The Impact of Physical Activity Levels and Caloric Intake on Weight Thresholds in Young Students

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ABSTRACT

Background: Young college students represent the sustainable future of a community. So their physical, mental wellbeing and development should be one of major concerns. In the present study, students' weight cut offs have been studied with relation to their Physical Activity Level (PAL) and calorie consumption.

Methodology: As per the study, total 285 female students of 18-20 years of age category were randomly selected. A framed questionnaire was distributed to collect data on the daily activity schedules, anthropometry measurements and dietary information. For PAL (Physical Activity Level) assessment, ICMR-NIN RDA report, 2020 has been referred.

Result: Reportedly based on WHO BMI cutoffs out of 285 subjects in underweight 41(14.40%), in normal weight 49 (17.20%), overweight 134(47%) and in obese 61(21.40%) cases were observed resulting more cases in overweight section. Whereas 221 subjects (77.55%) were classified under sedentary worker category (PAL= ≤ 1.4), 57 (20%) under moderate worker (PAL= 1.4 to 1.8) and 7 (2.45%) under heavy worker category (PAL=1.8 to 2.3) as per ICMR, NIN, RDA, 2024. So there more subjects were coming under sedentary group. Focusing on calorie consumption patterns, 81 (28.42%) subjects consume below 1800 kilo calories through their daily food intake, 98 subjects (34.38%) have a calorie intake of below 2400 kilocalories and rest 106 (37.20%) consume below 3200 kilocalories. As deduced from statistical analysis the association between PAL and BMI, Calorie consumption and BMI, lastly PAL and calorie consumption, it has showed significant difference in different groups of each categories with the p values 0.0012*, 0.00* and 0.0067* respectively.

Conclusion: So the observation of above study results in students' overweight condition with more inclination towards sedentary lifestyle and heavy calorie intake whereas underweight condition is too associated with low calorie consumption. The study can be further carried out with other forms of Nutritional status assessment methods and then following intervention methods like Nutrition education program .

Keywords: Anthropometric measurements, Body Mass Index, Nutrition education, Physical Activity Level.

BACKGROUND

Young college students possess a dynamic demeanor and contribute to the vitality of a nation's youth. It is imperative for the well-being, effectiveness, and enduring prospects of a country to have an engaged and healthy younger generation. Therefore, the primary focus for a nation's development and empowerment is the overall well-being, including the nutritional status and physical health and fitness level of the youth

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(Amruth and Kumar, 2019). The college-going age refers to the period when one has finished growing and reached sexual maturity (Das and Rout, 2023). The timing of when a growth spurt and the beginning of sexual development occur may differ. It is a time of change as individual's transition from being reliant on others during childhood to acquiring independence in adulthood (Das and Evans, 2014). The productivity of a nation is reliant on the nutritional and health well-being of young adult women (Young et al., 2021)., who serve as productive members of society (Azadbakht et al., 2004). Therefore, the well-being of this group is crucial for the adequate progress of a nation (Joglekar and Bhoi, 2016). Currently, there is a significant worry regarding issues such as excessive work, mental pressure, feeling homesick, and the influence of one's social circle (Kaur L., 2021).The eating patterns of students can become disrupted due to pressure, an unbalanced lifestyle, and unhealthy food habits (Gunasegaram et al., 2024). A large number of college students tend to follow similar unhealthy eating habits (Chen et al., 2014), skipping meals, dining out, munching, and consuming fast food (Yadav, 2015). Therefore, these harmful behaviors developed during this phase can result in the development of long-term health conditions in the future (Dickson, 2011).

In recent times, numerous researches have indicated that adolescents and young adults need to make changes to their lifestyle due to the rising prevalence of adverse health conditions such as hypertension, dyslipidemia, and metabolic syndromes, which are not commonly associated with their age group (Singh et al., 2021). Following a healthy diet and engaging in sufficient exercise help decrease the chances of those aforementioned illnesses (Ballon et al., 2019). Several recent studies have emphasized the dangers of consuming too much energy and leading a sedentary lifestyle among young adults (Pal et al., 2020). Specifically, a lack of physical activity, such as spending a lot of time on mobile (Kigaru et al., 2015), is linked to unhealthy snacking habits (Gopalan, 2013). These habits include not eating enough fruits and vegetables, as well as consuming excessive amounts of energy and fat (Araujo et al., 2023). Due to the impact on physical condition, health, and quality of life (George et al., 2024), it is crucial to engage in various levels of physical activity until the age of 25-30 in order to optimize the enhancement of motor skills and physical fitness (Gorniak et al., 2016).

