International Journal of Bio-resource and Stress Management https://ojs.pphouse.org/index.php/IJBSM

Crossref

IJBSM June 2024, 15(6): 01-16 **Article** AR5331

Research Article *Stress Management*

DOI: HTTPS://DOI.ORG/10.23910/1.2024.5331

Determinants of Perceived Stress among Indian Adults during Second Wave of COVID-19

Nidhi Joshi[1,#], Rita Singh Raghuvanshi[1] and Anuradha Dutta[1]

[1]Dept. of Food Science and Nutrition, College of Community Science, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand (263 145), India

[#]Krishi Vigyan Kendra, ICAR-Central Institute of Agricultural Engineering, Bhopal, Madhya Pradesh (462 038), India

Open Access

Corresponding joshinidhi894@gmail.com

0000-0003-3829-6698

ABSTRACT

The present study was conducted from June–July, 2021 in online mode and a questionnaire was designed at the Department of Food Science and Nutrition, College of Community Science, G. B. Pant University of Agriculture and Technology, Pantnagar. The study aims to find an association of perceived stress with socio-demographic factors, health profile and physical activity among Indian adults during the second wave of COVID-19. Data on perceived stress was collected through an online cross-sectional survey of 1933 Indian adults based on the Perceived Stress Scale (PSS). Multivariate ordinal regression was conducted to identify the predictors of perceived stress. Indian adults were moderately stressed, with a mean PSS score of 19.7±5.5 during the crisis time of COVID-19. The study population remained moderately active (59.3%) during the lockdown period. Perceived stress was negatively associated with age, education, income, and physical activity and positively associated with random blood sugar levels and sitting time. Odds of perceived stress increased with female gender, separated marital status, having one child or adolescent in the family, graduate or postgraduate as the educational status of the family's head, and increased sitting time. High educational status, retirement, regular employment, middle or lower-class social class, and high physical activity level were negative predictors of perceived stress. The current investigation highlights the role of multiple factors in the perception of stress and the need for tailored interventions for vulnerable groups focusing on education and physical activity.

KEYWORDS: COVID-19, education, India, perceived stress, physical activity

***Citation* (VANCOUVER):** Joshi et al., Determinants of Perceived Stress among Indian Adults during Second Wave of COVID-19. *International Journal of Bio-resource and Stress Management,* 2024; 15(6), 01-16. HTTPS://DOI.ORG/10.23910/1.2024.5331.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Funding: The University Grants Commission supported this work through the Senior Research Fellowship to the first author [UGC Ref. No.: 1499/(NET-JULY 2018)].

Conflict of interests: The authors have declared that no conflict of interest exists.

RECEIVED on 26th March 2024 RECEIVED in revised form on 03rd June 2024 ACCEPTED in final form on 12th June 2024 PUBLISHED on 21st June 2024

1. INTRODUCTION

The COVID-19 was declared a global health emergency by WHO on 11 March 2020 (Anonymous, 2020). The first case of COVID-19 was detected in India in January 2020 (Srivastava and Priyadarshini, 2020), leading to a total of 45 million cases and 0.53 million deaths till January 2024 (Anonymous, n.d.). COVID-19 impacted the health, social, and economic dimensions and greatly affected people's mental well-being by increasing the rates of anxiety and depressive disorders above 25% (Anonymous, 2022), particularly among women and young people.

The thoughts and feelings of an individual about stressful situations at a given time or period are called Perceived Stress. Perceived stress indicates the feeling of unpredictability or uncontrollability in one's life. The perceived stress is measured by a Perceived Stress Scale (PSS) questionnaire. A 14-item PSS is developed to assess "the degree to which situations in one's life are appraised as stressful" (Cohen et al., 1983). The PSS possess good psychometric properties (Chan and Greca, 2013) and is designed for use with community samples with an educational level of junior high school and above.

The influence of the COVID-19 pandemic on the perception of stress is evaluated among various occupational groups, and high to moderate stress levels have been reported. A study conducted among IT professionals in India during COVID-19 revealed significant differences in perceived stress across gender, marital status, and parental status, with a negative association between gratitude and perception of stress (Kurian and Thomas, 2021). A cross-sectional study conducted during lockdown among the Indian population found a high prevalence of perceived stress among women, younger ages, and the unemployed. The main stressors identified were fear of contracting coronavirus, inability to indulge in daily exercise, and worry about the future (Wakode et al., 2021). A negative association of perceived stress with resilience and hope was found among Indian youth during COVID-19 (Deb et al., 2023). An online survey revealed high perceived stress levels, lower knowledge, and better adherence to preventive guidelines among Indians compared to the US sample (Sinharoy et al., 2021). Perceived stress led to poor sleep quality and difficulty concentrating on studies among medical students in South India during COVID-19 (Praveena Daya et al., 2022). A cross-sectional study conducted among Indian students during COVID-19 reported mild to high stress levels with hurdles of online classes and self-management as contributory factors (Chhetri et al., 2021). A comparative study of perceived stress levels in 11 countries during COVID-19 found the highest stress among respondents from Spain, Portugal, India, and the Czech Republic. A negative trend in levels of hope and a decline in well-being was observed among Indians during the pandemic (Krafft et al., 2023).

All this indicates the psychological consequences of the COVID-19 pandemic influencing work performance, sleep quality, well-being, and overall quality of life, which cannot be ignored. Global gaps and imbalances exist in the mental health system regarding information, research, resources, and services (Anonymous, 2022). According to a systematic review of the psychological impact of COVID-19, there is a notable lack of relevant research that provides insight into stress levels among South Asian Indians (Lad et al., 2022). Most studies have examined the perception of stress among Indian samples during the first wave of COVID-19. To our knowledge, only a few researchers have explored perceived stress during the second wave in India. A complex interplay of various factors, such as personal, social, and contextual factors, influences the perception of stress. Therefore, the current study was aimed to measure perceived stress among Indian adults during the second wave of the COVID-19 pandemic and its association with socio-demographic characteristics, health profile, and physical activity.

2. MATERIALS AND METHODS

2.1. Study design and data collection

The study was conducted among Indian adults aged 18 years or older with internet access and minimum education of 12th standard. The data for this study were collected through a cross-sectional survey in June and July 2021 during the second wave of the COVID-19 pandemic in India. An online survey was distributed to university students, staff and agribusiness executives using convenience sampling. Participants were requested to share the survey link with family, friends, and colleagues based on snowballing technique. The survey link was also posted to social media platforms for broader dissemination. Survey Monkey software was used to conduct the online survey.

2.2. Survey instrument

2.2.1. Socio-demographic profile

The first section of the survey assessed the socio-demographic profile of the respondents viz age, gender, marital status, religion, caste, education, occupation, number of employed family members, monthly family income, family type and size, number of children or adolescents in the family, number of old family members, educational status and occupation of family's head, house location and residential zone (Anonymous, n.d.).

Based on the income variable, respondents were classified into five social classes (Prasad, 1961). The Multiplication factor, the All-India Consumer Price Index for Industrial

Workers (CPI-IW), and monthly per capita income (MPCI) defined social classes. The multiplication factor and the latest CPI-IW for July 2021 (base year=2016) were considered to obtain new income limits (Anonymous, n.d.). MPCI was calculated, and respondents were classified into five social classes.

2.2.2. Health profile and physical activity status

Self-reported data on random blood sugar levels were collected. Respondents with blood sugar levels of 140 mg dl^{-1} or less were classified as normal, while those with blood sugar levels between 141–160 mg dl^{-1} and 160 mg dl^{-1} and above were classified as high and very high, respectively (Anonymous, 2017).

2.2.3. Physical activity

The respondents' physical activity status was assessed using the short version of the International Physical Activity Questionnaire (Anonymous, 2002). The information was collected on the frequency and duration of vigorous and moderate-intensity activities and walking undertaken in the last seven days. Time spent sitting per day was ascertained as an indicator of sedentary activity. Responses obtained on IPAQ were used to derive Metabolic equivalents (MET-minute $week^{-1}$). IPAQ scoring protocol was followed to calculate Total physical activity MET-minute/week. Respondents were classified as low, moderate, and high physical activity levels with <600, 600–2999, and ≥3000 Total MET-min $week^{-1}$, respectively (Sjostrom et al., 2005).

