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Impact of baseline body mass index on antidepressant response: A study in newly diagnosed patients at a tertiary care center in Kolkata

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ABSTRACT

Background: Depression, affecting 350 million globally, poses significant morbidity and mortality. The correlation between major depressive disorder (MDD) and obesity is noted, with studies indicating poorer treatment outcomes among obese individuals. Measuring weight and body mass index (BMI) could aid in predicting depression treatment outcomes, influencing drug efficacy due to their ease of measurement, amid the shared public health burden of MDD and obesity. **Aims and Objectives:** The aims and objectives of the study are to evaluate baseline BMI's impact on antidepressant response in newly diagnosed outpatient department (OPD) patients at a tertiary care center. **Materials and Methods:** This longitudinal observational study was conducted with OPD patients at a tertiary care center, aged 18–65 years with newly diagnosed MDD. Assessment tools included the Diagnostic Criteria for Research accompanying the ICD-10, the Hamilton Rating Scale for Depression, and physical measurement devices. Sample size determination considered BMI groups: Normal to underweight (N1 = 120), overweight (N2 = 120), and obese (N3 = 70). The methodology involved patient history, examination, and follow-up assessments after 6 weeks, analyzing antidepressant response statistically. **Results:** Obese patients exhibited reduced treatment response rates compared to normal and overweight counterparts. Responders had lower mean BMI. Gender disparities in obesity prevalence were noted. Limitations: The study's limitations include a small sample size of 310 cases, single-center design, and potential selection bias in a tertiary care setting. **Conclusion:** The findings underscore the complex relationship between BMI, depression severity, and treatment response. Obese individuals demonstrated higher initial depression scores and poorer treatment response, echoing previous research. The study highlights the need for personalized treatment approaches that consider individual BMI levels to optimize depression management strategies effectively.

Key words: Depression; Obesity; Body mass index; Antidepressant response

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INTRODUCTION

Depression is the second leading cause of disability globally, affecting approximately 350 million individuals worldwide, as reported by the World Health Organization (WHO).[1] It has significant potential for morbidity and mortality contributing to increased incidence of suicide, disruption in interpersonal relationships, substance abuse, and loss of work time. With appropriate treatment, 70–80% of individuals with major depressive disorder (MDD) can

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achieve a significant reduction in symptoms, although as many as 50% of patients may not respond to the initial treatment trial. After 1 year, 20% of untreated individuals with MDD will persist in meeting diagnostic criteria, while another 40% will experience partial remission. The WHO conducted a cross-cultural study on depressive disorders since 1972. During the 10-year follow-up of 439 patients, 36% experienced readmission, 18% had significantly poor clinical outcomes, 24% endured severe social impairment for over half the period, and 21% did not achieve full remission.[2] Several studies have demonstrated a correlation between obesity or weight and the effectiveness of treatment.[3] However, if being overweight reliably predicts treatment outcomes for depression, measuring body weight and body mass index (BMI) could be useful. They are easy to measure and could influence how drugs work in the body. MDD and obesity are both common heterogeneous disorders with complex etiology and pronounced public health impact.[4] In the past few decades, studies have addressed the relationship between obesity and MDD, and they have suggested that both disorders share a common pathophysiology to a certain extent. Several studies have reported a correlation between obesity and poorer response to antidepressant treatment in individuals with major depression.[5] In the United States, costs related to MDD such as medical expenses are estimated to be $210 billion a year.[6] With a lifetime prevalence of 16.2%, MDD is twice as common in women. Moreover, two-thirds of suicides are associated with MDD.[1] Concomitantly obesity is a debilitating epidemic affecting 34.9% of adults in the US (78.6 million individuals), resulting in estimated annual medical costs of $147 billion in 2008.[7] With a rapid rise of individuals taking antidepressants, numerous Western studies and very few Indian studies have investigated the effects of different classes of antidepressants on body weight.[8] Several studies have investigated the relationship between obesity, depression, and treatment response, particularly in hospitalized patients with MDD, revealing significant correlations among these variables. An Indian systematic review of 21 studies found a significant bidirectional association between obesity and depression, with stronger links observed in women. Evidence for anxiety disorders showed modest associations, while relationships with other psychiatric conditions were less clear. The study concluded that obesity and depression have a significant and bidirectional association, with gender being an important mediator in these relationships.[9] Another Indian cross-sectional study conducted in Mangalore found that while obesity and depression were prevalent among participants, they were not directly associated. Instead, a family history of mental health problems emerged as an independent risk factor for depression.[10] This research is novel in its focus on evaluating how baseline BMI influences antidepressant response in newly diagnosed psychiatric patients, addressing a critical gap in understanding treatment outcomes in relation to obesity and depression in a tertiary care setting. The findings aim to contribute personalized treatment strategies tailored to BMI levels, optimizing depression management.