Objective: The study is focused upon to find the relation among lifestyle like activities, calorie consumption and BMI among present generation young girl students.

METHODOLOGY

The present study was undertaken based on the objective to find the association between PAL value and daily calorie consumption with different categories of BMI cutoffs among college students. As per the objective, total 285 female students of 18-20 years of age category were randomly selected. After taking their consent a framed questionnaire was distributed to gather data on their daily activity schedules, anthropometric measurements and dietary habits. For research IIS University ethical approval was considered with ICMR ethical standard and norms. During data collection weighing machine, stadiometer, Fitness schedule tool and Diet survey format were used. For PAL assessment, ICMR-NIN RDA has been referred**.**

RESULTS AND ANALYSIS

The collected data shows out of total 285 subjects, 221 subjects are coming under sedentary category, 57 samples in moderate level and 7 subjects in heavy work category whereas in weight cutoff section underweight 41(14.40%), normal 49(17.20), overweight 134(47%) and in obese 61(21.40%) subjects found.

In daily energy intake category, collected data shows out of total 285 subjects, 81 subjects consuming daily calorie below1800 whereas 98 subjects have daily energy intake below 2400 calorie category and 106 subjects in 3200 calorie consumption group. Following are the tables showing the total number of individuals in various weight categories falling in different ranges of Physical Activity Label (PAL) and Daily calorie consumption.

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Table-1 Various weight categories falling in different ranges of PAL

PAL	No. of subjects	Underweight (BMI<18.5)	Normal (BMI 18.5-22.9)	Overweight (BMI 22.9-24.9)	Obese (BMI >25)
Sedentary (<1.4)	221(77.55)	36 (16.30)	37 (16.80)	96(43.40)	52 (23.50)
Moderate (1.4 to 1.8)	57 (20)	5(8.80)	9 (15.78)	34(59.64)	9(15.78)
Heavy (1.8 to 2.3)	7 (2.45)	0	3(42.85)	4(57.15)	0
Total	**285**	**41(14.40)**	**49(17.20)**	**134(47)**	**61(21.40)**

Figures in Parenthesis are Percentage

Based on above Table 1 observations in sedentary group 36(16.75%) subjects were coming in underweight, 37 (16.75%) in normal weight, 96 (43.43%) in overweight and 5 (23.52%) subjects were in Obese category depicting relation between sedentary lifestyle and overweight condition among students. In moderate PAL category out of 57(20%) there were 5(8.80%), 9(15.78%), 34(59.64%) and 9(15.78%) subjects were coming in underweight, normal, overweight and obese category respectively resulting in association of PAL or moderate lifestyle and overweight. In heavy PAL section out of 7(2.45%) subjects 3(42.85%) and 4 (57.15%) are noticed with normal and overweight section with no cases observed in underweight and obese group. Again there is concern found for overweight conditions. Same observations are found in another study of Sangwanna et al. (2019).

Table 2 Relation between Physical Activity Level (PAL) and BMI Category

Source	Sum of Squares	df	Mean Square	F-Statistic	p-value
Between Groups	145.67	3	48.56	6.12	**0.0012***
Within Groups	1235.44	281	4.39		
Total	1381.11	284			

The Table 2 indicates significant differences (P- 0.00*) among the group means, showing that the groups are not all the same. This determines that the PAL has a significant effect on the BMI being studied.

