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RESEARCH ARTICLE

ASSESSMENT OF PERCEIVED STRESS LEVELS AMONG MEDICAL STUDENTS AND THEIR DIETARY INTAKE AND LIFESTYLE DURING SECOND WAVE OF COVID-19 PANDEMIC

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ABSTRACT

BACKGROUND: "Stress is a response that embodies a range of integrative physiological and behavioral processes that occur when there is a real or perceived threat to homeostasis." A stressor is a stimulus that causes stress. According to various research findings, medical students tend to perceive stress more than other populations their age. The continuing COVID-19 pandemic may pose a major challenge for medical students' learning and also have a profound effect on their psychological well-being. Furthermore, the relationship between stress, diet, and nutrition is complex, and experimental research varies widely. **OBJECTIVE(S):** Study objectives include determining the prevalence of stress among medical students during the second wave of COVID-19 and examining its relationship with dietary intake and lifestyle. **METHOD:** A cross-sectional descriptive study was conducted on 69 undergraduate medical students of JSS Medical College, Mysore during February 2021 to April 2021 using Medical Student Stress Questionnaire (MSSQ) to assess stress levels and a pre-designed semi-structured questionnaire which consists of Socio-Demographic details; Food Frequency Questionnaire (FFQ); 3 day's 24-hour dietary recall to know the consumption pattern and average intake of nutrients after taking their informed consent and Institutional Ethical Committee approval. Statistical analysis was performed using SPSS software. **RESULTS:** Out of 69 students, 41 are female and 28 are male. MSSQ analysis revealed that the high prevalence of stress is due to academic related stressors (60.5%) followed by group activity related (45.25%), intrapersonal and interpersonal related (41.5%), teaching and learning related (35.5%), social related (33%), and drive & desire related stressors (28.25%). From FFQ and dietary recall analysis, it was observed low energy intake and high-fat consumption was associated with high-stress levels. **CONCLUSION:** Stress and Diet can be consideredas a two-edged sword that is stress may alter dietary intake and dietary intake may also alter stress levels. In the study conducted, stress appears to alter the overall food intake in different ways and vice-versa, with some consuming fast foods more often and while some skipping the meals, some are under-eating and some are overeating. So identifying the predisposing factors that stimulate stress levels might help in designing specific programs to reduce stress levels atleast to a certain extent.

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INTRODUCTION

Stress is prevalent all around the world and all people may have experienced it throughout one's lifespan and is defined as "a complex physiological state that embodies a range of integrative physiological and behavioral processes that occur when there is a real or perceived threat to homeostasis." Students were once thought to be the least affected population by stress or problems, but now researchers have realized that stress is a lifestyle crisis that affects all individuals.

Globally, by various research findings, it was found that the prevalence of stress among medical students is higher when compared to the population of the same age group (1). The estimated prevalence was found to be ranging from 29.2% - 38.7% among medical students when compared to the general population of the same age group which is not more than 10%. Research stated that certain levels of stress may enhance academic performance, motivation, and adaptation when it is managed efficiently but either due to lack of knowledge to cope with the stress or due to wrongly influenced coping

strategies (alcohol, substance use, etc.) or unhealthy eating habits, it may cause miserable consequences for the student as well as to the institute (2). A 2012 Lancet report also quoted that the 15-29 age group bracket in India has the highest rate of suicide in the world (as cited in "India has the Highest Suicide Rate", n.d.) And these numbers show no sign of dropping (3). There are various causing factors of stress and most of the research relates stress in medical students to factors like academic obstacles, immense course workload, lack of time, lesser preparation time, irregular nutrition habits, sedentary lifestyle, high parent expectations, exposure to patients' suffering & deaths, student abuse, insufficient or inappropriate practical as well as economical support and presently as the new outbreak of COVID-19 pandemic continues, the changes in course curriculum along with uncertainty about the exam has become a major challenge for medical students' learning which has a profound effect on their psychological wellbeing and contributes to their weakening mental health; These all factors together may precipitate anxiety and depression which may cause intense feelings of fear and panic; and also anxiety sufferers can experience physiological symptoms like fatigue, dizziness, headache, nausea, abdominal pain, palpitations, shortness of breath, urinary incontinence & psychological syndrome-like burnout phenomenon (4,5).

