



THE ASSOCIATION OF BODY MASS INDEX WITH PHYSICAL & COGNITIVE PERFORMANCE IN HUMAN PHYSIOLOGY WITHIN 1ST YEAR MEDICAL STUDENTS OF T.S. MISRA MEDICAL COLLEGE & HOSPITAL.

Physiology

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ABSTRACT

Background: - Appropriateness of body mass with height can be computed by body mass index (BMI). BMI is defined as weight in kilogram/ Square of the height in meter.

Purpose: - Does BMI has any effects on physical performance (classroom attendance) and cognitive performance (baseline academic achievements) in medical students?

Study design: - Observational study at the end of 1st year MBBS.

Results: - Association between BMI and physical/ cognitive performance was analyzed using X2 test for trends. For physical performance p-value was 0.5102 in total population, 0.3171 in female population, and 0.948 in male population. Similarly, for cognitive performance p-value was 0.234 in total population, 0.8549 in female population, and 0.0485 in male population.

Conclusion: - There is no relation of BMI with physical and cognitive performance in medical students except males, where there was positive association between BMI and cognitive performance.

KEYWORDS

BMI, Classroom Attendance, Academic performance, Human Physiology.

INTRODUCTION

Appropriateness of body mass with height can be computed by body mass index (BMI). BMI is defined as weight in kilogram/ square of the height in meter.¹ BMI has been classified in 5 major groups; underweight <18.5, normal 18.5–24.9, overweight 25.0–29.9, obesity 30.0–39.9, and extreme obesity ≥ 40 .² BMI >30 is associated with risk of multitude of diseases especially cardiovascular and T₂DM.^{2,3} Abnormal BMI is common in Indian Medical students.⁴ Obesity results from greater food intake as compared to expenditure. Decreased physical activity, abnormal feeding behavior, childhood over nutrition, neurogenic abnormality, and genetic factors are possible causes of obesity.⁵ Treatment of obesity involve dietary therapy, physical activity, behavioral therapy, pharmacotherapy, and bariatric surgery.⁶

Regulation of body weight involves interplay of different mechanisms. Leptin is an endocrine secretion of adipocytes promoting satiety in hypothalamus and thereby decreasing food intake. Similarly, Ghrelin from specialized endocrine cells of gastric mucosa stimulates hunger center in hypothalamus and thereby increases food intake. Any change in nutrient concentration; changes blood level of different hormones like leptin, ghrelin, insulin, glucagon, growth hormone etc. Thus over or undereating causes hormonal disturbance in blood.⁶ These disturbances might have some psychosomatic effects. So in present study we are trying to find out whether BMI has any effects on classroom attendance and baseline performance in medical students.

MATERIALS & METHODS:

This observational study was conducted at TS Misra Medical College & Hospital, Lucknow between 2017 to 2019 in the Department of Physiology. Study population included 1st year MBBS students of 2018 & 2019 batch. All participants were informed about study & data was collected after getting consent from each participants. All the participants were staying in the hostel of medical college; thus they were getting similar food from hostel mess. All the female students were getting same diet from common girl's hostel mess and similarly all the male students from boy's hostel mess. Data was collected at end of 1st year MBBS, thus they all were exposed to almost similar stressors.

There were 294 MBBS students in present study; 147 students from each batch. There were 153 male students & 141 female students. All students were classified in 4 groups as per standard BMI classification. Underweight group included students with BMI < 18.5, similarly normal weight group with BMI 18.5–24.9, overweight with BMI 25–24.9, & obese group included students with BMI >30.

There were 31 students in underweight group; 20 females and 11 males. Normal BMI group had 161 students; 74 females and 87 males. Similarly, overweight group had total 68 participants with 29 female & 39 male students. Finally, obese group had total 34 participants with 18 female & 16 male students (table-01 & 02).

Percentage classroom attendance was taken as measure of physical performance. Attendance > 75% was considered satisfactory while less than < 75% unsatisfactory. Similarly, average performance of section completion test (SCT) conducted at end of each section of Human Physiology was taken as measure of cognitive performance. Average SCT performance ≥ 25 was considered satisfactory & < 25 unsatisfactory.

