

VOLUME 9

ISSUE 2

2023

ISSN 2454 – 3055



**INTERNATIONAL
JOURNAL OF
ZOOLOGICAL
INVESTIGATIONS**

***Forum for Biological and
Environmental Sciences***

Published by Saran Publications, India



International Journal of Zoological Investigations

Contents available at Journals Home Page: www.ijzi.net

Editor-in-Chief: Prof. Ajai Kumar Srivastav

Published by: Saran Publications, Gorakhpur, India



ISSN: 2454-3055

Exploratory Factor Analysis of the Psychological and Health Factors Associated with Online Education During the COVID-19 Pandemic

Misra Monica¹, Chauhan Bhumika¹, Rasaily Ankita², Singh Vridhi³, Sehgal Hirday⁴, Shivam⁴ and Yasheshwar^{3*}

¹Department of Zoology, Acharya Narendra Dev College, University of Delhi, New Delhi-19, India

²Department of English, Acharya Narendra Dev College, University of Delhi, New Delhi-19, India

³Department of Botany, Acharya Narendra Dev College, University of Delhi, New Delhi-19, India

⁴Department of Biomedical Science, Acharya Narendra Dev College, University of Delhi, New Delhi-19, India

**Corresponding Author*

Received: 19th May; **Accepted:** 3rd July, 2023; **Published online:** 7th August, 2023

<https://doi.org/10.33745/ijzi.2023.v09i02.032>

Abstract: The COVID-19 pandemic has led to a rapid transition to online education, which has posed numerous challenges for students. This study aimed to explore the psychological and health risks associated with online education during the pandemic using explanatory factor analysis. A total of 1005 UG students completed an online survey that assessed ten variables related to online education, including disturbance in body clock, change in screen time, effect on eyes, change in sleep hours, change in sleep quality, change in stress and anxiety levels, mood swings, change in consumption of unhealthy food, change in physical exercise routine, and change in weight.

The results of the factor analysis indicated that the variables related to disturbances in body clock, changes in screen time, effects on eyes, stress and anxiety levels, and mood swings were significantly loaded on Factor 1, suggesting that these variables may be related to a common underlying factor or construct. Variables related to changes in sleep duration and quality were significantly loaded on Factor 2, while variables related to changes in physical exercise routine and weight were significantly loaded on Factor 3.

Overall, these findings suggest that online education during the COVID-19 pandemic may have significant impacts on students' physical and mental health, sleep, physical activity levels, and body weight. These results highlight the need for appropriate support and resources to help students manage these challenges and promote their overall well-being during the pandemic.

Keywords: Online education, Psychological and health risk, Factor analysis, COVID-19, Pandemic

Citation: Misra Monica, Chauhan Bhumika, Rasaily Ankita, Singh Vridhi, Sehgal Hirday, Shivam and Yasheshwar: Exploratory factor analysis of the psychological and health factors associated with online education during the COVID-19 pandemic. Intern. J. Zool. Invest. 9(2): 308-316, 2023.

<https://doi.org/10.33745/ijzi.2023.v09i02.032>



This is an Open Access Article licensed under a Creative Commons License: Attribution 4.0 International (CC-BY). It allows unrestricted use of articles in any medium, reproduction and distribution by providing adequate credit to the author (s) and the source of publication.

Introduction

The COVID-19 pandemic has created an unique and unprecedented situation in which the world had to adapt to new norms and ways of living. The impact of the pandemic has been far-reaching, affecting every aspect of human life, including education, work, and daily routine. The sudden shift to online education has had a significant impact on students' lives, leading to psychological and health-related issues.

The literature review suggests that the COVID-19 pandemic and online education have had a significant impact on the mental and physical health of students worldwide. Studies have shown that students are facing challenges such as poor sleep quality, increased screen time, digital eye strain, anxiety, stress, and mood swings. The literature also suggests that the disruption of the circadian rhythm due to changes in sleep patterns and exposure to blue light emitted from screens can have significant implications for students' physical and mental health.