Table-3 Various weight categories falling in different Daily calorie consumption ranges

Daily calorie intake	No. of subjects	Underweight (BMI<18.5)	Normal (BMI 18.5-22.9)	Overweight (BMI 22.9-24.9)	Obese (BMI >25)
<1800	81(28.42)	36(87.80)	23(46.95)	18(13.45)	4(6.55)
<2400	98(34.38)	5(12.20)	26 (53.05)	52(38.80)	15(24.60)
<3200	106(37.20)	0	0	64(47.75)	42(68.85)
Total	**285**	**41**	**49**	**134**	**61**

Figures in Parenthesis are Percentage

Concerning with calorie consumption patterns above Table 3 depicts, out of 285 subjects 81 (28.42%) subjects consume below 1800 kilo calories through their daily food intake, 98 subjects (34.38%) have a calorie consumption of below 2400 kilocalories and rest 106 (37.20%) consume below 3200 kilocalories showing more observations in high calorie intake group. So in below 1800 consumption out of 81subjects 36(87.80%) were in underweight and 23(46.95%) in normal group whereas 18(13.45%) subjects in overweight and 4(6.55%) in obese group found. Consumption below 2400 includes 5(12.20%), 26(53.05%), 52 (38.80%) and 15(24.60%) subjects under low weight, normal, overweight and obese categories out of 98 subjects. Likewise for the category of calorie intake more than 3200 among 106 subjects, 64(47.75%) and 42(68.85%) subjects observed in overweight and obese section creating relation between more calorie consumption and obesity.

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Table 4 Relation between Daily Calorie Intake and BMI Category

Source	Sum of Squares	df	Mean Square	F-Statistic	p-value
Between Groups	345.22	2	172.61	22.35	**0.00***
Within Groups	1035.89	282	3.67		
Total	1381.11	284			

Significant difference at <0.05*

Based on above Table 4 the analysis results of groups of daily calorie intake and Body Mass Index (BMI) category indicate a significant difference between the group means ($p<0.001$*).

Table 5 Relation between Physical Activity Level (PAL) and Daily Calorie Intake

Source	Sum of Squares	df	Mean Square	F-Statistic	p-value
Between Groups	98.5	5	19.7	3.45	**0.0067***
Within Groups	1282.61	279	4.6		
Total	1381.11	284			

Significant difference at <0.05*

Refering above Table 5 the statistical analysis results of groups of daily calorie intake and Physical activity Label (PAL) category indicate a significant difference between the group means ($p<0.001$).

Regression Lines for Confirmation of Correlation between the Variables:

The following table 6 shows the mean PAL and daily calorie intake values for each weight category. As BMI increases from underweight to obese, mean calorie intake also rises. This suggests that higher caloric intake is a contributing factor to higher BMI categories. PAL decreases slightly in the obese category, indicating a sedentary lifestyle may exacerbate weight gain. However, the differences in PAL among categories are small. The underweight group consumes fewer calories and has a lower PAL, which might lead to a deficit, while the overweight and obese groups consume more calories than needed relative to their activity levels, leading to energy surplus and weight gain.

Table-6 Mean BMI, Mean PAL and daily calorie intake

Category	Mean BMI	Mean PAL	Mean Daily Calorie Intake
Underweight	18.1881	1.27619	1400.405
Normal	20.91143	1.364	1801.02
Overweight	24.0963	1.382222	2430
Obese	29.8871	1.293443	2648.952

To make reliable regression lines, the data was divided into smaller ranges of BMI, and accordingly the means of the various parameters were taken in those ranges, as shown in the following table.

The table 7 highlights the critical role of energy balance in determining BMI. Individuals with low PAL and high caloric intake are more likely to be overweight or obese. Conversely, those with higher PAL and moderate caloric intake tend to maintain a healthy BMI. Interventions for overweight and obese individuals should focus on reducing calorie intake and increasing physical activity to improve energy balance (Liu et al., 2018).