Research hypothesis (H1)

Baseline BMI significantly affects the antidepressant response in newly diagnosed MDD patients.

Alternate hypothesis (H0)

Baseline BMI does not significantly affect the antidepressant response in newly diagnosed MDD patients.

Aims and objectives

Primary objective

The primary objective of the study is to assess sociodemographic profiles and investigate the relationship between baseline BMI and antidepressant response in newly diagnosed patients.

Secondary objectives

The secondary objective of the study is to measure baseline severity of depressive symptoms.

MATERIALS AND METHODS

Study type

This is a longitudinal observational study.

Study setting

The study was conducted at the Psychiatry outpatient department, R. G. Kar Medical College and Hospital, Kolkata, over a 1½-year period.

Inclusion criteria

- Patients aged between 18 and 65 years
- Newly diagnosed cases of depression without psychosis and for whom antidepressant treatments are recommended
- Score should be a minimum of 14 on the Hamilton Rating Scale for Depression (HAM-D 17) scale
- Having no prior intervention.

Exclusion criteria

- The presence of any other psychiatric disorder, for example, anxiety disorder, obsessive-compulsive disorder, bipolar disorder, psychosis, etc.
- Substance use disorder
- Any organic brain disorder.

Tools for assessment

Semi-structured questionnaire for sociodemographic profile, case record form, family history sheet, the

Diagnostic Criteria for Research accompanying the ICD-10 (DCR-10), HAM-D 17, weight machine, stadiometer, sphygmomanometer, stethoscope ICD 10 (DCR 10) developed by the WHO, offers standardized criteria for diagnosing mental disorders, derived from extensive international collaboration and research. It emphasizes diagnostic reliability and clarity, incorporating contributions from various psychiatric traditions and global experts, and has been extensively tested and refined through field trials in multiple countries.

The HAM-D is the most widely used clinician-administered tool to assess the severity of depression symptoms. It contains 17–21 items and various versions and translations are available including semi-structured interview guides and adaptations for different languages and specific types of depression.

Sample size

In previous studies, it was observed that the response rates of antidepressants are different in different groups of BMI.[11] Therefore, in the present study, three different groups of BMI were considered such as Group 1 – normal to underweight (BMI <25), Group 2 – overweight (BMI 25–29), and Group 3 – obese (BMI >29). According to the formula of determining sample size for a qualitative variable, sample size,

$$\text{(Denoted as N)} = \frac{(Z_1 - \alpha/2)2 \times p \times q}{l \times l}$$

Here (Z_1 - $\alpha/2$) stands for standard normal variant (at 5% type 1 error [P<0.05], it is 1.96 and at 1% type 1 error [P<0.01], it is 2.58). P-values are considered significant below 0.05 in the majority of studies; hence, 1.96 is used in the formula.

p = expected proportion of cases diagnosed with depression among patients q =100-p

l = absolute error or precision.

Here, among normal to underweight (BMI <25) group, P=50%, overweight (BMI 25–29) group P=46.5%, and obese (BMI >29) group P=17.4%.

Hence, the sample size in each group was as follows:

1. Normal to Underweight (BMI <25) group [N1]

$$N1 = \frac{1.96 \times 1.96 \times 50 \times (100 - 50)}{9 \times 9} = 118.56 \approx 120$$

2. Overweight (BMI 25–29) group [N2]

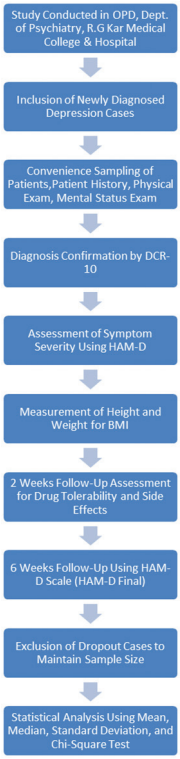
$$N2 = \frac{1.96 \times 1.96 \times 46.5 \times (100 - 46.5)}{9 \times 9} = 117.98 \approx 120$$

3. Obese (BMI >29) group [N3]

$$N3 = \frac{1.96 \times 1.96 \times 17.4 (100 - 17.4)}{9 \times 9} = 68.16 \approx 70$$

We excluded dropout cases to maintain the sample size; only patients who completed two subsequent follow-ups were included in the analysis.

Convenience sampling was done after the patient fulfilled the diagnostic criteria. Statistical analysis of central tendencies (mean, median, and standard deviation) and Chi-square test were done. The study protocol is prepared in the flow chart and presented below.



RESULTS

In this study, BMI Group 1 comprised 120 patients (38.7%), BMI Group 2 included 120 patients (38.7%), and BMI Group 3 consisted of 70 patients (22.6%). These results are presented in Table 1.

