, MSK; funding acquisition, SA, YD, and SAS, VK. All authors have read and agreed to the published version of the manuscript.

### ORCID ID

Sreekanth Kumar Mallineni- 0000-0002-9432-2590  
 Sivakumar Nuvvula- 0000-0002-1204-5551  
 Ahmad Faisal Ismail- 0000-0001-8996-5180  
 Sami Aldhuwayhi- 0000-0002-0695-0889  
 Saquib Ahmed Shaikh- 0000-0003-0794-8104  
 Yahya Deeban- 0000-0002-4393-1636  
 Vaibhav Kumar- 0000-0003-2166-1740  
 Merve Erkmen Almaz- 0000-0001-6766-2023

### Data Availability Statement

The data will be available upon request to the correspondence author.

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