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RESEARCH ARTICLE

A study of correlation between body mass index and cognitive performance of undergraduate medical students

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ABSTRACT

Background: Obesity affects our body in different manner and considered as an important public health problem. Various cognitive functions of brain get affected by high body mass index (BMI > 30 Kg/m^2). **Aims and Objectives:** This study aims to study the correlation of BMI with cognitive performance of undergraduate medical students. **Materials and Methods:** A total of 230 medical students were selected in random manner in a medical college. Informed consent was given by all study subjects. All study subjects were informed about tests to be performed. Quetlet's formula was used to measure BMI. "Montreal Cognition Assessment Test" was used to check cognitive functions in medical students. **Results:** There was significant negative correlation between BMI and cognitive function score in overweight and obese category ($P < 0.05$). Proportion of study subjects with cognitive function score <26 was significantly more in overweight and obese group in comparison with BMI group within normal limit ($P < 0.01$). **Conclusion:** The elevated BMI is associated with decreased cognitive function even in very healthy individuals also. This is an indication of the implementation of public health measures to maintain appropriate lifestyle so as to maintain normal BMI.

KEY WORDS: Body Mass Index; Correlation; Cognitive Performance

INTRODUCTION

There is marked decrease in physical activity due to improvement in mechanics such as transport and other types of labor work. Furthermore, there is an increased tendency of eating junk food, high-energy drinks, and fast food. This is the picture of most of the Asian countries.[1]

Like patients of other medical conditions even in normal persons increased weight have association with decreased cognitive function such as executive function attention and memory. A number of evidence for this scenario are increasing.[1] Exact phenomenon responsible for this scenario is under research. Furthermore, it is almost established fact that high body mass index (BMI) has association with output such as Alzheimer's disease, stroke, and vascular dementia.[2]

The study was done to evaluate the correlation between obesity and cognitive performance of undergraduate medical students in medical college of western Maharashtra.

Objective

The objective of this study was to study the correlation of BMI with cognitive performance in young individuals of the age group of 18–25 years.

MATERIALS AND METHODS

This observational study was carried out in students at medical college in western Maharashtra for 1 year. Approval

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from the institutional ethics committee was taken. Written informed consent was taken from each student.

Study Population

The first year-final year students were considered as the study population.

Selection of Subjects

- A total of 230 students in medical college selected randomly by systematic random sampling.
- All necessary pretest instructions were given to the participants.

Methodology

The study subjects who were not present on the day of examination and the study subjects with associated comorbidities were removed from the study. Detailed history and examination was done with the help of predesigned pro forma in the first step. Cognitive function was assessed with the help of "Montreal Cognition Assessment Test."

BMI

Anthropometric parameters such as height and weight were measured by trained personal. BMI was formulated and classified into four categories according to the Centers for Disease Control guidelines, i.e., underweight – BMI < 18.5, normal weight – BMI between 18.5 and 24.9, overweight – BMI between 25 and 29.9, and obese – BMI > 30.

Cognitive Performance

"Montreal Cognition Assessment Test"[3] (MoCA) was used to assess cognitive functions in medical students. Test was carried out for 10 min and includes 30 points. This test consists of the following domains:

- Naming
- Language
- Orientation
- Memory
- Executive skills
- Attention
- Abstraction

Range of MoCA scores was in 0 and 30. >26 scores were normal for the study subjects.

Statistical Analysis

Data were analysed using software SPSS version 24. Results were presented in the form of tables. Pearson correlation coefficient was calculated to see correlation between BMI and cognitive function. $P < 0.05$ was considered of statistical significance.

RESULTS

Table 1 shows that of 230 students, 52.17% were male and 47.87% were female. Maximum students were come under normal category of BMI. Table 2 shows that there was significant negative correlation between BMI and cognitive function score in overweight and obese category ($P < 0.05$). However, we do not found significant correlation between BMI and cognitive function score in underweight and normal category. Table 3 shows that proportion of the study subjects with cognitive function score <26 was significantly more in overweight and obese group in comparison with BMI within normal limit ($P < 0.01$). This indicates that cognitive performance is less in obese individuals.

DISCUSSION

This observational study was conducted in medical students at medical institute in western Maharashtra for 1 year. In the present study, it was observed that correlation between BMI and cognitive function score in overweight and obese

Table 1: Distribution of the study subject's according to BMI and gender

BMI	Male	Female	Total
Underweight	5	7	12
Normal weight	74	46	120
Overweight	25	45	70
Obese	16	12	28
Total	120	110	230

BMI: Body mass index

Table 2: Correlation between BMI and cognitive performance

BMI groups (kg/m²)	Number of subjects	r value	*P*-value
Underweight	12	0.661	0.019
Normal weight	120	−0.167	0.068
Overweight	70	−0.429**	0.00
Obese	28	−0.715**	0.000
Total	230	−0.642**	0.000

BMI: Body mass index

Table 3: Frequency distribution of total cognitive performance score

BMI	MoCA score		Total	*P*-value
	<26	≥26		
Underweight	0	12	12	-
Normal	2	118	120	<0.01
Overweight	10	60	70	0.15
Obese	11	17	28	<0.01
Total	23	207	230	

BMI: Body mass index

category was significantly negative ($P < 0.05$). However, we do not found significant correlation between BMI and cognitive function score in underweight and normal category.

Furthermore, we observed that proportion of the study subjects with cognitive function score <26 was significantly more in overweight and obese group in comparison with BMI within normal limit ($P < 0.01$). This indicates that cognitive performance is less in obese individuals. Results from the present study show that cognitive performance is related to BMI, even in very healthy individuals, excluding subjects with significant medical and psychiatric conditions.

Reason for association between BMI and decreased cognitive function till now not known. Insulin resistance is increased and glucose metabolism is reduced due to increase in adipose tissue. There is an inverse correlation between increased BMI and increased metabolic activity in various regions of brain.[4]

Alswat *et al*.[5] in their study concluded that in results of physics subjects, there was significant positive correlation between the BMI and school performance where increased weight had low performance as compared to normal weight students. Liyanage[6] stated in their research skipping breakfast did not affect some aspects of cognition and BMI significantly. Aimé *et al*.[7] observed in their study females with high BMI had low grades in academics and depression. Bhattacharya and Sarkar[2] concluded from their study that BMI has negative impact on attention which is one of the important components of cognition of the individual. Anderson *et al*.[8] in their study found that there was significant correlation between normal BMI and increase in school performance. Their study also indicates that further study will be required in the aspect of increase in weight, diet, exercise, and association of all these with school performance.

Irfan *et al*.[9] in their study found that significant relationship was discovered between weight, BMI, and PSS stress score. Bassil[10] in their research concluded that in male hostel students, there was measurable correlation of BMI with anxiety score. Cognition was not significantly correlated with BMI in the study carried out by Agarwal *et al*.[1] Franz and Feresu[11] concluded in their study that the study subjects with BMI within normal limit were having more GPA and ACT scores as compared to the study subjects with high BMI. Burkhalter and Hillman[12] concluded in their review that the number of area in our brain would have been responsible for reduction in cognitive function which is due to increase in BMI. Gunstad *et al*.[13] conducted study and found that there was inverse correlation between BMI and cognitive function. Cournot *et al*.[14] in their study concluded that there was independent association between BMI and cognitive performance. Gustafson *et al*.[15] concluded in their study that patients with Alzheimer's disease were having BMI on higher side and almost 3.6 times higher as compared to normal counterpart. There was decreased academic performance in adolescent who was having BMI in category of overweight and obese, and this finding given in the study conducted by Lebel *et al*.[16]

CONCLUSION

There was an association between increased BMI and cognitive function even in individuals without any medical comorbidity. This is indication for urgent implementations of public health interventions to follow appropriate lifestyle to maintain BMI within normal limit.

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