Original Research Paper

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Physiology

"EXERCISE INTERVENTION FOR UNDERGRADUATE STUDENTS: A SIX-MONTH OBSERVATIONAL STUDY IN ANDHRA PRADESH"

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ABSTRACT **Introduction:** Several studies have shown that sedentary lifestyle with concerning drifts to health threats in various population[5,7,14-16]. However, early intervention of exercise and its correlation with Body Mass Index (BMI) and overall well-being, in young adults fulfilling adolescents and moving into adulthood still has a gap in understanding. The study aims to compare the impact of a 6-month exercise program's effect on the BMI, physical and mental fitness of undergraduate students in Andhra Pradesh. **Methodology:** Students from a teaching hospital were enrolled with consent. Baseline BMI measurements were taken. Participants were divided into two groups:

1. Exercise Group: engaged in sports (badminton, basketball, volleyball) involving 150- 250 mins per week (roughly 30- 45 mins of exercise 6 days/week) with sports competitions as motivators.
2. Non-Exercise Group: maintained their regular routines.

Weight changes were followed up and measured at 3 and 6 months, and perceived stress levels was assessed at 6th month. **Results:** The Exercise Group exhibited a significant reduction in BMI at both 3 and 6 months, as compared with the controls ($p<0.001$), while the Non-Exercise Group had significant increase in BMI due to regular sedentary lifestyle ($p< 0.001$). The data collected also showed mean PSS score for the exercise group was 18.65, which was significantly lower($p<0.005$) than the mean PSS score for the non-exercise group was 22.35. **Conclusion:** Under high academic stress, routine did not reduce BMI or stress in young adults. A 6-month exercise intervention and sports programs improved well-being and reduced weight, mitigating health risks.

KEYWORDS : Physical fitness, Body Mass Index, undergraduate students, exercise intervention, health promotion

INTRODUCTION:

Physical fitness is a fundamental aspect of overall health and its importance is emphasized during the formative years of youth. [1] Young adults who are just evolving from adolescents into adulthood need to know the importance of regular physical exercise and its benefit in stress management. [4] Since, in current times medical students often grapple with academic stressors in university life include heavy assignments, meeting deadlines, juggling academic and personal life with financial concerns. These stressors are associated with a higher risk of distress and lower academic performance. Currently, limited research examines the prevalence of perceived stress among Indian students. Therefore, this study aims to determine stress prevalence and its relationship with physical activity. This study introduces a novel intervention designed to address these apprehensions through a 6-month moderate – vigorous (as recommended by WHO) [2] exercise program.

In recent years, mounting evidence has linked sedentary lifestyle with a plethora of health issues, including cardiovascular diseases, diabetes, and mental health problems [5,7]. This study also builds upon previous research that has demonstrated the benefits of exercise in enhancing physical fitness [9,10] and reducing stress levels.[12,19] Physical activity appears to not only attenuate the health risks of overweight and obesity, but active obese individuals have lower morbidity and mortality than normal weight individuals who are sedentary. [3] Physical activity encompasses any bodily movement involving energy expenditure, including both planned exercises and everyday activities like walking, cleaning, working, and transportation. [8] However, many undergraduate students face barriers to engaging in regular exercise, such as academic pressures and lack of motivation.

Perceived stress refers to feelings of pressure and strain, a form of psychological discomfort. [19,20] Some stress in small amounts can be beneficial, enhancing academic or athletic performance, motivating individuals, aiding adaptation, and responses to the environment. However, excessive stress can lead to physical harm and mental illnesses such as depression. [17,20] Stress and the mental health of university students are vital public health concerns since healthy students are likely to become healthier future professionals. Therefore, investigating their mental health at the end of 6 months with PSS-10. The Perceived Stress Scale (PSS) is a widely used psychological instrument designed to measure the degree to which individuals perceive life situations as stressful. It was developed by psychologists Sheldon Cohen, Thomas Kamarck, and Robin Mermelstein in 1983. The PSS has since become a valuable tool in assessing stress levels in various research and clinical settings. [20] Since the development of the PSS, numerous studies have utilized it to explore stress and its impact on health and well-being. [20]

Given the lack of research specific to this demographic, our study aims to fill a critical gap in the literature by assessing the impact of exercise on the BMI and mental health of undergraduate students in this academic setting. The intervention is grounded in the understanding that regular, moderate exercise has the potential to mitigate the negative effects of a sedentary lifestyle and added stress.[9,12] Therefore, this study aims to focus on a specific population of undergraduate students and measuring BMI changes over time, we aim to contribute to the growing body of knowledge on the impact of exercise interventions in academic settings, especially ones with high stress levels as that of medical undergraduates, in the state of Andhra Pradesh.

MATERIALS AND METHODOLOGY:

Study setting: teaching hospital - Andhra Pradesh.

Study design: observational longitudinal study

Study period: January- June 2023

- **Sampling technique:** simple random sampling

- **Study population:** undergraduate medical students
- The inclusion criteria were: (1)19–22 years old at the time of the visit (2) Ready to follow-up for 6 months. Exclusion criteria were: (1) having any reported mental health diseases, (2) being unable to answer the questionnaires and perform suggested routine for this study.
- The study enrolled students with consent from a teaching hospital

and they were assured of confidentiality. Overall, 300 students were enrolled, and 255 continued to be following inclusion parameters till the end of 6 months. Within 255 final participants: - 139- were in exercise group (Males= 79; Females=60) and 116 were in non- exercise group (Males= 29; Females=87).

Measuring instrument:
Trained research staff measured each participant's weight (using Digital Weighing scale) and height (using stadiometer) with standardized procedures and calibrated equipment.

Data Collection:
At the onset of the study, baseline data were collected from all participants. This involved the following: Height was measured to the nearest centimetre, and weight was measured to the nearest tenth of a kilogram. The BMI (Body Mass Index) for each participant was calculated using the formula: BMI = (weight in kilograms) / (height in meters)^2. This provided an initial assessment of each participant's baseline BMI (bmi0). After the baseline measurements, participants were divided into two groups:

- Exercise Group: Participants in this group were prescribed a structured exercise regimen consisting of 150- 250 mins per week in the form of outdoor sports (badminton, football, volleyball, basketball). They were provided with guidelines and recommendations.
- Non- Exercise Group: Participants in this group were advised to maintain their regular daily activities without engaging in any structured exercise program. They served as the comparative group.
- Throughout the 6-month intervention period, participants in the exercise group were actively motivated to adhere to their exercise regimen. One motivational strategy employed was the organization of sports competitions within the group, inter college and intra college level competition, fostering a sense of accomplishment and enthusiasm to go on, despite the academic pressure of being a medical under graduate student.
- Weight was again measured ate interval 3months at the 3rd month(bmi3) and 6th month(bmi6). PSS with the 10-item version, have been more suited for this study's research needs. PSS data was collected through Goggle forms at the end of 6 months and entered in excel sheet.
- Since most of the study participants lived in the hostel it was convenient to keep a track of their exercise schedule. However, no diet plan could be followed due to unavoidable cravings from due to hostel food. So, both groups had a similar hostel diet.

Data analysis:
Data was analysed using SPSS 29.0 version (trial version).
Descriptive statistics: Quantitative data – Mean with SD.
Associations: Independent sample t test.

Descriptive statistics, including means and standard deviations, were calculated for BMI measurements at each time point (bmi0, bmi3, and bmi6). These statistics allowed for the summary of central tendencies and variations in the data. To assess the statistical significance of the differences in BMI changes between the exercise and non-exercise groups, independent samples t-tests were conducted.

RESULT :
Total of 255 final participants:- 139- were in exercise group (Males= 79; Females=60) and 116 were in non- exercise group (Males= 29; Females=87). Mean age of participants was 19.5 years.

1)Table 1:

Table 1: Descriptive Statistics of Average BMI of all Participants at different point of times

	N	Minimum BMI	Maximum BMI	Mean BMI
BMI at the Beginning (bmi0)	255	17.34	34.41	27.6149
BMI at 3 Months (bmi3)	255	16.48	34.81	27.1602
BMI at 6 Months (bmi6)	255	15.61	35.38	26.8973

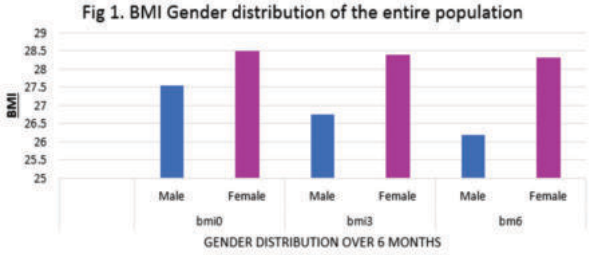
The descriptive statistics for BMI measurements at various time points provide insights into the physical fitness of our study participants. At the beginning of the study (bmi0), the mean BMI was 27.6149, indicating that, on average, participants had a BMI in the overweight range. This baseline measurement highlights the need for interventions to improve physical fitness in this population.

2)Table 2:

Table 2: BMI Gender Distribution of Study Participants

	Gender	N	Mean BMI	Std. Deviation
Bmi0	Male	108	27.54	2.526
	Female	147	28.5	2.565
Bmi3	Male	108	26.76	2.572
	Female	147	28.39	3.021
Bmi6	Male	108	26.19	2.786
	Female	147	28.31	3.772

Fig 1. BMI Gender distribution of the entire population



bmi0 (BMI at 0 Months): For males, the mean BMI is approximately 27.54, with a standard deviation of about 2.526 and for females it is approximately 28.50, with a standard deviation of about 2.565.

bmi3 (BMI at 3 Months):For males, the mean BMI at 3 months is approximately 26.76, with a standard deviation of about 2.572 and for females, the mean BMI is approximately 28.39, with a standard deviation of about 3.021.

bmi6 (BMI at 6 Months):For males, the mean BMI at 6 months is approximately 26.19, with a standard deviation of about 2.786 .For females mean BMI is 28.31, with a standard deviation of about 3.772.

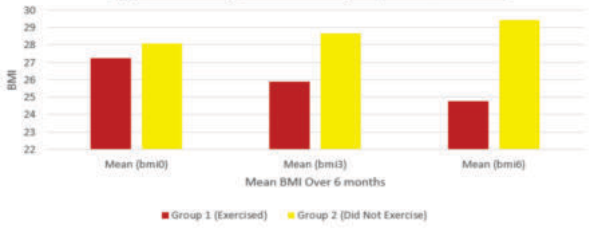
In summary, this analysis shows statistically significant (p value- < 0.001) average BMI of females tend to have higher BMIs than males in at all three time points (0, 3, and 6 months). Additionally, there is more variability in BMIs among females, particularly at the 3-month and 6-month marks, as indicated by their higher standard deviations.

Table 3:

Table 3: : BMI Changes Over Time for Group 1 (Exercised) and Group 2 (Did Not Exercise)

Groups:	Mean (bmi0)	Mean (bmi3)	Mean (bmi6)
Group 1 (Exercised)	27.2267	25.8933	24.7835
Group 2 (Did Not Exercise)	28.0802	28.6782	29.4301

Fig 2: BMI changes btweeen 2 groups over 6 months



At 3 months (bmi3) and 6 months (bmi6), we observed changes in BMI. Notably, participants in Group 1 (Exercised) demonstrated a statically significant ($p<0.005$) decrease in BMI over the study period. The mean BMI for Group 1 decreased from 27.2267 (bmi0) to 24.7835 (bmi6). In contrast, Group 2 (Did Not Exercise) showed an increase in mean BMI from 28.0802 (bmi0) to 29.4301.

Table 4:

Table 4 : Gender distribution between exercise and non- exercise group.

GENDER	Time Interval	Groups	N	Mean BMI	Std. Deviation
Male	bmi0	exercise	79	27.82	2.336
		non exercise	29	26.76	2.887

	bmi3	exercise	79	26.52	2.385
		non exercise	29	27.41	2.97
	bm6	exercise	79	25.43	2.302
		non exercise	29	28.24	2.984
Female	bmi0	exercise	60	27.55	1.064
		non exercise	87	29.15	3.056
	bmi3	exercise	60	26.33	0.951
		non exercise	87	29.8	3.147
	bm6	exercise	60	25	0.902
		non exercise	87	30.6	3.265

Table 4: Gender distribution between exercise and non- exercise group.

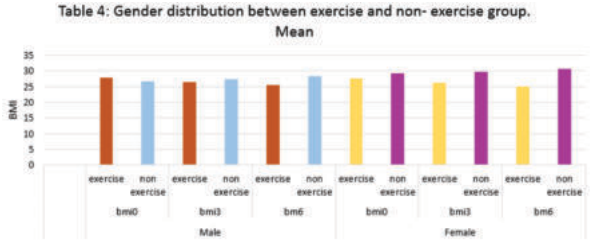


Table 4 provides a breakdown of gender distribution within the exercise and non-exercise groups at different time intervals (0 months, 3 months, and 6 months). The table includes the number of participants (N), the mean BMI, and the standard deviation for each subgroup.

Male Participants:

At 0 months (bmi0), the exercise group (N=79) has a slightly higher mean BMI (27.82) compared to the non-exercise group (N=29) with a mean BMI of 26.76.

At 3 months (bmi3), the exercise group (N=79) has a lower mean BMI (26.52) compared to the non-exercise group (N=29) with a mean BMI of 27.41.

At 6 months (bmi6), the exercise group (N=79) maintains a lower mean BMI (25.43) compared to the non-exercise group (N=29) with a mean BMI of 28.24

Female Participants:

At 0 months (bmi0), the exercise group (N=60) has a lower mean BMI (27.55) compared to the non-exercise group (N=87) with a mean BMI of 29.15.

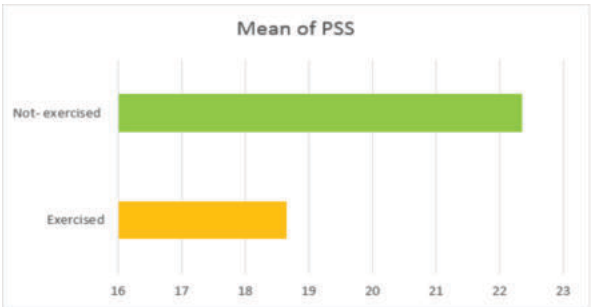
At 3 months (bmi3), the exercise group (N=60) continues to have a lower mean BMI (26.33) compared to the non-exercise group (N=87) with a mean BMI of 29.80.

At 6 months (bmi6), the exercise group (N=60) maintains a lower mean BMI (25.00) compared to the non-exercise group (N=87) with a mean BMI of 30.60.

Overall, the table shows that, for both males and females, the exercise group tends to have lower BMIs compared to the non-exercise group at all three-time intervals (0 months, 3 months, and 6 months). This suggests that regular exercise may have a positive impact on BMI, especially in the long term (6 months).

These findings are consistent with the previous analysis and suggest that exercise may contribute to lower BMI values over time, and these effects are more pronounced in female participants.

Table 5: Mean Of PSS Scale Among Exercised And Non- Exercised Individuals



The table shows the mean of the Perceived Stress Scale (PSS) scores for the exercise and non-exercise groups. The PSS is a 10-item scale that is used to measure the level of perceived stress in individuals. A higher score indicates a higher level of perceived stress. The table shows that the mean PSS score for the exercise group was 18.65, while the mean PSS score for the non-exercise group was 22.35. This means that the exercise group had a significantly lower level of perceived stress than the non-exercise group.

DISCUSSION:

The results of this study emphasise the significant impact of a 6-month moderate exercise intervention on the physical fitness and overall health of undergraduate students within a teaching hospital environment. These findings carry important implications for combating the growing challenges associated with sedentary lifestyles and elevated BMI among young adults. Data from controlled clinical trials have shown that increases in physical activity result in weight loss and changes in body composition and fat distribution. [6,8,14].

At this study's outset, both the exercise and non-exercise groups presented with average BMI values indicating an overweight status. However, as the intervention unfolded, distinct trends in BMI changes became evident. Notably, the exercise group exhibited a consistent and statistically significant reduction in BMI at both the 3-month and 6-month intervals. This not only confirms the efficacy of the exercise program but also emphasizes the potential of regular, moderate exercise in promoting healthier body weight and reducing the risk of chronic diseases. [9,10]

In contrast, the non-exercise group experienced an increase in BMI over the same period. These results are consistent with a growing body of evidence that links physical inactivity with higher BMI and associated health risks. [11] Overweight and obesity are directly related to increased risk of several chronic diseases and impaired physical function, whereas physical activity and cardiorespiratory fitness are most often contrarywise associated with similar increased risks. [4]

While detailed findings regarding perceived stress levels (PSS) are not presented here, ongoing analyses will explore the complex relationship between exercise, stress reduction, and overall well-being among undergraduate students. Stress management is crucial for holistic health, and exercise can play a pivotal role in this context. [12] Also, an increase trend BMI of females is observed there are many factors that may have led to a overall increase in BMI of Females over males as men tend to have higher levels of lean muscle mass compared to women. Muscle weighs more than fat, so this can lead to slightly higher average BMIs in men. and women often have a different pattern of fat distribution than men. Women tend to carry more of their body fat in subcutaneous areas, while men may have more visceral fat. Visceral fat is associated with certain health risks and can influence BMI. [21,22]

The present study reinforces the importance of integrating exercise interventions into academic institutions to enhance the physical fitness and well-being of young adults. The inclusion of motivational elements, such as sports competitions, effectively addresses the challenges posed by sedentary lifestyles and academic pressures. [2,14]

This difference in PSS scores is likely since exercise has been shown to reduce stress levels. Exercise releases endorphins, which have mood-boosting effects. Physical activity encompasses any bodily movement involving energy expenditure, including both planned exercises and everyday activities like walking, cleaning, working, and transportation. Exercise can also help to improve sleep quality, which can also reduce stress levels.

CONCLUSION:

The data underscores the positive effects of moderate exercise on undergraduate students' physical fitness, notably in reducing BMI for those who exercised regularly. This highlights the need for universities to integrate exercise programs, fostering overall well-being and countering the health risks of sedentary habits. Furthermore, findings from Table 5 indicate that exercise can significantly diminish perceived stress, a crucial insight given the detrimental effects of chronic stress on physical and mental health. Future research should explore the enduring benefits of these interventions and encompass broader health metrics for a more holistic understanding..

The findings from table5, suggest that exercise can be an effective way to reduce perceived stress. This is important because chronic stress can

have negative consequences for physical and mental health. Future investigations should delve into the long-term impacts of such interventions and consider additional health parameters to provide a comprehensive approach.

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