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Table-7 Small range depiction of Mean BMI, Mean PAL and Mean calorie intake

BMI Range	Mean BMI	Mean PAL	Mean Calorie intake
<18	17.9	1.22	1292.6
18-18.5	18.22703	1.283783784	1414.972973
18.6-20	19.2	1.37	1798.8
20.1-21	20.39778	1.311111111	1808.722222
21.1-22.9	22.19636	1.404545455	1795.727273
23-24	23.77222	1.409722222	2455.138889
24.1-24.9	24.46667	1.350793651	2401.269841
25-27	26.625	1.2625	2824
27.1-28	28	1.3	2546.666667
28.1-29	29	1.2625	2627.25
29.1-30	30	1.31	2715.6
30.1-31	31	1.291666667	2704.416667
31.1-33	32.26667	1.306666667	2676.742857

Below Figure 1 depicts the association of mean Body mass index (BMI) and mean Physical activity label (PAL). The figure suggests that there is almost low degree relationship between different categories of BMI variables and mean PAL.

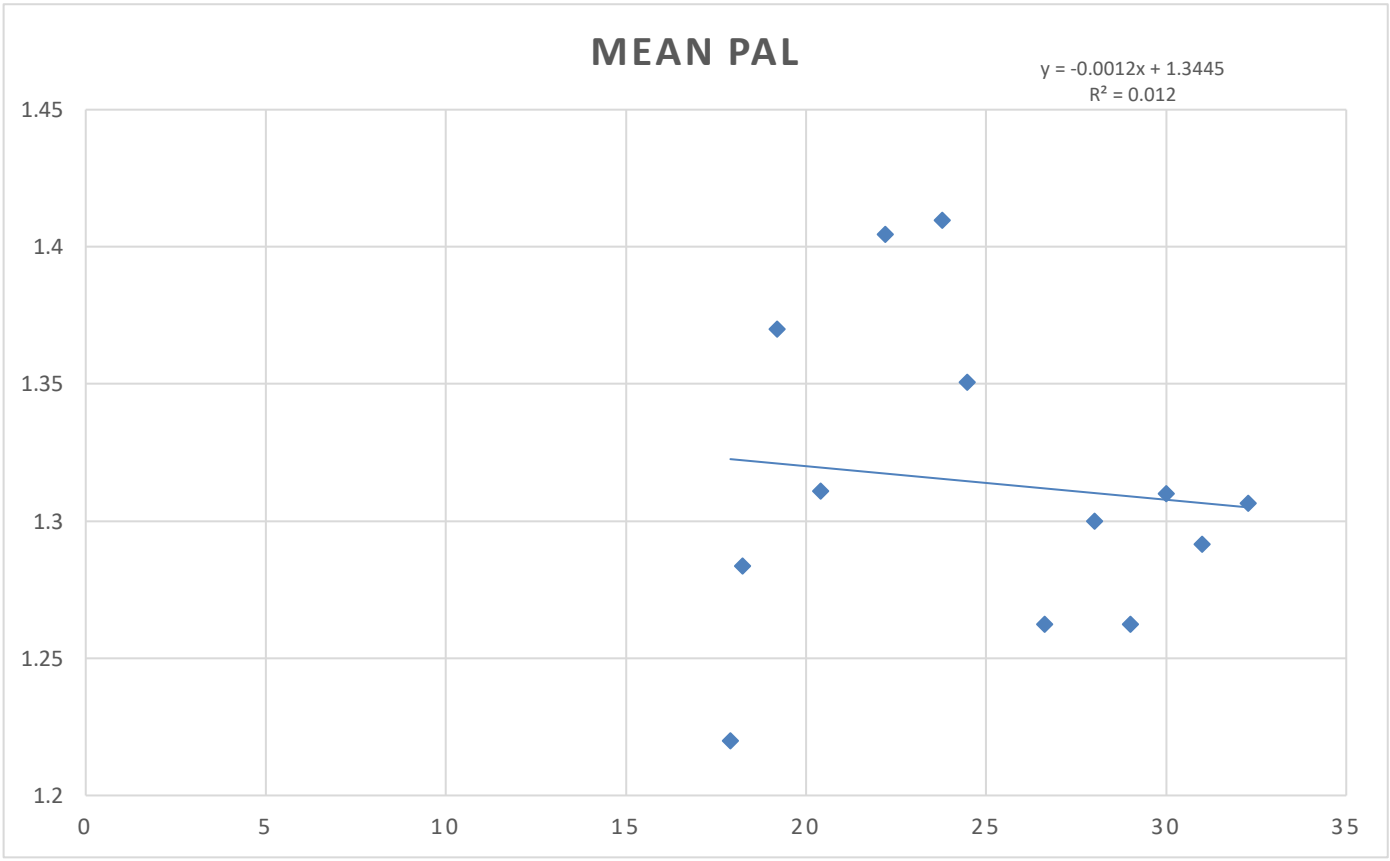

Figure-1: Regression equation, determination coefficient and trend line for association of mean BMI (X) with mean PAL (Y).