Table 1: Distribution of BMI Group

BMI group	Frequency	Percentage
BMI group 1	120	38.7
BMI group 2	120	38.7
BMI group 3	70	22.6
Total	310	100.0

BMI: Body mass index

In BMI Group 1, 11 patients (9.2%) were classified as having an inadequate response, whereas 109 patients (90.8%) were classified as having a response. Similarly, in BMI Group 2, 33 patients (27.5%) were categorized as having an inadequate response, and 87 patients (72.5%) were categorized as having a response. In BMI Group 3, 36 patients (51.4%) were classified as having an inadequate response, and 34 patients (48.6%) were classified as having a response. The statistical analysis revealed a significant association between outcome and BMI Group, with a P<0.0001. This indicates that the distribution of treatment outcomes varied significantly across different BMI groups. The figure illustrates this association, showing the proportion of patients with inadequate response and response in each BMI group. As depicted in the figure, there is a clear trend of increasing proportion of patients with inadequate response as BMI increases from Group 1 to Group 3. Conversely, the proportion of patients with response decreases with increasing BMI. These findings suggest that higher BMI may be associated with a greater likelihood of experiencing an inadequate response to treatment for depression. The association between different BMI groups and treatment outcomes is shown in Table 2 and Figure 1.

The mean HAM-D final scores (mean±SD) in BMI Group 1, Group 2, and Group 3 were 8.6167±3.7823, 11.6500±3.7229, and 13.5000±3.2693, respectively. A statistically significant difference was observed in the mean HAM-D final scores among the three BMI groups (P<0.0001). This indicates that there were notable variations in the final depression severity scores across different BMI groups. The results suggest that BMI may have an impact on the severity of depressive symptoms at the conclusion of the study period. These findings highlight the importance of considering BMI as a potential factor influencing depression outcomes and suggest that individuals with higher BMI levels may experience more severe depressive symptoms. Detailed statistical representation is presented in Table 3 and means value illustrative is shown in Figure 2.

The study demonstrated higher HAM-D initial scores in overweight and obese patients, contrasting with lower scores in normal-weight individuals, a statistically significant finding. Obese patients exhibited reduced response rates compared to normal and overweight counterparts, also statistically significant. Moreover, responders had significantly lower mean BMI. Among patients, the inadequate response was noted in 25.8%, whereas 74.2% achieved a response. Furthermore, males showed a higher prevalence of obesity than females.

Table 2: Association between outcome and BMI Group

	BMI group			
Outcome	**BMI group 1**	**BMI group 2**	**BMI group 3**	**Total**
Inadequate response	11	33	36	80
Row%	13.8	41.3	45.0	100.0
Col %	9.2	27.5	51.4	25.8
Response	109	87	34	230
Row%	47.4	37.8	14.8	100.0
Col %	90.8	72.5	48.6	74.2
Total	120	120	70	310
Row %	38.7	38.7	22.6	100.0
Col %	100.0	100.0	100.0	100.0

Chi-square value: 41.5343; *P*<0.0001. BMI: Body mass index

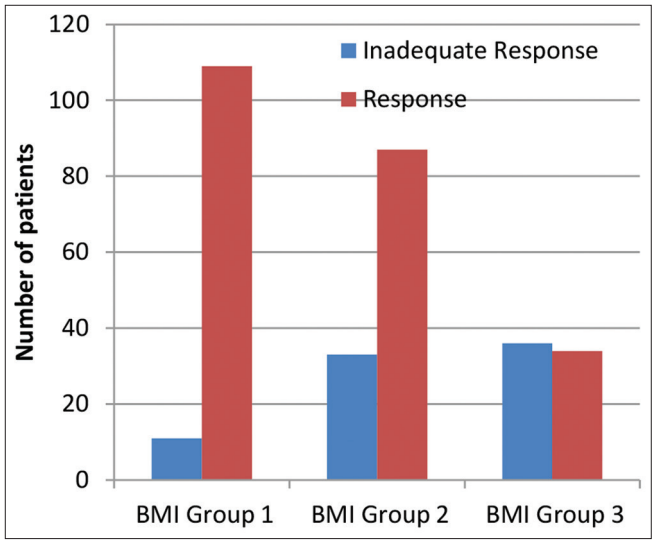


Figure 1: Association between outcome and body mass index group

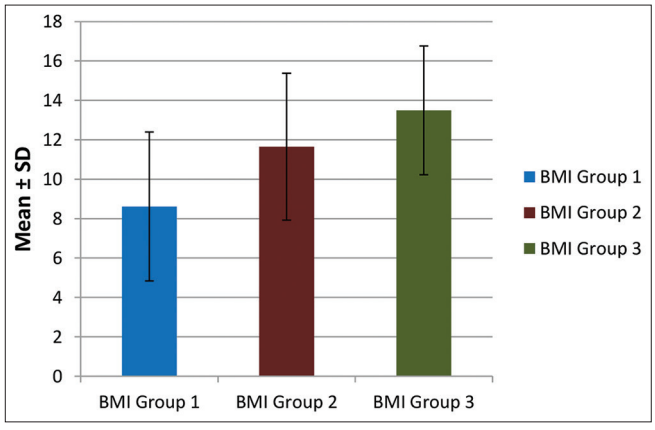


Figure 2: Distribution of mean HAM-D final: Body mass index group

DISCUSSION

This study explains the complex relationship between baseline BMI, depression severity, and antidepressant response. The findings reveal that obese individuals presented with higher initial depression scores and poorer

Table 3: Distribution of mean HAM-D Final: BMI Group

Different BMI Groups	Number	Mean	SD	Minimum	Maximum	Median	P-value
HAM-D final							
BMI group 1	120	8.6167	3.7823	3.0000	22.0000	8.0000	<0.0001
BMI group 2	120	11.6500	3.7229	6.0000	20.0000	12.0000	
BMI group 3	70	13.5000	3.2693	8.0000	20.0000	14.0000	

BMI: Body mass index, HAM-D: Hamilton rating scale for depression

treatment responses compared to their normal weight and overweight counterparts. These observations are consistent with international research, such as the studies conducted by Papakostas et al., Uher et al., and Lin et al., which also noted a correlation between obesity, depressive symptoms, and treatment outcomes.[3,5,8]

The results of this study provide valuable insights into the relationship between baseline BMI and antidepressant response within an Indian clinical setting. These findings are also consistent with previous Indian research, such as Rajan and Menon, Joseph and Nangia supporting the idea that obesity is associated with a less favorable response to antidepressant treatment.[9,10] This study, therefore, adds to the global understanding by providing data specific to the Indian context, where obesity rates are increasing. A unique aspect of this study is its focus on the Indian population, which provides region-specific and culturally relevant data. The study emphasizes the need for personalized treatment strategies that consider patients' BMI, particularly in Indian settings. The finding that responders had a lower mean BMI suggests a potential association between lower weight and improved treatment efficacy. This is consistent with the hypothesis that obesity-related biological factors, such as inflammation and insulin resistance, might adversely affect the response to antidepressants.

These findings have significant implications for clinical practice. They suggest that clinicians should routinely assess BMI as part of the diagnostic and treatment planning process for depression. Understanding the patient's BMI can help predict treatment outcomes and tailor interventions accordingly. For instance, combining antidepressant therapy with weight management programs might enhance treatment efficacy for obese patients. This integrated approach could address both the psychological and physical aspects of depression, potentially leading to better overall outcomes.

It underscores the necessity for health-care providers in India to adopt a holistic approach when treating depression, considering both mental and physical health aspects. This study highlights the intricate interplay between BMI, depression severity, and antidepressant response, offering valuable insights into the nuanced impact of obesity on treatment outcomes in a clinical setting. By aligning with international research and emphasizing region-specific data, the study paves the way for more personalized and effective treatment strategies in the Indian context.

Limitations of the study

Despite sincere efforts, this study has several limitations. The sample size was relatively small, with only 310 cases, which may not be sufficient for this type of study. Conducting the study in a single center limits the generalizability of the findings, and hospital bias cannot be ruled out as it was carried out in a tertiary care hospital. In addition, dropout cases were not included to maintain the sample size, which could affect the study's comprehensiveness. The use of convenience sampling may introduce selection bias, and different SSRIs were administered based on hospital supply and availability at the time, potentially influencing the consistency of the results.

CONCLUSION

These findings emphasize the importance of incorporating BMI assessment into depression management strategies, as it may serve as a crucial determinant of treatment response. By recognizing the influence of weight on depressive symptoms and treatment outcomes, clinicians can better tailor interventions to meet the diverse needs of patients. Overall, the study underscores the complex relationship between BMI, depression, and treatment response, providing valuable insights for optimizing depression management strategies in clinical practice. Further research with larger, multi-center samples is warranted to validate these results and explore underlying mechanisms. Longitudinal studies with standardized antidepressant treatments and more robust sampling methods would provide a clearer understanding of the relationship between BMI and antidepressant response. Further exploration into the biological and psychological mechanisms underlying this relationship is also warranted, with a focus on developing targeted interventions for obese individuals with depression.

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Authors Contribution:
USM- Literature survey, prepared the first draft of the manuscript, implementation of study protocol, and manuscript revision; **NM-** Definition of intellectual content, concept, design, clinical protocol data collection, data analysis, and preparation of figures; **SM-** Manuscript preparation, editing, and manuscript revision; statistical analysis and interpretation, **AD-** Manuscript preparation, editing, and coordination; **AB-** Data collection, data analysis, preparation of figures, manuscript preparation, and editing; **SN-** Statistical analysis and interpretation, and coordination.

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