2.2.4. Stress profile

The Perceived Stress Scale (PSS) was used to assess respondents' stress perception (Cohen et al., 1983). The above scale comprises ten questions to assess how an individual felt and their thoughts about various situations for the last month. For each question, respondents must choose from five response options: 0=Never, 1=Almost Never, 2=Sometimes, 3=Fairly Often, and 4=Very Often. The scale is composed of six negatively and four positively constructed items. Responses on four positively stated items (items 4, 5, 7, 8) were reversed. Perceived Stress Scale score, which ranges from 0 to 40, was calculated by taking the sum of scores assigned to ten items. Respondents were classified into three stress levels: low, moderate, and high, with PSS scores of 0–13, 14–26, and 27–40, respectively.

2.3. Data analysis

The reliability of PSS was assessed using Cronbach's alpha coefficient with a minimum acceptable value of ≥0.7 (Bland and Altman, 1997). Descriptive statistics were calculated as percentage, mean, median, and standard deviation. The chi-square test was used to compare categorical variables. Mann-Whitney U test assessed the difference in mean and median values. Spearman's rho correlation coefficient was calculated to examine the association between perceived stress level and other variables. Bivariate and multivariate ordinal regression analysis was run to identify the association between the dependent variable (perceived stress) and independent variables (socio-demographic, health, and physical activity). Crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) were calculated. The significance level was fixed at a $p<0.05$. Statistical analysis was conducted using Jamovi software (Anonymous, 2021).

2.4. Ethical approval

University Ethics Committee for Human Research (UECHR) of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, approved the study (Approval No. CHS/Ethical Comm/319). Electronic informed consent was obtained from all the respondents, indicating their willingness to participate.

3. RESULTS AND DISCUSSION

3.1. Socio-demographic profile

A total of 1933 individuals participated in the survey, with an equal proportion of males (48.7%) and females (51.3%). The average age of the respondents was 30.6±10.5 years. Most respondents were students (44.7%), postgraduates (38.1%), and upper social class (78.5%). Half of the respondents were from the Central zone of India (50%) living in cities (46.1%). Complete information about the socio-demographic profile of the respondents is shown in Table 1.

3.2. Health profile

Out of 1933 respondents, 683 provided information on random blood sugar levels, and the rest, 1250 respondents, chose the "Do not know" option. Only 35.3% were aware of their blood sugar, and the remaining 64.7% had poor information about their health. Out of 683 respondents, 72.3% of respondents reported normal blood sugar levels (≤140 mg dl^{-1}), 23.4% reported high blood sugar levels (140–160 mg dl^{-1}), and 4.2% reported very high blood sugar levels (>160 mg dl^{-1}).

3.3. Physical activity status

On average, respondents spent more time walking (35.8±27.0 min day^{-1}) followed by vigorous (33.8±27.3 min day^{-1}) and moderate activity (31.6±23.6 min day^{-1}) (Table 2). Respondents walked for a greater number of days (5.03±2.22 days $week^{-1}$), followed by engaging in moderate (2.54±2.35 days $week^{-1}$) and vigorous activity (2.50±2.38 days $week^{-1}$). The maximum number of mean METs was contributed by vigorous activity (848±1316 min $week^{-1}$), followed by walking (628±636 min $week^{-1}$) and moderate activity (378±559 min $week^{-1}$). The mean value of total physical activity undertaken by the respondents was

Table 1: Socio-demographic characteristics of the sample (n = 1933)

Variable	Category	Frequency (%)
Age (years)	18–24	599 (31.0)
Mean±SD= 30.6±10.5	25–34	850 (44.0)
	35–44	246 (12.7)
	45–54	143 (7.4)
	55–64	78 (4.0)
	65 and above (range: 65–77 years)	17 (0.9)
Gender	Male	941 (48.7)
	Female	992 (51.3)
Marital status	Never married	1249 (64.6)
	Currently married	658 (34.0)
	Other (Widower/ Widowed; Divorced; Separated)	26 (1.3)
Religion	Hindu	1705 (88.2)
	Muslim	79 (4.1)
	Christian	51 (2.6)
	Sikh	68 (3.5)
	Buddhist	13 (0.7)
	Jain	9 (0.5)
	Atheist	7 (0.4)
	Donyi-Polo	1 (0.1)
Caste	General	1450 (75.0)
	Other backward class	285 (14.7)
	Scheduled caste	150 (7.8)
	Scheduled tribe	48 (2.5)
Education	Class 12th pass	276 (14.3)
	Diploma	56 (2.9)
	Graduate	577 (29.8)
	Postgraduate	737 (38.1)
	Doctorate	287 (14.8)
Occupation of the respondent	Unemployed	86 (4.4)
	Homemaker	79 (4.1)
	Student	865 (44.7)
	Employee (govt. sector, teaching, private company, NGO)	567 (29.3)
	Business/Self-employed	308 (15.9)
	Retired	28 (1.4)
Employed family members	None	103 (5.3)
	1	792 (41.0)
	2	717 (37.1)
	3	203 (10.5)
	4	87 (4.5)
	5	20 (1.0)
	> 5	11 (0.7)
Monthly per capita income, Indian Rupees (INR)	Preferred not to answer	44 (2.4)
Mean±SD=26,827± 42,537	< 1,000	17 (0.9)
	1,000–10,000	623 (32.2)
	10,001–20,000	654 (33.8)
	20,001–30,000	208 (10.8)
	30,001–40,000	126 (6.5)
	40,001–50,000	73 (3.8)
	> 50,000	188 (9.7)
Social class based on MPCI (INR)	Unclassified[a]	44 (2.3)
7993 and above	i (upper class)	1517 (78.5)
3957–7992	i (upper-middle class)	241 (12.5)
2342–3956	iii (middle class)	63 (3.3)
1212–2341	iv (lower middle class)	42 (2.2)
1211 and below	v (lower class)	26 (1.3)
Family type	Joint	464 (24.0)
	Nuclear	1469 (76.0)
Family size	≤4	1035 (53.5)
	5 to 6	621 (32.1)
	≥7	277 (14.3)
No. of children or adolescents in the family (≤18 years)	None	1214 (62.8)
	1	420 (21.7)
	2	201 (10.4)
	≥3	98 (5.1)
No. of old family members (≥60 years)	None	1130 (58.5)
	1	483 (25.0)
	2	277 (14.3)
	≥3	43 (2.2)

Table 1: Continue...

Variable	Category	Frequency (%)	Variable	Category	Frequency (%)
Education (head of the family)	No formal education	67 (3.5)		Business/Self-employed	662 (34.2)
	Fifth grade	35 (1.8)		Retired	313 (16.2)
	Highschool	235 (12.2)	House location	Rural	484 (25.0)
	Intermediate	191 (9.9)		Town	557 (28.8)
	Diploma	138 (7.1)		City	892 (46.1)
	Graduate	618 (32.0)	Residential zone, n (%)	Northern	386 (20.0)
	Postgraduate	491 (25.4)		Central	967 (50.0)
	Doctorate	158 (8.2)		Eastern	101 (5.2)
Occupation (head of the family)	Unemployed	65 (3.4)		Western	272 (14.1)
	Homemaker	97 (5.0)		Southern	171 (8.8)
	Student	38 (2.0)		North Eastern	36 (1.9)
	Employee (govt. sector, teaching, private company, NGO)	758 (39.2)			

Note: [a] Unclassified: those respondents who selected the "prefer not to answer" option for the question on monthly family income

Table 2: Physical activity status of the respondents (n=1933)

Variable	Total (n=1933) (mean±SD)	Female (n=992) (median)	Male (n=941) (median)	*P*-value†
Vigorous activity (number of days/week)	2.50±2.38	1.00[b]	3.00[a]	< 0.001
Vigorous activity (min/day)	33.8±27.3	25.00[b]	30.00[a]	< 0.001
Vigorous intensity, MET-min/week	848±1316	200[b]	600[a]	< 0.001
Moderate activity (number of days/week)	2.54±2.35	2.00	2.00	0.373
Moderate activity (min/day)	31.6±23.6	25.00[b]	30.00[a]	< 0.001
Moderate intensity, MET-min/week	378±559	180[b]	240[a]	0.044
Walking (number of days/week)	5.03±2.22	6.00	6.00	0.161
Walking (min/day)	35.8±27.0	30.00	30.00	0.003
Walking, MET-min/week	628±636	462[b]	495[a]	0.012
Sitting (hours/day)	5.84±3.31	5.00	5.00	0.737
Total MET-min/week	1854±1955	1191[b]	1535[a]	< 0.001

Note: †Mann-Whitney U test; Different letter superscripts indicate significant differences (p<0.05) between median scores of females and males

1854±1955 MET-min week^{-1}, indicating a wide variation in the physical activity pattern of the respondents. Respondents spent 5.84±3.31 hours sitting daily (Median=5.00 hours day~300 min day^{-1}).

The engagement of males in vigorous and moderate physical activity and walking was significantly (p<0.05) higher than females, as shown in Table 2. Males were significantly more physically active than females, with median total physical activity of 1535 MET-min week^{-1} and 1191 MET-min week^{-1}, respectively (Mann-Whitney U=388201, p<0.001). Of the total 1933 respondents, 24.0% reported a low level of physical activity, as shown in Figure 1. More than half of the respondents were moderately active (59.3%). About 16.7% of the respondents reported a high level of physical activity. A significant difference was observed in the proportion of males and females across three levels of physical activity (χ^2 (2)=44.3, p<0.001).

The current sample spent 83 min daily in all physical activities (walking, vigorous activity, and moderate activity). A study conducted among Indian university students

during the first wave of COVID-19 reported spending more time in all physical activities (94 min day^{-1}), with 29 min daily walking (Sarangi et al., 2022). The difference can be attributed to the use of IPAQ- long form, in the above study, which incorporates a detailed set of questions to investigate various types of physical activity. More than half of the participants (59.3%) were moderately active and spent six hours daily sitting in the current study. In contrast, low physical activity (56.5%) was reported among South Indian residents spending seven hours daily sitting during the first wave of COVID-19, while the levels of high physical activity were similar (17.0% both) (Ganesh et al., 2022). The levels of physical activity vary with study settings. The levels of physical activity increased during the second wave of the pandemic in India, as observed in the current investigation. Males were more physically active than females. An ICMR-India Diabetes study conducted among individuals aged ≥20 years reported higher physical activity levels among males than females (Anjana et al., 2014). Gender gaps in physical activity levels have been similarly displayed in previous studies (McCarthy and Warne, 2022; Podder et al., 2020)

3.4. Stress profile

Table 3 displays responses to items of PSS provided by the respondents. Most respondents responded in the "sometimes" category for the ten questions on the scale (35.5%–45.7%). Following trends were observed in the

Table 3: Responses to the items of perceived stress scale (n=1933), n (%)

Sl. No.	Statement	Never	Almost never	Sometimes	Fairly often	Very often
1.	In the last month, how often have you been upset because of something that happened unexpectedly?	130 (6.7)	209 (10.8)	883 (45.7)	483 (25.0)	228 (11.8)
2.	In the last month, how often have you felt that you were unable to control the important things in your life?	132 (6.8)	217 (11.2)	809 (41.9)	530 (27.4)	245 (12.7)
3.	In the last month, how often have you felt nervous and "stressed"?	123 (6.4)	221 (11.4)	834 (43.1)	479 (24.8)	276 (14.3)
4.	In the last month, how often have you felt confident about your ability to handle your personal problems? [a]	337 (17.4)	708 (36.6)	687 (35.5)	138 (7.1)	138 (7.1)
5.	In the last month, how often have you felt that things were going your way? [a]	183 (9.5)	553 (28.6)	865 (44.7)	242 (12.5)	90 (4.7)
6.	In the last month, how often have you found that you could not cope with all the things that you had to do?	149 (7.7)	314 (16.2)	880 (45.5)	433 (22.4)	157 (8.1)
7.	In the last month, how often have you been able to control irritations in your life? [a]	224 (11.6)	637 (33.0)	814 (42.1)	177 (9.2)	81 (4.2)
8.	In the last month, how often have you felt that you were on top of things? [a]	158 (8.2)	534 (27.6)	823 (42.6)	273 (14.1)	145 (7.5)
9.	In the last month, how often have you been angered because of things that were outside of your control?	124 (6.4)	277 (14.3)	847 (43.8)	480 (24.8)	205 (10.6)
10.	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	189 (9.8)	340 (17.6)	864 (44.7)	378 (19.6)	162 (8.4)

Note: [a] Items are reversely coded

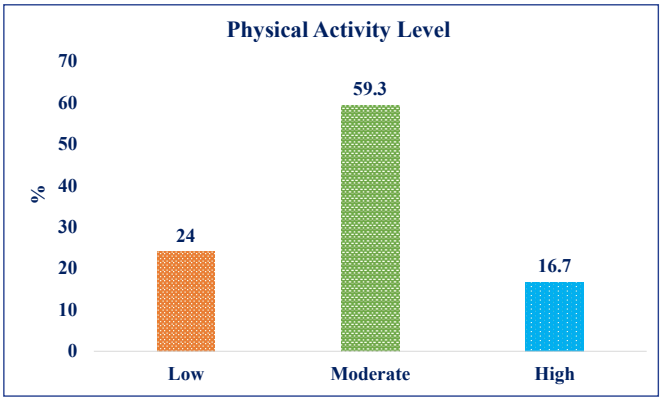

Figure 1: Physical activity level of the respondents

responses to the items of PSS during last month: 40.1% of the respondents (fairly or very) often felt that they are unable to control the important things in their life; 39.1% often felt nervous and stressed; 36.8% were often upset because of something that happened unexpectedly; 35.4% were often angered due to things that happened outside of their control; 30.5% often found that they could not cope with all the things that they had to do; 28.0% often felt that difficulties were piling up so high that they could not overcome them. Conversely, a small proportion (21.6%) of respondents often felt that they were on top of things, 17.2% often felt that things were going their way, 14.2% often felt confident in their ability to handle personal problems, and 13.4% often were able to control irritations in their lives. The PSS reported good reliability with Cronbach's alpha coefficient of 0.755.

3.4.1. Mean perceived stress scale scores

The mean scores obtained on ten items of the PSS ranged from 1.42 to 2.29 (Table 4). The lowest mean score was obtained on item 4, indicating respondents were least confident handling their problems. Respondents scored highest on item 3, indicating stress and nervousness. The mean value of total PSS scores was 19.7±5.5. Females had a significantly higher mean perceived stress score than males (20.5 versus 18.9; p<0.001). Females scored significantly (p<0.05) higher than males in all items of PSS, except for items 4 and 8.

Table 4: Mean scores on items of Perceived Stress Scale, mean (SD)

Sl. No.	Statement	Total (n=1933)	Female (n=992)	Male (n=941)	p-value†
1.	In the last month, how often have you been upset because of something that happened unexpectedly?	2.24 (1.02)	2.33[a] (1.02)	2.16[b] (1.01)	< 0.001
2.	In the last month, how often have you felt that you were unable to control the important things in your life?	2.28 (1.04)	2.39[a] (1.04)	2.17[b] (1.03)	< 0.001
3.	In the last month, how often have you felt nervous and "stressed"?	2.29 (1.05)	2.44[a] (1.04)	2.14[b] (1.04)	< 0.001
4.	In the last month, how often have you felt confident about your ability to handle your personal problems?[1]	1.42 (0.97)	1.44 (0.93)	1.40 (0.997)	0.147
5.	In the last month, how often have you felt that things were going your way?[1]	1.74 (0.95)	1.82[a] (0.97)	1.66[b] (0.93)	< 0.001
6.	In the last month, how often have you found that you could not cope with all the things that you had to do?	2.07 (1.01)	2.13[a] (1.02)	2.01[b] (0.995)	0.022
7.	In the last month, how often have you been able to control irritations in your life?[1]	1.61 (0.95)	1.67[a] (0.94)	1.55[b] (0.96)	0.005
8.	In the last month, how often have you felt that you were on top of things?[1]	1.85 (1.01)	1.89 (1.01)	1.81 (1.02)	0.083
9.	In the last month, how often have you been angered because of things that were outside of your control?	2.19 (1.02)	2.30[a] (0.997)	2.08[b] (1.03)	< 0.001
10.	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	1.99 (1.05)	2.08[a] (1.05)	1.90[b] (1.04)	< 0.001
Perceived stress score		19.7 (5.5)	20.5[a] (5.47)	18.9[b] (5.4)	< 0.001

Note: SD (standard deviation); [1] Items are reversely coded; † Mann-Whitney U test; Different letter superscripts indicate significant differences (p<0.05) between mean scores of females and males

3.4.2. Perceived stress levels

Based on the PSS scores, each respondent was classified into three categories of perceived stress: low, moderate, and high. Most respondents (80.3%) were moderately stressed, as shown in Figure 2. About 11.7% of respondents were classified into the low-stress category, with a higher proportion of males than females (6.6% and 5.10%, respectively). A small proportion of respondents (8.0%) reported high levels of perceived stress, with a higher proportion of females than males (5.7% and 2.3%, respectively). A significant difference was observed in the proportion of males and females across three levels of perceived stress ($\chi^2(2)=29.5$, $p<0.001$).

The respondents of the current study, in the age group of 18 to 77 years, coming from different occupations and income groups, were stressed (92.0%) during the COVID-19

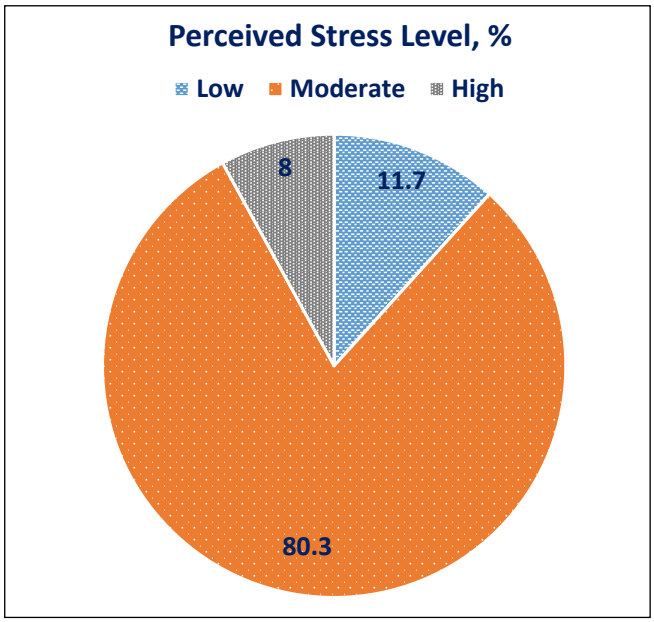

Figure 2: Perceived stress levels among respondents

pandemic. Nearly two out of five respondents (40.0%) could not control essential things and often felt nervous and stressed. The reported prevalence of perceived stress was in line with previous researchers (Bhakat and Das, 2023; Kumar et al., 2022), who also observed high and moderate levels of perceived stress among 62.0 to 96.0% of respondents during the second wave of COVID-19 in India. Studies conducted during the first wave of COVID-19 in India reported high and moderate perceived stress in the range of 74.0 to 95.0% (Wakode et al., 2021; Deb et al., 2023; Suresh Babu et al., 2021; Agrawal et al., 2021; Sharma et al., 2021; Kumawat, 2020; Garg et al., 2021). The above studies conducted during the first and second wave of the COVID-19 pandemic were limited to Indian youth (16–29 years), younger adults, college and university students, medical students, doctors, staff nurses, and teachers, with a small sample size.

The spread of coronavirus was controlled through immunization, lockdown imposition, closure of educational institutes, markets, and businesses, and measures to educate and inform the public. Despite intensive efforts to control the spread of the virus, India faced a second wave of COVID-19 in March 2021 with a more contagious variant, of coronavirus (Joshi and Mehendale, 2021). Compared to the first COVID-19 wave, which was observed with higher mortality among older age groups (60 years and above) and those with comorbidities, while in the second wave, higher mortality was reported among younger adults in India (25 to 50 years) (Asrani et al., 2021). Considering the pandemic's uncertainty, assessing the population's stress levels is essential to provide mental and emotional support. The current study targeted a large sample of Indian adults, diverse in their educational and occupational profiles from various states. Despite various preventive measures, stress levels remained the same during the second wave among the Indian sample, as observed in the current study, which can be attributed to a second consecutive wave hitting the country after the first wave, which led to continued anxiety among the population, fearing the pandemic's perennial nature. Further apprehension of contracting infection, unemployment, lockdown imposition, and social distancing influenced respondents' perception towards the pandemic.

3.5. Correlates of perceived stress

Table 5 shows the association of perceived stress levels with socio-demographics, health profile, and physical activity status. An increase in age reduced perceived stress among respondents, consistent with the findings of the previous studies (Agrawal et al., 2021; Garg et al., 2021; Correa et al., 2020; Lakhdir et al., 2022; Jain et al., 2023). The possible explanation might be that events are interpreted as less stressful and better coping skills develop with ageing. In contrast, no age difference in perceived stress was reported among medical students during COVID-19 in South India (Praveena Daya et al., 2022). Educational status was negatively correlated with a higher level of perceived stress. Perceived stress increased among respondents with lower MPCI and lower social classes. Perceived stress was negatively associated with all forms of physical activity. Similar results showing higher stress levels among respondents with lower income, low socioeconomic status, and physical inactivity were previously reported (Algren et al., 2018; Cheon et al., 2020; Cohen and Janicki-Deverts, 2012). Perceived stress was positively associated with random blood sugar levels and sitting duration. Thus, perceived stress increased with random blood sugar levels or vice versa. Psychological stress influences the metabolic control of blood sugar levels by increasing catecholamine

Table 5: Association of perceived stress with socio-demographics, health profile, and physical activity status

Variables	Perceived stress r_s
Age (years)	−0.146***
Education	−0.146***
MPCI (INR)	−0.113***
Social class	−0.051*
Random blood sugar level	0.092*
Vigorous activity (number of days/week)	−0.067**
Vigorous activity (min/day)	−0.084**
Vigorous intensity, MET-min/week	−0.063**
Moderate activity (number of days/week)	−0.064**
Moderate activity (min/day)	−0.062*
Moderate intensity, MET-min/week	−0.064**
Walking (number of days/week)	−0.087***
Walking (min/day)	−0.065**
Walking, MET-min/week	−0.084***
Sitting (hours/day)	0.071**
Total MET-min/week	−0.11***
Physical activity level	−0.069**

Note: r_s: Spearman's rho correlation coefficient *p<0.05, **p<0.01, ***p<0.001

levels, resulting in glucose intolerance, as observed among healthy individuals (Hamburg et al., 1980). An Indian study reported higher fasting blood glucose levels among people with severe levels of perceived stress (Mishra et al., 2020). A study conducted among Korean university students reported an increase in stress, anxiety, and depression with an increase in sitting hours (Lee and Kim, 2019).

3.6. Predictors of perceived stress

Table 6 reports the findings of bivariate and multivariate ordinal regression. Variables significant in the bivariate model were included in the multivariate ordinal regression model.

According to multivariate ordinal regression, gender, marital status, education and occupation of the respondent, number of children or adolescents in the family, educational status of family's head, social class, physical activity level, and time spent sitting were significantly associated with perceived stress. Females were 1.5 times (AOR=1.51, 95% CI=1.18–1.94) more likely to have high levels of perceived stress than males. Females experiencing higher odds of perceived stress than males are well documented in the scientific literature. (Correa et al., 2020; Cohen and Janicki-Deverts, 2012; Saeed et al., 2016; Feizi et al., 2012; Costa et al., 2021). Similar results were obtained by Indian researchers reporting female gender as a risk factor for increased levels of perceived stress during COVID-19 across various occupational profiles (Kurian and Thomas,

Table 6: Predictors of perceived stress levels: Bivariate and multivariate ordinal regression analysis

Variable	Crude OR	95% CI	AOR	95% CI
Gender				
Male	Reference		Reference	
Female	1.75***	1.39–2.20	1.51**	1.18–1.94
Marital status				
Never married	Reference		Reference	
Currently married	0.58***	0.46–0.74	0.82	0.58–1.17
Widower/ Widowed	0.10*	0.01–0.82	0.17	0.02–1.40
Divorced	1.52	0.42–5.07	1.93	0.49–6.97
Separated	7.70**	1.61–34.80	12.33**	2.42–58.98
Education				
Class 12th pass	Reference		Reference	
Diploma	0.77	0.38–1.56	0.92	0.43–1.97
Graduate	0.84	0.58–1.21	0.95	0.63–1.42
Postgraduate	0.54***	0.38–0.78	0.62*	0.42–0.91
Doctorate	0.30***	0.20–0.45	0.47**	0.27–0.80
Occupation				

Variable	Crude OR	95% CI	AOR	95% CI
Unemployed	Reference		Reference	
Homemaker	0.75	0.35–1.62	0.60	0.25–1.47
Student	0.69	0.39–1.22	0.55	0.31–1.01
Employee (govt. or private sector)	0.32***	0.18–0.58	0.40**	0.22–0.76
Business/Self-employed	0.55	0.30–1.02	0.62	0.31–1.25
Retired	0.13***	0.05–0.33	0.21**	0.08–0.63
No. of children or adolescents in the family				
None	Reference		Reference	
1	1.45*	1.09–1.92	1.42*	1.05–1.92
2	0.93	0.64–1.34	1.09	0.73–1.62
≥ 3	1.12	0.67–1.88	1.26	0.72–2.21
Educational level of the family's head				
No formal education	Reference		Reference	
Fifth grade	1.13	0.43–3.06	1.13	0.41–3.23
Highschool	1.82	0.93–3.48	1.66	0.81–3.31
Intermediate	1.69	0.85–3.29	1.53	0.73–3.12
Diploma	2.35*	1.14–4.74	2.08	0.96–4.45
Graduate	1.95*	1.05–3.54	2.00*	1.01–3.89
Postgraduate	1.92*	1.02–3.51	2.16*	1.08–4.22
Doctorate	0.92	0.46–1.80	1.88	0.85–4.07
Social class				
I (upper class)	Reference		Reference	
II (upper-middle class)	0.51	0.16–1.63	0.66	0.20–2.21
III (middle class)	0.41	0.14–1.22	0.39	0.13–1.20
IV (lower middle class)	0.42	0.17–1.09	0.32*	0.12–0.87
V (lower class)	0.33*	0.14–0.85	0.33*	0.13–0.88
Physical activity level				
Low	Reference		Reference	
Moderate	0.85	0.64–1.11	0.85	0.63–1.13
High	0.56**	0.39–0.79	0.57**	0.39–0.83
Sitting (hours/day)	1.07***	1.03–1.11	1.07***	1.03–1.11

Note: * p<0.05, ** p<0.01, *** p<0.001; AOR: Adjusted odds ratio

2021; Wakode et al., 2021; Deb et al., 2023; Agrawal et al., 2021; Sharma et al., 2021; Podder et al., 2020; Das et al., 2020; Uvais et al., 2020). However, few studies have found no effect of gender on perceived stress during COVID-19 in India (Praveena Daya et al., 2022; Kumar et al., 2022; Suresh Babu et al., 2021; Dagli and Dagli, 2021). Biological, psychological, and social determinants, such as hormonal changes, expression of emotions, thoughts about the social situation, gender labels, inequity, social discrimination, and autonomy, expose women to a greater risk of psychological stress (Boyd et al., 2015; AlAteeq et al., 2020). Increased care burden among women during COVID-19 can be attributed as a factor contributing towards perceived stress (Power, 2020). In certain cultures or societies, women may have traditional roles as homemakers or caregivers. The pandemic has increased the demands of caregiving responsibilities, such as caring for children or elderly family members, which can lead to additional stress. The pandemic also brought about remote work and work-from-home arrangements for many. Women may have faced challenges

balancing work responsibilities with household chores, leading to increased stress.

Respondents separated from their partner were twelve times (AOR=12.33, 95% CI=2.42–58.98) more likely to experience high perceived stress than unmarried respondents. Contrary to the results of the present study, no significant influence of marital status on perceived stress among Indian professionals was reported in previous studies (Garg et al., 2021; Biswas and Naidu, 2019). The perception of stress was reported higher among unmarried IT professionals than among married professionals in India during the pandemic (Kurian and Thomas, 2021). A study conducted among US Nationals identified marital status as a significant predictor of perceived stress. Loneliness, social commitments, and money/economy mediate stress among single individuals (Ta et al., 2017). Psychological and social factors are responsible for higher stress levels among respondents with separated marital status. The absence of an emotional support system to cope with an uncertain situation, lack of a social support network, and isolation contribute towards increased stress.

Postgraduates and doctorates had 38.0% (AOR=0.62, 95% CI=0.42–0.91) and 53.0% (AOR=0.47, 95% CI=0.27–0.80) lower odds of experiencing high levels of perceived stress than 12th pass respondents. Most of the previous research has supported the present study's findings, showing lower odds of perceived stress among respondents with a higher level of education (Correa et al., 2020; Cheon et al., 2020; Feizi et al., 2012). Analysis of three national surveys of the US sample revealed increased stress with decreasing education levels (Cohen and Janicki-Deverts, 2012). However, previous researchers also found no influence of education on perceived stress among the Indian and Danish samples, contradicting the results of the present study (Wakode et al., 2021; Mæhlisen et al., 2018). Educated people might have greater access to resources and information and are more skilled in dealing with stressful events (Correa et al., 2020; Belek, 2000). At the same time, lower educational status places people in a disadvantaged position to experience financial stress, lower perceived health status, and a lack of social support and cohesion (Mulder et al., 2011). World Mental Health Report also highlights the importance of quality education in strengthening individual resilience (Anonymous, 2022).

Odds of high perceived stress were reduced by 79.0% (AOR=0.21, 95% CI=0.08–0.63) and 60.0% (AOR=0.40, 95% CI=0.22–0.76) among retired personnel and those working as an employee in government or private sector, respectively. Similar findings showing low-stress levels among retired and high among unemployed persons were reported in previous studies (Wakode et al., 2021; Cohen and Janicki-Deverts, 2012; Kocalevent et al., 2011). In contrast, no clear association between employment type and perceived stress is also reported by the researchers (Feizi et al., 2012). Work-related stress reduces with retirement with more time to spend on leisure and relaxation. However, the experience of stress in retirement can vary significantly depending on individual circumstances. Individuals with regular employment have a sense of purpose, financial security, and social support from the workplace, which may contribute towards reduced stress. However, the nature of the job, workplace conditions, individual personality, and coping mechanisms influence the above relation. Decent work is a protective factor for sound mental health (World Health Organization, 2022).

Respondents with one child or adolescent in the family were 1.42 times (AOR=1.42, 95% CI=1.05–1.92) more likely to have high levels of perceived stress than respondents with no children or adolescents. Similar findings were reported by previous researchers (Deb et al., 2023; Taylor et al., 2008). Respondents with a single child or adolescent in the family are generally younger adults or are from 'young families' (Taylor et al., 2008). In this study, 28.4% of the respondents with one child or adolescent in the family reported high levels of perceived stress. Such a finding is cause for concern, considering family circumstances. During the pandemic, children or adolescents were made to stay home, which increased family stress risk (Anonymous, 2022).

The odds of high perceived stress were twofold among those respondents who reported graduate (AOR=2.00, 95% CI=1.01–3.89) or postgraduate (AOR=2.16, 95% CI=1.08–4.22) as the educational status of family's head. The educational status of the family's head as a graduate or postgraduate increased the risk of perceived stress among respondents. Similar findings were received in a study among Indian youth during COVID-19, indicating high perceived stress among those with mothers's higher levels of education (Deb et al., 2023). Heads of the family with some form of formal education and who possess knowledge about their dependents' academic or professional progress were concerned about their growth due to the closure of colleges and institutes, which increased psychological stress.

Respondents in social class IV (lower-middle class) and V (lower class) had 67.0 to 68.0% (AOR=0.32, 95% CI=0.12–0.87; AOR=0.33, 95% CI=0.13–0.88) lower odds of experiencing high levels of perceived stress. The present study's results align with previous investigations showing social class as a significant predictor of psychological distress and that white-collar employees have a lower risk of psychological distress than blue-collar workers (Belek, 2000). Contrary to the results of the present study, lower socioeconomic status contributes towards increased stress

as reported in previous literature (Kocalevent et al., 2011; Michou and Costarelli, 2021). A cohort study conducted in North Denmark found no influence of income level on perceived stress (Mæhlisen et al., 2018). A meta-analysis showed that while there were socioeconomic inequalities in depression (a related but distinct construct from perceived stress), the association with perceived stress was not as straightforward (Lorant et al., 2003). A possible explanation for the findings could be fewer work demands, community support, simpler lifestyles, and lower expectations among middle and lower-social-class individuals. Perceived stress is influenced by the complex interplay of economic, social, cultural, and individual factors. People from all social classes can experience stress, and it is essential to avoid generalizing stress levels based solely on social class. Therefore, more research is needed in the above direction.

High physical activity levels reduced the odds of high perceived stress by 43.0% (AOR=0.57, 95% CI=0.39–0.83). Thus, physical activity has a protective role in reducing stress levels. The findings of the present investigation supported the conclusions of earlier studies showing a negative association between physical activity and perceived stress (Feizi et al., 2012; Tan et al., 2020; Ng and Jeffery, 2003; Can, 2019). Previous researchers have reported that indulgence in exercise was a protective factor in reducing stress levels during COVID-19 (Lakhdir et al., 2022). Regular exercise positively impacts mental health by reducing stress, anxiety, and depression. The proposed mechanism lies behind increased blood flow to the brain during exercise, which influences the hypothalamic-pituitary-adrenal (HPA) axis and subsequent reactivity to stress. The HPA axis communicates with several brain regions regulating mood, motivation, and memory (Guszkowska, 2004). Physical activity stimulates the release of endorphins, which is a "feel-good" hormone crucial in reducing stress and promoting a positive mood (Mikkelsen et al., 2017). Physical activity also provides a temporary distraction from pandemic-related stressors, allowing individuals to break from constant worry and anxiety (Stanton and Reaburn, 2014).

Increased sitting time (hours day^{-1}), an indicator of sedentary behaviour, increased the odds of high perceived stress by 1.07 times (AOR=1.07, 95% CI=1.03–1.11). Concurrent with the present results, a study showed that lower sedentary time was associated with reduced perceived stress scores (Tan et al., 2020). Sedentary behaviour such as screen time and other leisure time increases the risk of perceived stress (Felez-Nobrega et al., 2020). A cross-sectional study conducted among older adults from low- and middle-income countries reported that sedentary behaviour for more than four hours per day increased the risk of perceived stress by two to nine times (Ashdown-Franks et al., 2018). Sitting alone or with family members at home has led to pondering over difficult situations of COVID-19, and not seeing any solution in front has led to helplessness and frustrations in many, leading to stress. Spending prolonged periods sitting, especially when it involves sedentary activities like watching TV or using electronic devices, can lead to social isolation. Lack of social interactions and connections can increase feelings of stress and loneliness. Working from home during COVID-19 contributed towards extended periods at a desk or computer, which increased the sitting duration of the respondents.

Thus, various demographic and lifestyle factors had a significant influence on perceived stress levels. Key stressors and protective factors identified in the study can guide policymakers in developing evidence-based strategies to enhance the population's well-being.

3.7. Limitations of the study

The convenience sampling technique was used in the present study. Thus, the results are limited in the extent to be generalized.

3.8. Strengths of the study

The study provides intriguing insights into the perception of stress among Indian adults during the second wave of COVID-19, with a large sample size compared to other studies conducted in the Indian context. We considered various factors related to perceived stress, including socio-demographic variables (gender, age, family structure, educational status, income), lifestyle factors (physical activity, sitting time), and occupational status. This comprehensive approach allows for a more detailed understanding of stress experiences. Using regression analysis to identify predictors of perceived stress provides quantifiable measures of the strength of these associations. Using validated stress and physical activity scales further adds reliability to the findings.

4. CONCLUSION

Indian adults were moderately stressed during the second wave of COVID-19. Factors influencing perceived stress are multisectoral; tailored interventions should involve multiple sectors to support vulnerable groups. A stable occupation or supportive retirement can contribute to better stress management. Engagement in indoor physical activities such as yoga, stretching exercises, and dancing can help citizens deal with stress during the pandemic and daily life. Public health strategies may involve education and physical activity as essential components to reduce stress and enhance resilience.

5. ACKNOWLEDGEMENT

The authors would like to thank all the study participants for cooperating.

6. REFERENCES

Agrawal, N., Sharma, H., Dabas, A., Mishra, A., 2021. Perceived Stress Among Medical Students and Doctors in India During COVID-19 Pandemic. MAMC Journal of Medical Sciences 7(1), 14. https://doi.org/10.4103/mamcjms.mamcjms_17_21

AlAteeq, D.A., Aljhani, S., AlEesa, D., 2020. Perceived stress among students in virtual classrooms during the COVID-19 outbreak in KSA. Journal of Taibah University Medical Sciences 15(5), 398–403. https://doi.org/10.1016/j.jtumed.2020.07.004

Algren, M.H., Ekholm, O., Nielsen, L., Ersbøll, A.K., Bak, C.K., Andersen, P.T., 2018. Associations between perceived stress, socioeconomic status, and health-risk behaviour in deprived neighbourhoods in Denmark: A cross-sectional study. BMC Public Health 18(1), 250. https://doi.org/10.1186/s12889-018-5170-x

Anjana, R.M., Pradeepa, R., Das, A.K., Deepa, M., Bhansali, A., Joshi, S.R., Joshi, P.P., Dhandhania, V.K., Rao, P.V., Sudha, V., Subashini, R., Unnikrishnan, R., Madhu, S.V., Kaur, T., Mohan, V., Shukla, D.K., ICMR– INDIAB Collaborative Study Group., 2014. Physical activity and inactivity patterns in India-Results from the ICMR-INDIAB study (Phase-1) [ICMR-INDIAB-5]. The International Journal of Behavioral Nutrition and Physical Activity 11(1), 26. https://doi.org/10.1186/1479-5868-11-26

Anonymous, n.d. Index Numbers. Available from http://labourbureau.gov.in/LBO_indnum.htm. Accessed on 22nd March, 2021.

Anonymous, n.d. Zonal Council. Available from https://www.mha.gov.in/zonal-council. Accessed on 9th March, 2021.

Anonymous, n.d. India: WHO Coronavirus Disease (COVID-19) Dashboard With Vaccination Data. Available from https://covid19.who.int. Accessed on 22nd July, 2023.

Anonymous, 2002. Short last 7 days self-administered version of the IPAQ. Available from https://sites.google.com/site/theipaq/. Accessed on 8th April, 2021.

Anonymous, 2017. National Family Health Survey (NFHS-4), 2015-16: India. Available from https://rchiips.org/nfhs/NFHS-4Reports/India.pdf. Accessed on 21st March, 2021.

Anonymous, 2021. The jamovi project (Version 2.2) [Computer software]. Available from https://www.jamovi.org. Accessed on 16th March 2021.

Anonymous, 2020. WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020. Available from https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020. Accessed on 22nd July, 2023.

Anonymous, 2022. World mental health report: Transforming mental health for all. World Health Organization, 296.

Ashdown-Franks, G., Koyanagi, A., Vancampfort, D., Smith, L., Firth, J., Schuch, F., Veronese, N., Stubbs, B., 2018. Sedentary behavior and perceived stress among adults aged ≥50 years in six low- and middle-income countries. Maturitas 116, 100–107. https://doi.org/10.1016/j.maturitas.2018.08.005

Asrani, P., Eapen, M.S., Hassan, M.I., Sohal, S.S., 2021. Implications of the second wave of COVID-19 in India. The Lancet Respiratory Medicine 9(9), e93–e94. https://doi.org/10.1016/S2213-2600(21)00312-X

Belek, I., 2000. Social class, income, education, area of residence and psychological distress: Does social class have an independent effect on psychological distress in Antalya, Turkey? Social Psychiatry and Psychiatric Epidemiology 35(2), 94–101. https://doi.org/10.1007/s001270050013

Bhakat, P., Das, K., 2023. Status of mental health among college and university students during first and second wave of COVID-19 outbreak in India: A cross-sectional study. Journal of Affective Disorders Reports 12, 100494. https://doi.org/10.1016/j.jadr.2023.100494

Biswas, S., Naidu, S., 2019. A study to correlate perceived stress with marital status in working men and women in Bengaluru city. International Journal of Physiology 7(4), Article 4. https://doi.org/10.37506/ijop.v7i4.93

Bland, J.M., Altman, D.G., 1997. Statistics notes: Cronbach's alpha. BMJ 314(7080), 572. https://doi.org/10.1136/bmj.314.7080.572

Boyd, A., Van de Velde, S., Vilagut, G., de Graaf, R., O-Neill, S., Florescu, S., Alonso, J., Kovess-Masfety, V., 2015. Gender differences in mental disorders and suicidality in Europe: Results from a large cross-sectional population-based study. Journal of Affective Disorders 173, 245–254. https://doi.org/10.1016/j.jad.2014.11.002.

Can, S., 2019. The Determining of relationship between physical activity and perceived stress level in security service employees. Journal of Education and Training Studies 7(1), 149.

Chan, S.F., Greca, A.M.L., 2013. Perceived Stress Scale (PSS). In: Gellman, M.D., Turner, J.R. (Eds.), Encyclopedia of behavioral medicine. Springer, 1454–1455. https://doi.org/10.1007/978-1-4419-1005-9_479.

Cheon, Y., Park, J., Jeong, B.Y., Park, E.Y., Oh, J.K., Yun, E.H., Lim, M.K., 2020. Factors associated with

psychological stress and distress among Korean adults: The results from Korea National Health and Nutrition Examination Survey. Scientific Reports 10(1), Article 1. https://doi.org/10.1038/s41598-020-71789-y.

Chhetri, B., Goyal, L.M., Mittal, M., Battineni, G., 2021. Estimating the prevalence of stress among Indian students during the COVID-19 pandemic: A cross-sectional study from India. Journal of Taibah University Medical Sciences 16(2), 260–267. https://doi.org/10.1016/j.jtumed.2020.12.012.

Cohen, S., Janicki-Deverts, D., 2012. Who's stressed? Distributions of psychological stress in the united states in probability samples from 1983, 2006, and 20091. Journal of Applied Social Psychology 42(6), 1320–1334. https://doi.org/10.1111/j.1559-1816.2012.00900.x.

Cohen, S., Kamarck, T., Mermelstein, R., 1983. A global measure of perceived stress. Journal of Health and Social Behavior 24(4), 385–396.

Correa, P.S., Mola, D.J., Ortiz, M.V., Godoy, J.A., 2020. Variables relacionadas al estrés percibido durante el aislamiento por COVID-19 en Argentina. Salud & Sociedad 11, e4558–e4558. https://doi.org/10.22199/issn.0718-7475-2020-0007.

Costa, C., Briguglio, G., Mondello, S., Teodoro, M., Pollicino, M., Canalella, A., Verduci, F., Italia, S., Fenga, C., 2021. Perceived stress in a gender perspective: a survey in a population of unemployed subjects of southern Italy. Frontiers in Public Health 9. https://www.frontiersin.org/article/10.3389/fpubh.2021.640454.

Dagli, N., Dagli, R., 2021. Perceived stress during lockdown due to corona pandemic in Indian urban population: A questionnaire-based study. Journal of Health Research and Reviews 8(1), 23–26.

Das, A., Sil, A., Jaiswal, S., Rajeev, R., Thole, A., Jafferany, M., Ali, S.N., 2020. A study to evaluate depression and perceived stress among frontline indian doctors combating the COVID-19 pandemic. The Primary Care Companion for CNS Disorders 22(5), 26168. https://doi.org/10.4088/PCC.20m02716.

Deb, S., Dorji, N., Kar, S., Maria Sunny, A., Deb, S., Ghosh, S., Chakraborty, S., 2023. COVID-19 and stress of Indian youth: An association with background, on-line mode of teaching, resilience and hope. Journal of Affective Disorders Reports 12, 100502. https://doi.org/10.1016/j.jadr.2023.100502.

Feizi, A., Aliyari, R., Roohafza, H., 2012. Association of perceived stress with stressful life events, lifestyle and sociodemographic factors: a large-scale community-based study using logistic quantile regression. Computational and Mathematical Methods in Medicine 2012, e151865. https://doi.org/10.1155/2012/151865.

Felez-Nobrega, M., Bort-Roig, J., Briones, L., Sanchez-Niubo, A., Koyanagi, A., Puigoriol, E., Puig-Ribera, A., 2020. Self-reported and activPALTM-monitored physical activity and sedentary behaviour in college students: Not all sitting behaviours are linked to perceived stress and anxiety. Journal of Sports Sciences 38(13), 1566–1574. https://doi.org/10.1080/02640414.2020.1748359.

Ganesh, G.S., Dakshinamoorthy, A., Tamilalagan, M., Shah, D., Dokania, S., 2022. A cross-sectional study on the influence of COVID-19 pandemic on physical activity patterns among residents in a South Indian City. Bulletin of Faculty of Physical Therapy 27(1), 31. https://doi.org/10.1186/s43161-022-00092-w

Garg, R., Singla, A., Garg, J., 2021. Perceived stress among doctors working in a dedicated COVID-19 hospital in North India. Indian Journal of Medical Sciences 73(2), 155–158. https://doi.org/10.25259/IJMS_94_2021

Guszkowska, M., 2004. Effects of exercise on anxiety, depression and mood. Psychiatria Polska 38(4), 611–620.

Hamburg, S., Hendler, R., Sherwin, R.S., 1980. Influence of small increments of epinephrine on glucose tolerance in normal humans. Annals of Internal Medicine 93(4), 566–568. https://doi.org/10.7326/0003-4819-93-4-566.

Jain, A., Jain, N., Goyal, M.K., Goyal, A., Yadav, K.S., Yadav, R., 2023. Assessment of perceived stress during corona (COVID-19) pandemic among health-care workers. Journal of Primary Care Specialists. https://www.jpcsonline.org/preprintarticle.asp?id=374083

Joshi, R.K., Mehendale, S.M., 2021. Prevention and control of COVID-19 in India: Strategies and options. Medical Journal Armed Forces India 77(Suppl 2), S237–S241. https://doi.org/10.1016/j.mjafi.2021.05.009.

Kocalevent, R.D., Hinz, A., Brahler, E., Klapp, B.F., 2011. Regionale und individuelle Faktoren von Stresserleben in Deutschland: Ergebnisse einer repräsentativen Befragung mit dem Perceived Stress Questionnaire (PSQ). Das Gesundheitswesen 73(12), 829–834. https://doi.org/10.1055/s-0030-1268445.

Krafft, A.M., Chukwuorji, J.C., Choubisa, R., Comte, S., Fenouillet, F., Flores-Lucas, V., Guse, T., Kasprzak, E., Martin-Krumm, C., Marujo, H. A., Nair, C., Sinclair, M., Slezackova, A., Stecz, P., Varsos, O., 2023. Mastering the COVID-19 pandemic crisis: From anxiety to hope. In: Krafft, A.M., Guse, T., Slezackova, A. (Eds.), Hope across cultures: Lessons from the International Hope Barometer. Springer

International Publishing, 327–405. https://doi.org/10.1007/978-3-031-24412-4_9.

Kumar, S., Kartikey, D., Biswas, J., 2022. Status of perceived stress and quality of life in adults during COVID-19 pandemic. Indian Journal of Private Psychiatry 16(1), 25–28.

Kumawat, K., 2020. Perceived stress and burnout in online teaching in teachers in India during pandemic COVID-19. Indian Journal of Health and Wellbeing 11(10–12), 486–492.

Kurian, R.M., Thomas, S., 2021. Perceived stress among information technology professionals in India during the COVID-19 pandemic. Theoretical Issues in Ergonomics Science, https://www.tandfonline.com/doi/abs/10.1080/1463922X.2021.1901321.

Lad, S.S., Bhakta, S., Hira, V., 2022. Mental health and perceived awareness of the South Asian Indian community during the COVID-19 pandemic: A systematic review of findings. International Perspectives in Psychology: Research, Practice, Consultation 11(3), 169–177. https://doi.org/10.1027/2157-3891/a000051.

Lakhdir, M.P.A., Peerwani, G., Azam, S.I., Ali Nathwani, A., Iqbal, R., Asad, N., 2022. Burden and factors associated with perceived stress amidst COVID-19: A population web-based study in Pakistan. BMJ Open 12(6), e058234. https://doi.org/10.1136/bmjopen-2021-058234.

Lee, E., Kim, Y., 2019. Effect of university students' sedentary behavior on stress, anxiety, and depression. Perspectives in Psychiatric Care 55(2), 164–169. https://doi.org/10.1111/ppc.12296.

Lorant, V., Deliège, D., Eaton, W., Robert, A., Philippot, P., Ansseau, M., 2003. Socioeconomic inequalities in depression: A meta-analysis. American Journal of Epidemiology 157(2), 98–112. https://doi.org/10.1093/aje/kwf182.

Mæhlisen, M.H., Pasgaard, A.A., Mortensen, R.N., Vardinghus-Nielsen, H., Torp-Pedersen, C., Bøggild, H., 2018. Perceived stress as a risk factor of unemployment: A register-based cohort study. BMC Public Health 18(1), 728. https://doi.org/10.1186/s12889-018-5618-z

McCarthy, C., Warne, J.P., 2022. Gender differences in physical activity status and knowledge of Irish University staff and students. Sport Sciences for Health 18(4), 1283–1291. https://doi.org/10.1007/s11332-022-00898-0.

Michou, M., Costarelli, V., 2021. Perceived stress in relation to socioeconomic and lifestyle characteristics in greece: a cross-sectional study. International Journal of Home Economics 14(2), 108–115.

Mikkelsen, K., Stojanovska, L., Polenakovic, M., Bosevski, M., Apostolopoulos, V., 2017. Exercise and mental health. Maturitas 106, 48–56. https://doi.org/10.1016/j.maturitas.2017.09.003.

Mishra, A., Podder, V., Modgil, S., Khosla, R., Anand, A., Nagarathna, R., Malhotra, R., Nagendra, H.R., 2020. Higher perceived stress and poor glycemic changes in prediabetics and diabetics among Indian population. Journal of Medicine and Life 13(2), 132–137. https://doi.org/10.25122/jml-2019-0055.

Mulder, B.C., Bruin, M. de, Schreurs, H., Ameijden, E.J.C. van., Woerkum, C.M.J. van., 2011. Stressors and resources mediate the association of socioeconomic position with health behaviours. BMC Public Health 11, 798. https://doi.org/10.1186/1471-2458-11-798

Ng, D.M., Jeffery, R.W., 2003. Relationships between perceived stress and health behaviors in a sample of working adults. Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association 22(6), 638–642. https://doi.org/10.1037/0278-6133.22.6.638.

Podder, I., Agarwal, K., Datta, S., 2020. Comparative analysis of perceived stress in dermatologists and other physicians during national lock-down and COVID-19 pandemic with exploration of possible risk factors: A web-based cross-sectional study from Eastern India. Dermatologic Therapy 33(4), e13788. https://doi.org/10.1111/dth.13788.

Power, K., 2020. The COVID-19 pandemic has increased the care burden of women and families. Sustainability: Science, Practice and Policy 16(1), 67–73. https://doi.org/10.1080/15487733.2020.1776561.

Prasad, B., 1961. Social classification of Indian families. Journal of Indian Medical Association 37, 250–251.

Praveena Daya, A., Anithasri, A., Prema Priya, G., Ilamathi, K.R., Karthikeyan, G., 2022. Perceived stress among medical students during COVID-19 pandemic and its impact on sleep and studies-a cross-sectional study in South India. Journal of Communicable Diseases 143–149. https://doi.org/10.24321/0019.5138.202223.

Saeed, A.A., Bahnassy, A.A., Al-Hamdan, N.A., Almudhaibery, F.S., Alyahya, A.Z. 2016. Perceived stress and associated factors among medical students. Journal of Family & Community Medicine 23(3), 166–171. https://doi.org/10.4103/2230-8229.189132

Sarangi, P., Manoj, M., Bhosley, M., 2022. Impacts of COVID-19 lockdown on time allocation for sedentary and physical activities – The context of Indian university students. Journal of Transport & Health 25, 101383. https://doi.org/10.1016/j.jth.2022.101383.

Sharma, R., Bansal, P., Chhabra, M., Bansal, C., Arora, M., 2021. Severe acute respiratory syndrome coronavirus-

2-associated perceived stress and anxiety among Indian medical students: A cross-sectional study. Asian Journal of Social Health and Behaviour 4(3), 98. https://doi.org/10.4103/shb.shb_9_21.

Sinharoy, A., Pal, S., Das, J., Mondal, P., 2021. Perceived stress, knowledge, and preventive behaviors in indian versus us-based participants during COVID-19: A survey study. Frontiers in Public Health 9. https://www.frontiersin.org/articles/10.3389/fpubh.2021.687864.

Sjostrom, M., Ainsworth, B.E., Bauman, A., Bull, F.C., Hamilton-Craig, C.R., Sallis, J.F., 2005. Guidelines for data processing analysis of the International Physical Activity Questionnaire (IPAQ)—Short and long forms. https://api.semanticscholar.org/CorpusID:79242415.

Srivastava, V., Priyadarshini, S., 2020. India reports first case of novel coronavirus. Nature India. Available from https://doi.org/10.1038/nindia.2020.15. Accessed on 9th January, 2022.

Stanton, R., Reaburn, P., 2014. Exercise and the treatment of depression: A review of the exercise program variables. Journal of Science and Medicine in Sport 17(2), 177–182. https://doi.org/10.1016/j.jsams.2013.03.010.

Suresh Babu, L., Janarthanan Pillai, D.M., Janardhanan, K.A., 2021. Prevalence of perceived stress, due to COVID-19 Among Faculties of Government Dental Colleges in Kerala, India. Cogent Psychology 8(1), 1978635. https://doi.org/10.1080/23311908.2021.1978635.

Ta, V.P., Gesselman, A.N., Perry, B.L., Fisher, H.E., Garcia, J.R., 2017. Stress of singlehood: marital status, domain-specific stress, and anxiety in a National U.S. Sample. Journal of Social and Clinical Psychology 36(6), 461–485. https://doi.org/10.1521/jscp.2017.36.6.461.

Tan, S.L., Jetzke, M., Vergeld, V., Müller, C., 2020. Independent and combined associations of physical activity, sedentary time, and activity intensities with perceived stress among University Students: Internet-Based Cross-Sectional Study. JMIR Public Health and Surveillance 6(4), e20119. https://doi.org/10.2196/20119.

Taylor, M.R., Agho, K.E., Stevens, G.J., Raphael, B., 2008. Factors influencing psychological distress during a disease epidemic: Data from Australia's first outbreak of equine influenza. BMC Public Health 8(1), 347. https://doi.org/10.1186/1471-2458-8-347.

Uvais, N.A., Shihabudheen, P., Hafi, N.A.B., 2020. Perceived stress and stigma among doctors working in COVID-19-designated Hospitals in India. The Primary Care Companion for CNS Disorders 22(4), 26178. https://doi.org/10.4088/PCC.20br02724.

Wakode, N., Wakode, S., Santoshi, J., 2021. Perceived stress and generalized anxiety in the Indian population due to lockdown during the COVID-19 pandemic: A cross-sectional study. F1000 Research 9, 1233. https://doi.org/10.12688/f1000research.26371.3.