Data regarding study was taken as mean $\pm$ SD. Data was analyzed using Chi-square (χ^2) test with trends and p-value <0.05 considered significant. Microsoft office 2016 and GraphPad Prism 6 was used in analysis and presentation of result.

RESULTS

Distribution of mean age (years), height (meter), weight (kg), BMI, attendance (%), and acquired marks (maximum 50) in whole study population is summarized in table-01. Within underweight group mean age was 19.23 $\pm$ 1.05 years, mean height 1.75 $\pm$ 0.13 meter, mean weight 49.95 $\pm$ 8.31 Kg, BMI 16.22 $\pm$ 1.43, attendance 79.06 $\pm$ 3.44 %, and achieved mean marks was 25.36 $\pm$ 6.09. In normal weight group mean age was 19.32 $\pm$ 1.48 years, height 1.67 $\pm$ 0.1 meter, mean weight 62.03 $\pm$ 8.81 Kg, mean BMI 21.93 $\pm$ 1.76, mean attendance 79.99 $\pm$ 4.39 %, and achieved mean marks was 25.83 $\pm$ 7.30. While in overweight group mean age was 19.34 $\pm$ 1.07 years, height 1.64 $\pm$ 0.09 meter, mean weight 73.08 $\pm$ 8.68 Kg, mean BMI 27.03 $\pm$ 1.62, mean attendance 80.30 $\pm$ 3.87 %, and achieved mean marks was 26.42 $\pm$ 7.20. Finally, obese group had mean age 19.35 $\pm$ 1.35 years, height of 1.54 $\pm$ 0.16 meter, mean weight 82.43 $\pm$ 15.71 Kg, mean BMI 34.83 $\pm$ 6.12, mean attendance 80.02 $\pm$ 3.47 %, and achieved mean marks was 26.96 $\pm$ 7.08.

In female, distribution of data is summarized in table-02. Within underweight group mean age was 19.10 $\pm$ 1.12 years, height 1.76 $\pm$ 0.15 meter, mean weight 50.61 $\pm$ 9.41 Kg, BMI 16.11 $\pm$ 1.61, attendance 80.24 $\pm$ 3.50 %, and achieved mean marks was 26.52 $\pm$ 6.77. In normal weight group mean age was 19.18 $\pm$ 1.75 years, height was 1.64 $\pm$ 0.1 meter, mean weight 58.95 $\pm$ 8.96 Kg, mean BMI 21.69 $\pm$ 1.89, mean attendance 80.57 $\pm$ 3.76 %, and achieved mean marks was 27.82 $\pm$ 7.63. While in overweight group mean age was 19.10 $\pm$ 0.81 years, height 1.60 $\pm$ 0.9 meter, mean weight 69.96 $\pm$ 8.24 Kg, mean BMI 27.01 $\pm$ 1.19, mean attendance 80.37 $\pm$ 3.72 %, and achieved mean marks was 25.86 $\pm$ 6.1. Finally, obese group had mean age 18.83 $\pm$ 1.15 years,

height 1.53 ± 0.15 meter, mean weight 80.32 ± 15.17 Kg, mean BMI 35.04 ± 6.16 , mean attendance 80.57 ± 3.43 %, and achieved mean marks was 27.32 ± 8.06 .

In males, data is summarized in table-03. Within underweight group mean age was 19.45 ± 0.93 years, height 1.72 ± 0.10 meter, mean weight 48.74 ± 6.01 Kg, BMI 16.43 ± 1.06 , attendance 76.92 ± 2.12 %, and achieved mean marks was 23.24 ± 4.07 . In normal weight group mean age was 19.45 ± 1.19 years, height 1.70 ± 0.90 meter, mean weight 64.65 ± 7.83 kg, mean BMI 22.14 ± 1.63 , mean attendance 79.5 ± 4.82 %, and achieved mean marks was 24.14 ± 6.60 . While in overweight group mean age was 19.51 ± 1.21 years, height 1.66 ± 0.08 meter, mean weight 75.40 ± 8.35 Kg, mean BMI 27.04 ± 1.90 , mean attendance 80.25 ± 4.02 %, and achieved mean marks was 26.83 ± 7.96 . Finally, obese group had mean age of 19.94 ± 1.34 year, height 1.57 ± 0.15 meter, mean weight 84.81 ± 16.46 Kg, mean BMI 34.59 ± 6.27 , mean attendance 79.41 ± 3.52 %, and achieved mean marks was 26.56 ± 6.03 .

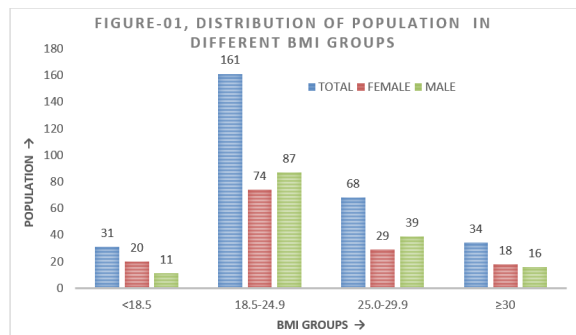


Table-01 Distribution Of Data In Different Bmi Groups Within Total Population

	AGE (YEARS)	HEIG HT (M)	WEIGHT (Kg)	BMI (Kg/M ²)	ATTEN DANCE (%)	MARKS (OUT OF 50)
<18.5 (31)	19.23±1.0 5	1.75±0.13	49.95±8.3 1	16.22±1.43	79.06±3.44	25.36±6.09
18.5-24.9 (161)	19.32±1.4 8	1.67±0.10	62.03±8.8 1	21.93±1.76	79.99±4.39	25.83 ± 7.30
25-29.9 (68)	19.34±1.0 7	1.64±0.09	73.08±8.6 8	27.03±1.62	80.30±3.87	26.42 ± 7.20
≥30 (34)	19.35±1.3 5	1.54±0.16	82.43±15.71	34.83±6.12	80.02±3.47	26.96 ± 7.08

Table-02 Distribution Of Data In Different Bmi Groups Within Female Population

	AGE (YEARS)	HEIGHT (M)	WEIGHT (Kg)	BMI (Kg/M ²)	ATTEN DANCE (%)	MARKS (OUT OF 50)
<18.5 (20)	19.10±1.1 2	1.76±0.15	50.61±9.4 1	16.11±1.61	80.24±3.50	26.52±6.77
18.5-24.9 (74)	19.18±1.7 5	1.64±0.10	58.95±8.9 6	21.69±1.89	80.57±3.76	27.82±7.63
25-29.9 (29)	19.10±0.8 1	1.60±0.90	69.96±8.2 4	27.01±1.19	80.37±3.72	25.86±6.10
≥30 (18)	18.83±1.1 5	1.53±0.15	80.32±15.17	35.04±6.16	80.57±3.43	27.32±8.06

Table-03 Distribution Of Data In Different Bmi Groups Within Male Population

	AGE (YEARS)	HEIGHT (M)	WEIGHT (Kg)	BMI (Kg/M ²)	ATTEN DANCE (%)	MARKS (OUT OF 50)
<18.5 (11)	19.45±0.93 11	1.72±0.10	48.74 ± 6.01	16.43 ± 1.06	76.92±2.12	23.24±4.07
18.5-24.9 (87)	19.45±1.19 87	1.70±0.90	64.65 ± 7.83	22.14 ± 1.63	79.50±4.82	24.14±6.60
25-29.9 (39)	19.51±1.21 39	1.66±0.08	75.40 ± 8.35	27.04 ± 1.90	80.25±4.02	26.83±7.96
≥30 (16)	19.94±1.34 16	1.57±0.15	84.81±16.46	34.59 ± 6.27	79.41±3.52	26.56±6.03

Table-04 Association Between Bmi & Physical Performance

STATISTICAL VARIABLES	TOTAL (N= 294)	FEMALE (N=141)	MALE (N=153)
CHI-SQUARE(X ²)	0.433	1.001	0.004
DEGREE OF FREEDOM (df)	1	1	1
P VALUE	0.5102	0.3171	0.948
SIGNIFICANCE	NO	NO	NO

Table-05 Association Between Bmi & Cognitive Performance

STATISTICAL VARIABLES	TOTAL (N=294)	FEMALE (N=141)	MALE (N=153)
CHI-SQUARE(X ²)	1.414	0.0334	3.892
DEGREE OF FREEDOM (df)	1	1	1
P VALUE	0.234	0.8549	0.0485
SIGNIFICANCE	NO	NO	Yes

Association between BMI & physical performance analyzed using χ^2 test for trends is summarized in table-04. Within overall study population χ^2 value was 0.433, degree of freedom 1, and p-value was 0.5102. While in female population χ^2 value was 1.001, degree of freedom 1, p-value was 0.3171. Finally, in male population χ^2 value was 0.004, degree of freedom 1, p-value was 0.948 with no significance. Thus there was no association between BMI and physical performance in either total population or female/male population.

Table-05 summarizes result of χ^2 test for association between BMI & cognitive performance. Within overall study population χ^2 value was 1.414, degree of freedom 1, and p-value was 0.234. While in female population χ^2 value was 0.0334, degree of freedom 1, p-value was 0.8549. Finally, in male population χ^2 value was 3.892, degree of freedom 1, p-value was 0.0485. Thus there was no association between BMI and cognitive performance in total population and in females but positive association found within male population.

DISCUSSION

Keating XD et.al. in his longitudinal research using a sample of Chinese pre-service teachers revealed that BMI was not significantly associated with GPA.⁷ Alswat KA et.al. in a study in intermediate & high school students found no correlation between the BMI and school performance, except in physics results where obese students perform worse than normal-weight students.⁸ Similarly, Wehigaldenia WGDS et.al. demonstrated no relationship between BMI & academic performance in University students.⁹ Hong HO et.al. found no relationship between body composition and academic performance in 30 college students of Korea.¹⁰ Agrawal S et.al. concluded similarly in 1st year medical students with no relation between BMI and cognition.¹¹ A study conducted by Baxter SD et.al in 920 4th grade school students concluded with no relationship between BMI & absenteeism.¹²

Sabia JJ in his study in adolescent finds significant negative relationship between body mass index and grade point average (GPA) for white females aged between 14-17 years. For nonwhite females and males, there was less convincing evidence of a causal link between body weight and academic performance after controlling for unobserved heterogeneity.¹³ Finn KE et al (2018) in his study among high school students confirms simple relationship between BMI and achievement. He demonstrated that BMI was negatively related to academic achievement. Higher BMI was also significantly correlated with lower classroom participation.¹⁴

In this study, we find no relation of BMI with physical or cognitive performance except males, where there was positive association between BMI and cognitive performance. We can see in table-03 that marks achieved increases in male population as we move from lower to higher BMI. There is only a slight decline in marks when we reach at BMI ≥ 30 . Outliers or major variation in hormones at high BMI may be the underlying cause.

As we give a closure look on height of different BMI groups, we see students with lower BMI has higher length. Furthermore, the height progressively decreases in higher BMI groups in both genders. Students in overweight group has lowest height in both genders although it falls within normal limits of Indian population.

Strength: All the students were staying in hostel of the medical college. They all were pursuing same MBBS 1st year. Age range with only few exception lies between 18-20 years. All the students belong to same higher socioeconomic status. Number of male and female students were almost same.

Limitations: Sample from only 2 batches were taken. No biochemical markers were used in this study. Wake up time level of physical activity, and detailed eating behavior were also not taken into consideration.

CONCLUSION

So to conclude, we can say that there is no relation of BMI with physical and cognitive performance in medical students except males, where there was positive association between BMI and cognitive performance. Furthermore, students on either pole of height have more prevalence of abnormal BMI, so they should be encouraged for healthy lifestyle during their course of study.

FUTURE RECOMMENDATIONS

Study should be performed with bigger sample size including multiple batches of medical students at multiple centers throughout the country. Biochemical markers should be included in the study to get more quantitative results. Biochemical markers can provide additional data in the cases of abnormal BMI leading to basic cause of extreme BMI in medical population.

AUTHORS CONTRIBUTION

Concept, design, & conduction of the study: SP&ST.

Data analysis & proofreading: RM.

Manuscript writing & correspondence: VKT.

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