The figure 2 provides strong evidence that increased caloric intake is associated with higher BMI. This reinforces the need to manage calorie consumption as part of interventions to control BMI and promote healthier body weights. A study by Zeron-Rugerio et al. (2019) showed similar results

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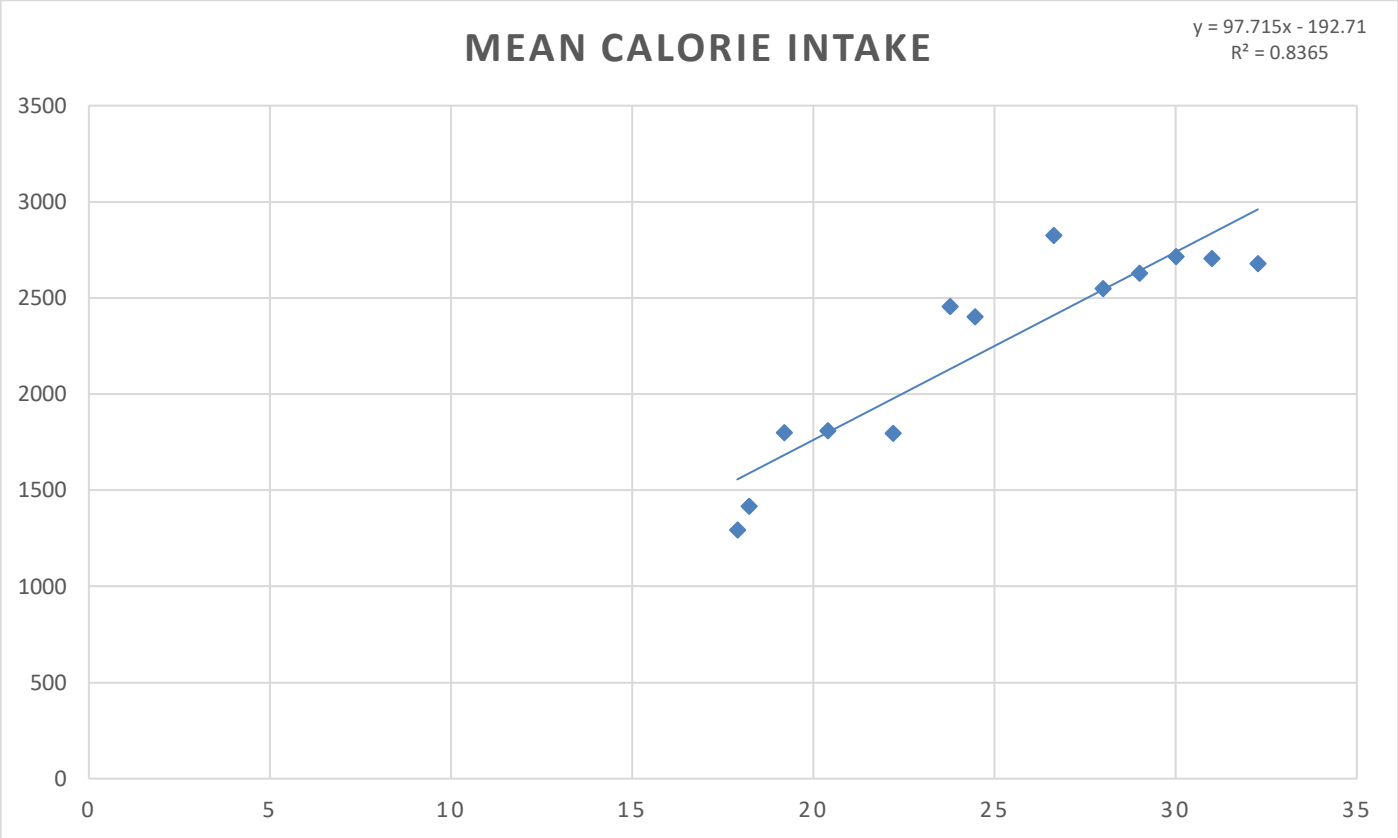

Figure-2: Regression equation, determination coefficient and trend line for association of mean BMI (X) with mean calorie intake (Y).