Stress may also impair goal-oriented direction, concentration, working memory and influence perceptual-motor function among medical students which are the important domains to provide safe and effective medical care to patients in the future. (1); It has also been hypothesized that the burnout phenomenon (emotional exhaustion, physical fatigue, cognitive weariness, depersonalization, and a sense of reduced accomplishment of day to day work) a measure of distress that is common among residents and medics in practice is originated in medical school and it has also been reported to be linked with cynicism, an unwillingness to care for the chronically ill, treating patients as objects and decreased empathy (5). In view of all these consequences, it is crucial for medical students to select appropriate coping strategies at an early stage, namely during the first year of medical school, which has an impact on their adjustment in medical school and also affects their quality of life. Stress affects health through direct physiological effects and also through indirect health-related behavior changes, according to growing research. The choice of food is one of the behavioral changes that negatively impact health because of changes in appetite and diet. The right diet and nutrition are important for the promotion and maintenance of good health throughout one's lifespan. Generally, people with stress tend to eat less healthy food and recent research has also reported that stress increases cortisol levels among individuals inducing increment in low-quality food choices (bidirectional study) Though the potential effects of a good diet might be indefinite and characterized by inter-individual differences focusing on eating habits, inculcating a good diet and lifestyle may help manage stress levels in individuals (6). The Diet of every individual varies according to their culture, personal traits, choices, etc and the internet is full of articles promoting foods that may help in managing stress levels. Some of them are complex carbohydrates from whole grains, omega 3 fatty acids, vitamin c rich foods, magnesium from nuts, beans, etc. Following a healthy dietary pattern with the inclusion of the above foods may not have a downside. Emerging research has also shown another way in which a healthy dietary pattern could be influential in managing stress.

"The gut microbiome and its connection to the brain is a big area of research at this time," says Giles. The Gut-brain axis is bidirectional communication between the central nervous system and enteric nervous system which links emotional and cognitive centers of the brain with peripheral intestinal functions. Stress exerts bi-directional effects between the gastrointestinal nervous system and central nervous system. In other words, stress might have negative effects on beneficial gut bacteria, and positive changes to the gut microbiome could have emotional benefits, such as a decrease in depression and anxiety." Thus consuming probiotic foods, prebiotics, and fiber may enhance the gut microbiome and could benefit multiple pathways of health including stress as determined by their bidirectional axis (7, 8). The association between stress levels, diet & nutrition is complex and the experimental research is inconsistent but "Making positive behavior changes regarding diet can also make a psychological contribution to stress reduction," says Alice H. Lichtenstein, given worrying too much about what foods to be eaten is not so productive. There are very few studies that have shown an association between perceived stress levels and dietary intake among medical students. Therefore the present study is designed to determine the prevalence of perceived stress among medical students and to observe the association between the stress levels and their dietary intake & lifestyle (6).

MATERIALS AND METHODS

The study was conducted among the 1st year undergraduate medical students of JSS Medical College, Mysore. A convenient sampling approach was used. There were 100 students aged 18-22 in the sample, out of which 69 students, including 41 females and 28 males, filled the total form. The study excluded students suffering from any psychiatric illness or any other disease condition. An informed consent was obtained from the participants after clearance from the Ethical Committee of the institute. It was explained verbally what the study was about and what its objectives were. Tools of data collection - The data regarding socio-demographic, medical history, physical activity, and smoking habits were collected by using an online semi-structured questionnaire through Google forms after explaining how the questionnaire could be filled out. Weight and height were measured and body mass index (BMI) was calculated as weight (kg) divided by square of height (m2). Medical Student Stress Questionnaire (MSSQ) was used to measure perceived stress levels. It has been validated and has shown internal consistency and reliability (Cronbach's alpha coefficient value was 0.95). Students respond to 40 questions grouped into 6 domains and rate the intensity of stress caused by each item using a 5 point likert scale where statements range from no stress (0) to mild stress (1) to moderate stress (2) to extreme stress (4). The MSSQ is scored by obtaining the mean values for each of the 6 categories and the scores are rated as mild (0 – 1), moderate (1.01 – 2), high (2.01 -3), and severe (3.01 – 4). A semi-structured questionnaire that includes Food Frequency Questionnaire and 3day's 24-hour dietary recall was used to know the frequency of consumption of foods and to know the average intake of nutrients.

Statistical analysis: Data were analyzed using IBM SPSS version 22.0. Independent two sample t-test was used to compare scores between male and female. Chi-square test was applied for comparing categorical variables and stress levels.

To observe the association between dietary intake and stress levels, one way anova and correlation analysis was used.

RESULTS

Table 1. Distribution of subjects according to their demographic details

1	Gender	Percentage (%)	
	Male	40.5	
	Female	59.5	
2	BMI	Male %	Female %
	<18.5 - underweight	3.7	8.8
	18.5 to 22.9 - normal	33.33	55.5
	23 to 24.9 – overweight	25.9	6.66
	>= 25 - obesity	37.03	26.6
3	Family type	Percentage (%)	
	Nuclear	91	
	Joint	9	

Table 2. Data Representing Lifestyle And Diet Preferences

Diet preferences	Percentage (%)
North Indian	56
South Indian	77
West Indian	5
East Indian	2
Vegetarian	48
Vegetarian with egg	35
Vegan	0
Non vegetarian	54
Physical activity	
Sedentary	20
Moderate	66
Active	14
Exercise frequency	
Once a week	14
Twice a week	12
Thrice a week	23
Daily	26
No exercise	25
Smoking & drinking habits	
Never drank	73
Never smoked	87
Smoking	13
Drinking	17
Sleep (hours / day)	
6 - 8 hours	77.23
< 6 hours	22.77

Table 3. Data Representing The Mean ± Sd Values Of Bmi, Exercise And Stress Score

Parameters	Male ± SD	Female ± SD	*P*
BMI	24.47 ± 4.54	22.85 ± 3.17	0.114
Exercise(days/week)	0.40 ± 0.79	1.52 ± 0.95	0.023
Stress Score	1.61 ± 0.62	1.52 ± 0.56	0.549

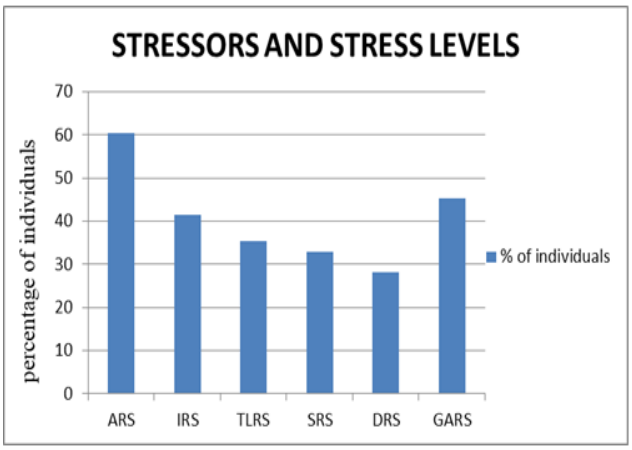
SD - standard deviation, BMI - Body Mass Index

Table 4 Data Representing Relationship Between Exercise And Stress Score

Exercise	Stress Score			*P*
	Mild	Moderate	High	
Yes	15	12	2	<0.0001
No	0	26	14	

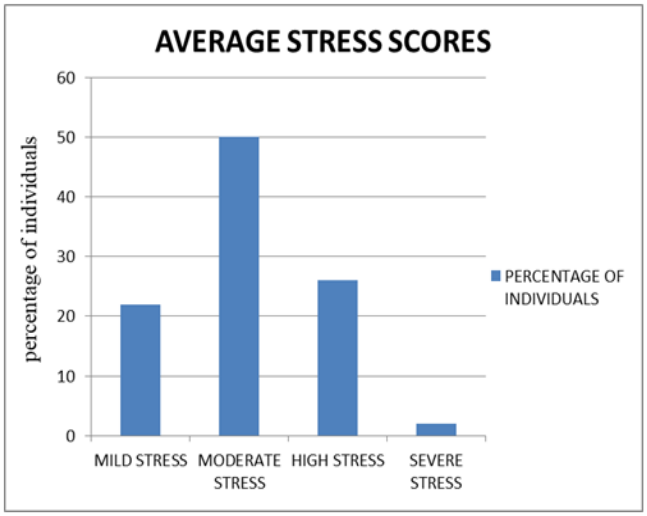
Table 5 Data Represnting Relatonship Between Stress Sore And Bmi

BMI	Stress Score			*P*
	Mild	Moderate	High	
Underweight	1	2	1	0.932
Normal	8	16	8	
Overweight	2	7	1	
Obese	4	13	6	



Graph 1. Representing The Various Stressors That Cause Stress In Medical Students

ARS- Academic Related Stressors; IRS- Intrapersonal & Interpersonal Related Stressors; TLRS- Teaching and Learning Related Stressors; SRS - Social Related Stressors; DRS - Drive and Desire Related Stressors; GARS– Group Activity Related Stressors.



Graph 2. Representing the average level of stress experienced by medical students

Table 6. Data Representing Dietary Intake Of Study Participants

DIETARY INTAKE	Daily	Once in a week	Occasional	Never
Fruits	11.88	39.6	39.6	8.91
Vegetables	24.75	58.41	9.9	4.95
Milk and milk products	80.19	8.9	10.89	0
Meat	11.88	28.71	13.86	45.54
Fast food	35.64	56.43	12.87	0

Table 7. Data Representing Rda And Average Consumption of Nutrients In Females

Nutrients	RDA (females)	< RDA (%)	≥ RDA (%)	Mean ± standard deviation
Energy	2130kcal/day	90.7	9.3	1697.5 ± 293.15
Carbohydrate	130g/day	0	100	241.59 ± 50.97
Protein	46g/day	21.42	78.58	56.76 ± 18.78
Fat	47g/day	21.42	78.58	51.13 ± 10.92

Table 7 showing the recommended dietary allowances of energy, carbohydrates, protein, fat and the average consumption of these nutrients among females of the selected population (n=41).

Table 8. Data Representing Rda And Average Consumption Of Nutrients In Males -

Nutrients	RDA (males)	< RDA (%)	≥ RDA (%)	Mean ± standard deviation
Energy	2710kcal/day	85.72	14.28	2022.67 ± 485.25
Carbohydrate	130g/day	0	100	277.82 ± 69.45
Protein	54g/day	28.57	71.43	69.22 ± 25.74
Fat	70g/day	67.86	32.14	64.41 ± 18.82

Table 8 showing the recommended dietary allowances of energy, carbohydrates, protein, fat and the average consumption of these nutrients among males of the selected population (n=28).

DISCUSSION

In the present study, of the total 100 students, 69 are selected out of which male students are 28 and female students are 41. Table 1 represents the socio-demographic details of the study participants, in which the majority (91%) were from nuclear families. Majority of males (37%) are obese compared to females (26%). Table 2 represents the lifestyle and physical activity of the selected subjects (n=69). It was observed that about 25% of subjects do not practice exercise every day and are sedentary, while some 13% and 17% were habituated to smoking and drinking habits respectively. But the majorities of the selected population were found to be moderately and weren't habituated to smoking or drinking habits. And most of the study participants (77%) slept for about 6-8 hours in a day. Table 3 shows the mean value of stress levels, exercise, and BMI of male and female subjects. The average BMI and stress score between males and females was statistically insignificant. The average days of exercise in a week for male and female was 0.4 and 1.52, respectively which was statistically significant. Table 4 represents the relationship between stress levels and exercise among the study participants. The numbers of study participants who do exercise and with mild, moderate, and high stress are 15, 12, and 2 respectively. While the number of study participants who do not exercise and with mild, moderate, and high stress are 0, 26, and 14 respectively. The number of study participants with higher stress among those who do exercise is significantly lesser than those who do not do exercise.

Thus in the study conducted, our results reflects that stress is inversely proportional to exercise i.e. exercise is associated with reduced stress.A study conducted by Gerber et al. suggested that vigorous physical activity has a higher stress-protective potential among undergraduate students with high-stress levels (11). Table 5 shows the relationship between stress levels and BMI among the study participants. The numbers of study participants whose stress levels are mild, moderate, and high with normal BMI are 8, 16, and 8 respectively, while that of who are overweight are 2,7, 1 and obese are 4, 13, 6 respectively.There is no significant association found in our study between stress levels and BMI.

Similar results are found in the study conducted by Saat et al (12). A study conducted by Heba et al. found that obese and underweight university students reported higher stress levels than overweight and normal students, showing a U-shaped correlation between stress levels and BMI (13). Graph 1 depicts the various stressors grouped into 6 domains that cause stress among the study participants. From the graph it was evident that high stress in the study participants (n=69) was caused due to academic related stressors(ARS – 60.5%) followed by group activity related stressors (GARS – 45.25%), intrapersonal & interpersonal related stressors(IRS – 41.5%), teaching and learning related stressors(TLRS – 35.5%), social related stressors(SRS – 33%) and lastly drive and desire related stressors(DRS – 28.25%). The stressors observed to cause severe & high stress are-Need to do well, large amount of content to be learnt and falling behind the reading schedule, heavy workload, self-conflictions are observed to be the major stressors that cause stress in the majority of the subjects. A study conducted by Patil et al. also inferred that academic stressors were the major contributing factors followed by social and group activity related stressors (14).

Graph 2 depicts the overall stress levels observed among the study participants. It was evident that the majority of the study participants were moderately stressed followed by high and mild stress. Table 6 represents the frequency of consumption of fruits, green leafy vegetables, milk and milk products, meat, and fast food consumption of study participants. The study inferred that regular consumption of fruits and vegetables is very low when compared with fast food consumption and we found an inverse relationship between stress and fruit & vegetable consumption (15). Table 7 shows the consumption of calories, protein, carbohydrates, and fat among the female study participants and its comparison with the recommended dietary allowances of reference female according to ICMR-NIN, RDA requirements, 2020. The average energy intake in females is low i.e. about 90.7% females consume less calories than required, carbohydrate consumption met RDA in all the female subjects, about 21.42% are below RDA requirements in proteins (16) and fat consumption is not met the required levels in about 21.42% subjects. Table 8 shows the consumption of calories, protein, carbohydrates, and fat among the male study participants and its comparison with the recommended dietary allowances of reference male according to ICMR-NIN, RDA requirements, 2020. The average energy intake in males is low i.e. about 85.72% males consume less calories than required, carbohydrate consumption met RDA in all the male subjects, about 28.57% are below RDA requirements in proteins and fat consumption does not met the required levels in about 67.86% subjects.

SUMMARY AND CONCLUSION

From the present study, medical students were found to experience moderate to higher stress and the prevalence of stress among the selected study participants is above 50% i.e. above half of the subjects face moderate to high stress on a daily basis. The stressors which cause stress in majority of the selected subjects is due to Academic related activities, the most being

- Need to do well (self-expectation as well as imposed by others)
- Large amount of content to be learnt, lack of time to review and falling behind reading schedule

- Heavy workload
- Self-conflict.

The anthropometric measurements of the study participants revealed that about 26.6% female students and 37% male students are obese; 25.9% male students and 6.6% female students are overweight.There is a significant association between stress and exercise in the present conducted study. This association of stress with physical activity is similar with the study conducted by Gillman et al. that is regular physical activity is associated with reduced stress levels (17). There are various mechanisms involved in the anxiolytic effects of exercise or regular physical activity on stress associated with lower sympathetic nervous system and hypothalamic-pituitary-adrenal (HPA) axis reactivity. Another possible mechanism could be due to release of endorphins during exercise that binds to the suitable receptors in brain and reduce pain. In the present conducted study it was found that there is high consumption of fast foods compared to fruits, vegetables. Majority of students were found to consume lesser caloriesand could not meet their recommended dietary allowances. Also from the 3 day dietary recall, it was observed that majority of the students were found to skip their meals mostly lunch and students who are stressed preferred canteen food such as sandwich, pizza, soft drinks, bakery foods during their lunch or snack time compared to less stressed students. Thus stress may affect eating habits of students and unhealthy eating habits may also cause stress.

Though there are studies which state that certain levels of stress may enhance academic performance, motivation, concentration and adaptation, due to lack of knowledge of coping strategies or ignorance or wrongly influencing coping strategies, stress can actually turn into depression and burnout at later stages. Chronic or constant stress can already cause long-term health problems, and when combined with nutritional depletion or nutritional stress, it adds up to health problems as well. Hence it is important and would benefit the students from understanding the link between diet and stress, especially in terms of nutrition.Thus identifying the predisposing factors that stimulate stress levels in medical students will help in designing early intervention programs that would help students adjust in medical school and adopt a healthy lifestyle. Limitations- Though the study can be done extensively, due to COVID raise sample size of 100 has been selected to address, out of which 69 subjects could give the dietary intake and as the study is based on self-reporting information therefore, reporting bias may have occurred especially related to dietary intake. Despite these limitations, the results are valuable in providing insights about prevalence of perceived stress and dietary intake among medical students.

Conflicts of interest: No conflict of interest

Glossary of abbreviations

ARS - Academic Related Stressors
DRS - Drive and Desire Related Stressors
GARS – Group Activity Related Stressors
IRS - Intrapersonal & Interpersonal Related Stressors
MSSQ – Medical Student Stress Questionnaire
SRS - Social Related Stressors
TLRS - Teaching and Learning Related Stressors

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