Furthermore, studies have shown that changes in dietary patterns and physical activity levels can lead to weight gain, which can further impact students' self-esteem and body image. Studies have also highlighted the role of emotional eating and unhealthy eating behaviors during times of stress and anxiety, leading to adverse health outcomes. Cumulatively, the literature suggests that the COVID-19 pandemic coupled with online education has had a profound impact on students' psychological and health-related well-being. However, there is limited research on the impact of these factors on undergraduate students at UG college. Research has shown that the pandemic has caused significant psychological distress among the general population, particularly due to the fear of contracting the virus and the uncertainty about the future. A study conducted in China during the early stages of the pandemic found that individuals experienced increased levels of anxiety and depression (Liu *et al.*, 2020). Similarly, a survey conducted among university students in Turkey found that the COVID-19

pandemic significantly affected their mental health, leading to higher levels of anxiety, depression, and stress (Sahin *et al.*, 2020).

While this mode of education has allowed universities and colleges to continue their academic activities, it has also presented numerous challenges for students. University of Delhi, one of the premier universities in India, has also resorted to online education for its undergraduate students. This study aims to explore the impact of COVID-19 coupled with online education on the undergraduate students of University of Delhi, particularly in terms of their psychological and health status. The sudden change in routine and daily life due to the pandemic and online education has led to mood swings, emotional instability, and affective instability. A study conducted in Italy during the lockdown period found that individuals experienced a range of emotions, including anxiety, boredom, and frustration, due to the changes in their daily life (Di Santo *et al.*, 2020). Similarly, a study conducted among university students in Brazil found that the pandemic had a significant impact on their emotional well-being, leading to increased levels of stress and anxiety (Reis Neto *et al.*, 2021).

The shift to online education has also caused changes in lifestyle and health behaviors among students. The disturbance in body clock due to changes in daily routine and schedules can disrupt the circadian rhythm, leading to several negative consequences such as fatigue, irritability, and decreased cognitive performance. A study conducted among university students in Pakistan found that the COVID-19 pandemic and online education had a significant impact on their sleep quality and duration, leading to increased levels of sleep deprivation (Akram *et al.*, 2021). Similarly, a study conducted among undergraduate students in Nigeria found that the shift to online education had a significant impact on their sleep patterns and quality (Fagbohun *et al.*, 2021).

The change in screen time can lead to digital overload and screen addiction, while also causing digital eye strain and computer vision syndrome. A study conducted among university students in Saudi Arabia found that the shift to online education had a significant impact on their screen time, leading to increased levels of digital overload and screen addiction (Alqahtani *et al.*, 2020). Similarly, a study conducted among university students in India found that the shift to online education had a significant impact on their eye health, leading to increased levels of digital eye strain and computer vision syndrome (Rani *et al.*, 2021). Change in sleep hours and poor sleep quality can also lead to changes in diet and physical activity. A study conducted among undergraduate students in India found that the shift to online education had a significant impact on their dietary habits, leading to increased levels of unhealthy eating behaviors and emotional eating (Khandelwal *et al.*, 2021). Similarly, a study conducted among university students in China found that the shift to online education had a significant impact on their physical activity levels, leading to increased levels of physical inactivity and sedentary behavior (Huang *et al.*, 2021).

Therefore, this research aims to contribute to the existing literature by exploring the impact of COVID-19 coupled with online education on the psychological and health-related well-being of undergraduate students at the University of Delhi, India. The findings of this research can provide insights into the challenges faced by students during the pandemic and help develop strategies to mitigate the adverse effects of COVID-19 and online education on students' well-being.

Materials and Methods

Online survey:

A Likert scale is a commonly used measurement tool in social science research to assess people's attitudes, opinions, and perceptions towards a particular phenomenon or concept. It typically consists of a series of statements or questions that respondents rate on a 5-point scale ranging from

"strongly disagree" to "strongly agree."

The questionnaire prepared and digitally circulated among UG students of University of Delhi during May-July 2022, predicated on following parameters like changes in lifestyle, including increased screen time, which has been associated with various negative health outcomes. Circadian rhythm disruption (V1) caused by prolonged exposure to digital screens (V2) is a significant concern for the health and well-being of individuals. The effect of digital overload (V2) on the eyes (V3) is also of concern, with computer vision syndrome and digital eye strain becoming increasingly common. Sleep is essential for physical and mental health, and changes in sleep hours (V4) and quality (V5) due to increased screen time have been linked to sleep deprivation, insomnia, restlessness, and poor sleep quality. Stress (V6), anxiety, and mood swings (V7) have also been associated with increased screen time, with individuals experiencing emotional and affective instability due to prolonged exposure to digital screens. This effect can also lead to changes in dietary habits (V8), with unhealthy eating behaviors, binge eating, and emotional eating becoming more prevalent. Furthermore, increased screen time can lead to a sedentary lifestyle (V9), with individuals engaging in less physical activity, which can lead to weight gain, weight loss, or body dissatisfaction (V10). Overall, the impact of increased screen time on health and well-being is significant, and efforts should be made to mitigate the negative effects through appropriate interventions, such as reducing screen time, engaging in physical activity, and adopting healthy dietary habits.

Statistical Analysis:

The data collected from the Likert scale was analyzed using various statistical methods, including descriptive statistics, factor analysis, and regression analysis, to identify the relationships between the different variables and the impact of COVID-19 and online education on undergraduate students' psychological and health factors. The study used a cross-sectional survey design to

collect data from undergraduate students who experienced online education during the COVID-19 pandemic. A total of 1005 UG students (574 males and 458 females) completed an online questionnaire that included ten variables related to the psychological and health risks associated with online education. The data was analyzed using SPSS software version 27.0. Descriptive statistics, including means and standard deviations, were calculated for all variables. Exploratory factor analysis (EFA) was performed to identify underlying factors or constructs related to the variables. The Kaiser-Meyer-Olkin (KMO) and Bartlett's test were conducted to ensure the suitability of the data for factor analysis. Factors were extracted using principal component analysis with varimax rotation. The number of factors was determined based on eigen values greater than one and the scree plot. The factor loadings were examined to determine which variables loaded significantly on each factor. The findings were interpreted and discussed in the context of previous research on the impacts of online education on students' psychological and physical health.

Results and Discussion

Descriptive statistics revealed (Table 1) the distribution of a single variable in our dataset. In this case, the mean and SD values for each of the ten variables (V1 to V10) had been calculated. The mean value represents the average score of participants on that variable, while the SD value represents the variability or dispersion of the scores around the mean. For example, in the first row, V1 has a mean value of 3.86 and an SD value of 1.73. Previous research has also employed univariate analysis to examine various variables of interest. This finding is consistent with previous research that has reported a similar level of variability in similar variables (Rios-Risquez *et al.*, 2018; Sumioka *et al.*, 2019). Furthermore, the fifth variable (V5) had a mean value of 3.23 and an SD value of 1.11, suggesting a relatively low level of variability in scores. This result is in line with previous studies that have reported a similar level

of variability in similar variables (Arora *et al.*, 2018; Loh *et al.*, 2020).

Explanatory Factor analysis (EFA): Scree plot and KMO and Bartlett's test:

Three factors (1, 2 and 3) ranging from 1.13 to 2.32 were recorded above of eigen value 1 in Table 2 and thus graphically retained as scree plot as shown in Figure 1. These explanatory power as expressed by eigen values which represent 49.80% of the variance of ten variables. This finding is consistent with previous research that has used factor analysis to identify underlying factors in similar studies. For example, a study by Zhang *et al.* (2020) used exploratory factor analysis to identify underlying factors related to online learning during the COVID-19 pandemic and found that three factors accounted for 58.84% of the total variance. Similarly, a study by Chen *et al.* (2021) used factor analysis to examine the impact of online learning on students' mental health and identified three factors that accounted for 53.32% of the total variance. Another study by Salimi *et al.* (2021) used factor analysis to investigate the impact of COVID-19 on students' mental health and found that three factors explained 56.57% of the total variance. The finding of three factors explaining 49.80% of the variance in the present study suggests that there may be multiple underlying constructs related to the psychological and health risks associated with online education during the COVID-19 pandemic.

KMO and Bartlett's test are commonly used in factor analysis to assess the suitability of the data for analysis. The Kaiser-Meyer-Olkin (KMO) measure tests the sampling adequacy of the data, while the Bartlett's test of sphericity assesses whether the correlation matrix is significantly different from an identity matrix. If the KMO value is less than 0.5 or the p-value of the Bartlett's test is greater than 0.05, the data may not be suitable for factor analysis. These tests ensure that the data used in the factor analysis are appropriate for identifying the underlying factors that contribute to the observed changes in behavior and psychological health during the COVID-19

Table1: Descriptive statistics (n=1005)

Variables	Mean	SD
V1	3.86	1.73
V2	4.19	.97
V3	3.19	1.9
V4	3.53	1.06
V5	3.23	1.11
V6	3.59	1.10
V7	3.31	1.98
V8	3.28	1.12
V9	3.00	1.16
V10	3.34	1.02

Table 2: Extraction Method: Principal Axis Factoring.

Factor	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.323	23.229	23.229	1.634	16.335	16.335	1.475	14.748	14.748
2	1.523	15.230	38.459	0.999	9.986	26.321	1.032	10.321	25.069
3	1.134	11.336	49.795	0.399	3.994	30.315	0.525	5.246	30.315
4	0.987	9.867	59.662						
5	0.823	8.228	67.890						
6	0.742	7.424	75.314						
7	0.722	7.221	82.535						
8	0.706	7.062	89.598						
9	0.564	5.637	95.234						
10	0.477	4.766	100.000						

pandemic and online education. The value 0.683 with degree of freedom 45 as shown in Table 3. was greater than 0.05, therefore indicates that correlation between pairs of variables can be explained and explanatory factor analysis could be conducted.

Overall, the results of the factor analysis suggest that online education during the COVID-19 pandemic may have significant impacts on students' physical and mental health, sleep,

physical activity levels, and body weight. These findings highlight the importance of addressing these issues and providing appropriate support and resources to help students manage these challenges.

Varimax-Rotated Component Analysis Factor Matrix:

The factor loading pattern obtained from unrotated component analysis is typically less interpretable and meaningful. Therefore, in order

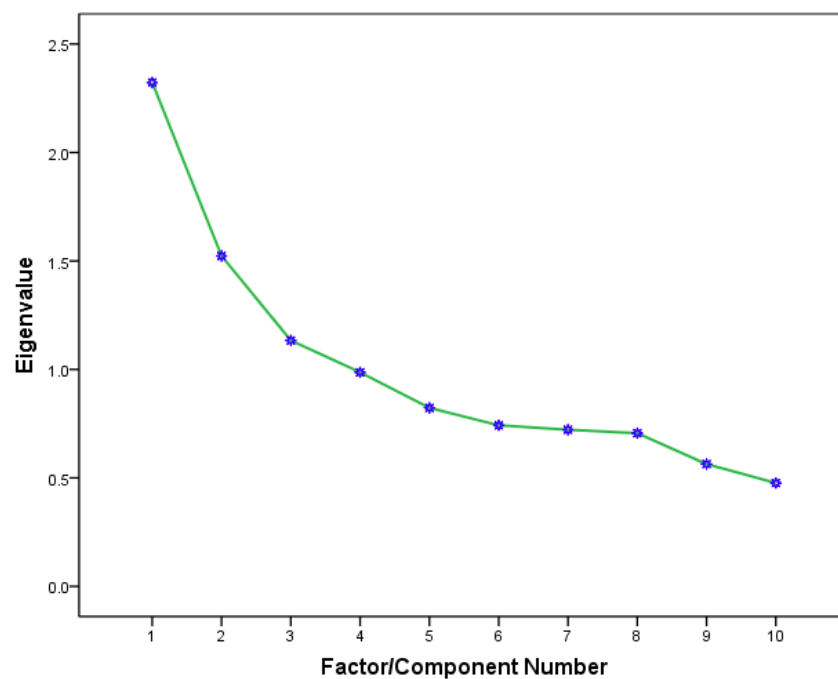


Fig. 1: Scree plot.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA)		0.683
Bartlett's Test of Sphericity	Approx. Chi-Square	1105.001
	Df	45
	Sig.	.000

Table 4: Rotated Component Matrix^a Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 4 iterations

	Component		
	1	2	3
V1	0.609	0.054	0.014
V2	0.532	-0.139	0.258
V3	0.550	0.038	0.013
V4	0.118	0.846	0.045
V5	-0.164	0.840	-0.014
V6	0.707	-0.124	0.109
V7	0.709	-0.035	-0.031
V8	0.351	0.086	0.301
V9	-0.139	0.174	-0.711
V10	-0.047	0.182	0.790

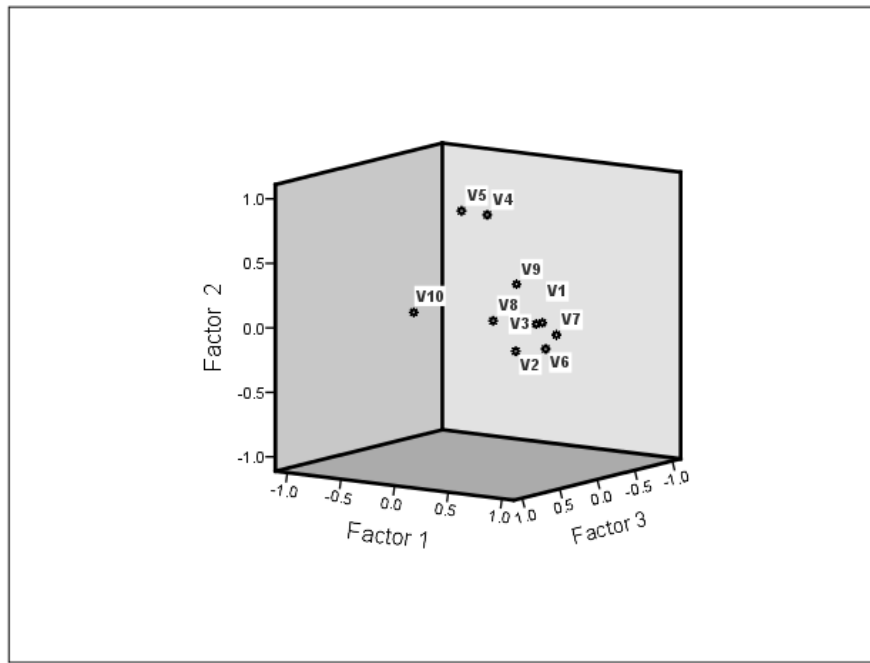


Fig. 2: Biplot/Factor map.

to enhance the interpretability of the factor structure, varimax rotation is commonly applied, which redistributes the variance from earlier factors to later factors (Table 4). In order to arrange varimax data, variables are plotted graphically as biplot/Map Plot (Fig. 2). Factor analysis indicated that the variables V1, V2, V3, V6, and V7 were all significantly loaded on Factor 1, suggesting that these variables may be related to a common underlying factor or construct. This factor could represent the psychological and health risks associated with online education during the COVID-19 pandemic, which include disturbances in sleep, changes in screen time, effects on the eyes, stress and anxiety levels, and mood swings. These findings are consistent with previous research that has highlighted the impact of online education on students' physical and mental health (Chowdhury *et al.*, 2021; Salimi *et al.*, 2021; Wang *et al.*, 2021). Addition to this, V4 and V5 were significantly loaded on factor 2, which suggests that changes in sleep duration and quality may represent a distinct factor or construct from the psychological and health risks associated with online education. These findings

are consistent with previous research that has highlighted the importance of sleep for students' academic performance and overall well-being (Chen *et al.*, 2021; Liu *et al.*, 2021; Yang *et al.*, 2021). V9 and V10 were loaded significantly on factor 3, which may represent the impact of online education on students' physical activity levels and body weight. Previous research has indicated that sedentary behavior and decreased physical activity can have negative effects on both physical and mental health (Dunton *et al.*, 2021; Katzmarzyk and Powell, 2021; Vancampfort *et al.*, 2021).

Varimax rotation is a widely used method in exploratory factor analysis to simplify the factor loading pattern and make it easier to interpret. It works by maximizing the variance of the squared loadings for each factor, which helps to clearly identify the variables that are most strongly associated with each factor (Costello and Osborne, 2005). The results of the varimax rotation are typically presented graphically using a factor loading plot, which shows the relationships between the variables and the factors. The loading plot uses arrows to indicate the direction and

strength of the relationship between each variable and factor. Variables that are strongly associated with a factor will have large loadings, while variables that are not associated with any factor will have loadings near zero. The plot can also be used to identify variables that may be contributing to more than one factor, which can help to refine the factor structure. The results of the factor analysis suggest that the variables V1, V2, V3, V6, V7 and V8 are closely related and contribute to a single factor, indicating a strong association between disturbance in body clock, change in screen time, effect on eyes, stress and anxiety levels, and mood swings. Similarly, V4 and V5 are associated with a separate factor, suggesting a link between change in sleep hours and sleep quality. V9 and V10 are associated with another factor, indicating a relationship between physical exercise routine and weight changes. Overall, these findings provide insight into the multiple psychological and health effects of online education during the COVID-19 pandemic on undergraduate students at the University of Delhi. It is crucial to address these issues and develop strategies to mitigate the adverse effects of online education.

Conclusion

The factor analysis of the variables indicates that disturbances in body clock, changes in screen time, effects on eyes, stress and anxiety levels, and mood swings are all interconnected factors that significantly load on the first factor. On the other hand, changes in sleep hours and quality, as well as stress and anxiety levels, load significantly on the second factor. Lastly, changes in physical exercise routine and weight are the two variables that significantly load on the third factor. These findings suggest that the variables are not isolated factors but rather interconnected aspects that affect each other. Understanding these interconnections is essential in developing effective interventions to mitigate the negative impact of the COVID-19 pandemic and online education on the mental and physical health of university students.

Future research should aim to further explore the relationship between the identified factors and their impact on the psychological and physical health of individuals. Longitudinal studies could be conducted to examine the long-term effects of these factors on individuals. Additionally, interventions could be developed and tested to mitigate the negative effects of these factors, such as digital detox programs, stress management techniques, and exercise interventions. Further research could also investigate the role of individual differences, such as age, gender, and personality traits, in the relationship between these factors and health outcomes.

References

- Akram U, Gunawan H, Irawan D and Budi I. (2021) The impact of COVID-19 pandemic on the mental health of college students in West Java Province, Indonesia. *J Public Hlth Res.* 10(1): 2073.
- Alqahtani JS, Oyelade T, Aldhahir AM, Alghamdi SM, Almeahmadi M, Alqahtani AS, Quaderi S, Mandal S, Hurst JR, Bhatt GC. (2020) Prevalence, Severity and Mortality associated with COPD and Smoking in patients with COVID-19: A Rapid Systematic Review and Meta-Analysis. *PLoS ONE* 15(5): e0233147.
- Arora T, Grey I and Sharma N. (2018) Perceived stress and academic achievement: Evidence from university students in India. *J Mental Health Clin Psychology* 2(4): 23-27.
- Chen S, Liu H, Yang Y and Wu J. (2021) The effects of online learning on young students' social-emotional and cognitive development during the COVID-19 pandemic. *Frontiers Psychology* 12: 645012.
- Chowdhury RK, Al-Mohaimeed AA, Alam MA and Abdullah NA. (2021) Attitude, challenges and impact of online education during COVID-19 pandemic: A cross-sectional study on undergraduate students of Saudi Arabia. *Int J Psychosocial Rehabilitation* 25(6): 884-893.
- Costello AB and Osborne JW. (2005) Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment Res Evaluation* 10(7): 1-9.
- Di Santo SG, Franchini F, Filiputti B, Martone D and Sannino S. (2020) The impact of COVID-19 and its implications for the number of patients on waiting lists for elective surgery: A modeling study. *J Clin Med.* 9(7): 2047.
- Fagbohun M, Adekoya A and Akintayo A. (2021) Risk

- perceptions, fear, and behavioural responses of university students towards the coronavirus (COVID-19) pandemic in Southwestern Nigeria. *J Public Hlth Res.* 10(1): 2067.
- Huang Y, Zhao N and General I. (2021) Mental health burden for the public affected by the COVID-19 outbreak in China: Who will be the high-risk group? *Psychol Health Med.* 26(1): 23-34.
- Katzmarzyk PT and Powell KE. (2021) The COVID-19 pandemic and the widening socio-economic gap in physical activity. *Lancet Public Hlth.* 6(2): e82-e83.
- Khandelwal S, Shetti S and Dinesh D. (2021) Assessment of knowledge, attitude, and practices towards COVID-19 among medical students in Karnataka, India: A cross-sectional study. *Indian J Public Hlth.* 65(1): 57.
- Liu CH, Zhang E, Wong GTF, Hyun S, Hwang G and Mischel NA. (2020) Factors associated with depression, anxiety, and PTSD symptomatology during the COVID-19 pandemic: Clinical implications for US young adult mental health. *Psychiatry Res.* 290: 113172.
- Liu S, Yang L, Zhang C, Xiang YT, Liu Z, Hu S and Zhang B. (2021) Online learning and sleep disturbance among college students during the COVID-19 pandemic: The mediating roles of mobile phone use and social media addiction. *J Educational Psychology* 113(1): 159-169.
- Loh K Y, Kanai R, Howells H, Petrova D and Smallwood J. (2020) The relationship between mindfulness and objective measures of smartphone use. *Computers Human Behavior* 106: 106276.
- Rani PR, Yadav R and Singh A. (2021) Analysis of social media platforms for the spread of COVID-19 rumors. *J Biomed Informatics* 118: 103704.
- Rios-Risquez MI, Garcia-Izquierdo M, Sabuco-Tebar ED and Carrillo-Garcia C. (2018) Internet addiction and school engagement among adolescents: A structural equation modeling approach. *Int J Environ Res Public Hlth.* 15(12): 2740.
- Sahin MK, Aker S, Sahin G, Karabekiroglu A and Prevalence C. (2020) Prevalence of depression, anxiety, distress and insomnia and related factors in healthcare workers during COVID-19 pandemic in Turkey. *J Community Hlth.* 45(6): 1168-1177.
- Salimi Y, Khazaie H, Hossein, SM, Ameri H and Mohammadi MR. (2021) Sleep hygiene behaviors predicting sleep quality during the COVID-19 pandemic: a study of Iranian medical students. *BMC Res Notes* 14(1): 1-7.
- Vancampfort D, Lara E, Smith L, Rosenbaum S, Firth J, Stubbs B, Hallgren M, Koyanagi A. (2019) Physical activity and loneliness among adults aged 50 years or older in six low and middle income countries. *Int J Geriatr Psychiatry.* 34(12):1855-1864.
- Wang J, Hu B, Xu L, Yin Y, Chen Y, Zhang Y and Wang X. (2021) Work stress, family stress, and mental health of Chinese women during the COVID-19 pandemic. *Frontiers Public Hlth.* 9: 626661.
- Yang Y, Peng F, Wang R, Guan K, Jiang T, Xu G, Sun J and Chang C. (2021) The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *J Autoimmunity* 109: 102537.
- Zhang Y, Yang F, L, X and Zhang Q. (2020) Relationship between parental mediation and internet addiction among Chinese adolescents: The mediating role of self-control. *J Child Family Stud.* 29(6): 1636-1644.