As deducible from the p-values resulting from the Chi-square test, the daily calorie intake highly influences the BMI of the subjects and although slightly, the PAL too influences the BMI. As from the coefficient of determination and the regression equation, the association is positive and fairly strong between calorie intake and BMI. However, the PAL and BMI are not as strongly associated, there being present a very weak and negative association. Notably, the physical activity level is a positively influencing factor for the BMI, if the regression line and mean figures are to be observed in the underweight category. However, the overweight category is showing the same trend coupled with a high calorie intake, making calorie intake the dominant factor in this fraction.

CONCLUSION

These results show that daily calorie intake is the factor largely influencing the BMI of the female college students of the target population. Hence, it needs to be maintained to an optimum level in order to avoid the increasing problem of obesity in this particular fraction of the population. That being established, there is also the minorly affecting factor of physical activity levels, which should not be ignored and inferentially, can be modified based on the body's requirement to achieve an ideal BMI, especially in the obese subjects who show the second lowest mean PAL among all the four groups. In conclusion, maintaining a balanced diet and awareness about the importance of modification of diet when required is essential in obtaining the desirable body weight, while also giving adequate attention to physical activity of individuals. With continued efforts, more comprehensive intervention programs can be implemented, incorporating a deeper assessment of nutritional status. This may include measurements such as waist-to-hip ratio (with appropriate cut-off values), clinical evaluations, and biochemical tests such as hemoglobin, TIBC, calcium, and vitamin D3 levels. Additionally, dietary assessments through food frequency surveys (to determine mean food intake) and 24-hour dietary recall (to calculate mean nutrient intake, including proteins, fats, calcium, iron, zinc, and vitamin C) can help identify key challenges related to food, nutrition, health, and fitness. These insights would provide a stronger foundation for planning and executing targeted interventions.

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LIMITATITIONS

- The study was conducted over a limited period; extending its duration could allow for the collection of more data related to the intervention.
- Additionally, while the study focused solely on females, it could be expanded to include other genders within the same age group who face similar dietary and fitness challenges.
- Including an assessment of both macro- and micronutrient intake would also enhance the study.
- Beyond evaluating calorie intake, BMI, and Physical Activity Level (PAL), incorporating clinical and biochemical parameters could provide more accurate data and support more effective planning and evaluation of the intervention.

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LETTER OF CONSENT TO PARTICIPATE

Dear Sir/Ma'am,

Jai Gurudev

Myself Mrs. Chinmayee Pattnayak Assistant professor, "Food Nutrition and Dietetics" Sri Sri University, the purpose of this letter is, for a research study on "Nutritional status of college going girls" a survey on students has to be conducted pertaining information like -

- Socio demographic data
- Anthropometric assessment
- Clinical observation
- Biochemical examination (Hemoglobin and TIBC to assure about Anemic condition).
- Dietary survey

Accordingly further intervention programs will be organized under "Nutrition education" through different events like Lecture, Demonstration, Training, Development of Iron rich recipe etc.

Following the first phase in the second phase again a survey will be conducted to examine the improvement in physiological parameter, change in Knowledge, Attitude and practices.

Through the whole procedure and after that also, utmost care would be taken for confidentiality of the data.

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For Biochemical tests students could opt lab of their own convenience or I will arrange here inside campus only. All the expenses would bear by the researcher (myself).

Thank you

Regards

Mrs. Chinmayee Pattnayak

Asst. Professor

FND/FOAG

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Mob. No.- 8502804202

Student's Name with signature:

Parents' name with signature: