

# Sex-Based Variations in Hemato-Physiological Characteristics of Patients with Major Depressive Disorder: Clinical and Socioeconomic Insights

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## Abstract

**Background:** Major depressive disorder (MDD) is a well-known psychiatric condition that can affect a diverse range of populations worldwide. **Objectives:** This research aimed to examine sex differences in hemato-physiological, clinical, and socioeconomic factors, as well as response to antidepressant psychiatric therapy, in a group of 198 adult subjects with MDD. **Materials and Methods:** The study collected basic demographic characteristics, including age, leukocyte counts, body mass index (BMI), hemoglobin (Hb) blood values, and inflammatory marker “C-reactive protein” (CRP). The cohort exhibited significant alterations between the two sexes in various clinical variables. **Results:** Despite females exhibiting high levels of somatic symptomatology, as evidenced by increased white blood cell counts and BMI, male patients presented higher Hb readings, reflecting probable disparities in physical body responses to depression. A comprehensive review of marital status and educational attainment revealed further sex-linked changes in MDD manifestation. The findings suggest that female patients with higher educational attainment exhibited higher BMI measures compared to their male counterparts, highlighting latent sociocultural impacts on disease presentation. Moreover, marital status meaningfully impacted the clinical presentation of both sexes. The age and BMI physical measurements of married individuals differed from those who were non-married. Additionally, the socioeconomic setting affects the clinical performances of MDD patients. The fluctuating BMI means of those residing in urban and rural areas underscore the significance of external inspirations on health outcomes. Furthermore, the administration of antidepressant medicines revealed sex-associated differences in clinical body reactions, predominantly in CRP serum levels, indicating potential alterations in the effectiveness of antidepressants between the two sexes. **Conclusion:** The present work focuses on the challenges in classifying and managing depressive symptoms, highlighting the importance of considering sex-specific alterations. Considering such variations might indeed help improve therapy plans and improve their outcomes. Given the complexity of MDD, medications should be modified to the individual's clinical symptomatology, sex, and socioeconomic circumstances.

**Keywords:** Antidepressant agents, major depression, MDD, sex-specific disparities, socioeconomic environment

## INTRODUCTION

The most common mental illness is major depressive disorder (MDD).<sup>[1]</sup> Gender differences exist in MDD prevalence, with women more likely than men to experience the disorder. The worldwide prevalence rate is 1.8% for males and 3.0% for females, respectively. This highlights the importance of recognizing how sex influences the incidence and impact of MDD.<sup>[2]</sup> The published data validate the variations in MDD based on sex. Major clinical signs, such as clinical symptoms, rates of suicidal

thoughts, and severity, vary between male and female sufferers. During the most severe phases of depression, females are inclined to demonstrate signs of exhaustion and insomnia, while men are particularly prone to exhibit

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evidence of impulsivity, sleep deprivation, emotional instability, and drug abuse issues.<sup>[3]</sup> Additionally, females characteristically respond more positively to selective serotonin reuptake inhibitors (SSRIs) than males.<sup>[4]</sup> Current neuroimaging-based studies have revealed that patients with depression exhibit different patterns of brain bioactivity and histo-anatomical abnormalities. Studies on brain ultrastructure have linked sex-specific alterations to size variations in gray matter due to cortical thickness and changes in surface area morphology. These structural differences in the brain may help in understanding the sex-related symptomatic variation in MDD.<sup>[3]</sup>

Due to the scarcity of research on these variations, there is still a lack of knowledge in this particular field between the sexes, while the available studies on MDD have primarily focused on hormonal, neuroimaging, socioeconomic, and radiological findings. However, the inflammatory response and its interaction with these factors have not been well-studied. The current study aims to investigate and outline the differences in clinical presentation, inflammatory, and demographic characteristics between patients with MDD based on their sex.

## MATERIALS AND METHODS

### Major depressive disorder patient selection

All 198 individuals involved in the study were diagnosed with MDD based on the “DSM-5 criteria for MDD version 7.0.2” using the “Mini International Neuropsychiatric Interview.”<sup>[5]</sup> The selection criteria included being on antidepressant medication for a maximum of 3 months, being diagnosed with MDD, attending the psychiatric outpatient health center at Merjan Hospital in Babylon province from the beginning of August 2020 to the end of August 2021, and following their follow-up schedules for both sexes. A self-administered form based on the “Patient Health Questionnaire depression module (PHQ-9)” contained nine items used to assess the severity of depression in accordance with MDD criteria.<sup>[6]</sup> MDD candidates were asked to assess the frequency of each item over the last week using a scale of 1 = not at all, 2 = several days, 3 = half days, and 4 = nearly every day. Higher scores indicate higher thought incidence. The computation of queries from 1 to 30 determines the total score, indicating the frequency of thoughts.

Five groups of patients were categorized based on their PHQ-9 scores: 0–4 had no depression; 5–9 had mild depression; 10–14 had moderate depression; 15–20 had

moderately severe depression; and 21–27 had severe depression. The psychologists recognized that using the PHQ-9 criteria alone was insufficient to prove or rule out MDD. However, a critical diagnosis is ultimately determined based on the patient’s ability to complete the assessment form and other relevant information obtained from the patient or family members.<sup>[6]</sup> Patients with a history of convulsions, traumatic or degenerative brain diseases, drug addiction, or use of corticosteroids during the previous several months were excluded from the study.<sup>[7]</sup>

### Biochemical assays of Hs-C-reactive protein

Blood samples were collected, centrifuged, and frozen in preparation for additional testing. The specimen collection time was the same for every participant. “Roche Diagnostics Cobas c 111 (Temecula, CA, USA)” immune analyzer used a “high sensitivity immunoturbidometric assay” to measure C-reactive protein (CRP) levels. Furthermore, the patients’ anthropometric data, such as their height, weight, and body mass index (BMI), were accurately calculated.

### Statistics analysis

The data were organized, grouped, analyzed, and examined using software from SPSS (V-27) (IBM, USA) and JASP (V-0.18.3.0) (Bruno Boutin, Amsterdam). *t* tests were utilized for continuous variables to determine the variations in the demographic data, and Pearson correlations were employed to assess the relationships between the parameters. The receiver operating characteristic curve was utilized to examine the predictive value of oxytocin and CRP for severe depression symptoms.

### Ethical approval and consent

The methodology of this observational study was approved by the health directorate’s local authority under reference number 374-2 on June 23, 2020, and involved 198 patients. The psychiatrists at the provincial major hospital nominated the selected patients, all of whom had been diagnosed with MDD. A written consent agreement had been completed by each candidate or their family members.

## RESULTS

Table 1 displays the initial demographic characteristics of MDD patients, including the mean and standard deviation values for various parameters.

**Table 1: Basic demographic features of MDD patients: Laboratory and clinical parameter mean and standard deviation**

| Characteristics | Age/years | Hs-CRP (mg/mL) | BMI (kg/m <sup>2</sup> ) | Hb     | WBC (1 × 10 <sup>3</sup> /μL) |
|-----------------|-----------|----------------|--------------------------|--------|-------------------------------|
| Mean            | 37.64     | 9.202          | 32.292                   | 13.414 | 8.175                         |
| SD              | 16.451    | 9.202          | 15.936                   | 1.788  | 2.192                         |

Table 2 displays the results of the Student *t* test comparing various clinical parameters between male and female cases. The parameters include age, hemoglobin (Hb) levels, BMI, white blood cell (WBC), and Hs-CRP levels. The Brown–Forsythe test was conducted, and according to a remark, its significance suggests a potential violation of the equal variance assumption for the Hs-CRP value. It is recommended to exercise caution when interpreting the Hs-CRP levels.

**Table 2: A comparison of clinical parameters between male (N = 84) and female (N = 114) patients is presented in Student *t* test results**

| Characteristics               | Group | Mean   | SE    | T       | df  | P                  |
|-------------------------------|-------|--------|-------|---------|-----|--------------------|
| Age (years)                   | F     | 38.793 | 1.328 | 1.515   | 276 | 0.131 <sup>a</sup> |
|                               | M     | 35.712 | 1.409 |         |     |                    |
| Hs-CRP (mg/mL)                | F     | 9.848  | 0.918 | 1.168   | 198 | 0.244              |
|                               | M     | 8.31   | 0.888 |         |     |                    |
| BMI (kg/m <sup>2</sup> )      | F     | 32.491 | 0.657 | 0.205   | 196 | 0.838              |
|                               | M     | 32.021 | 2.525 |         |     |                    |
| WBC (1 × 10 <sup>3</sup> /μL) | F     | 8.342  | 0.249 | 1.113   | 142 | 0.268              |
|                               | M     | 7.928  | 0.263 |         |     |                    |
| Hb                            | F     | 12.351 | 0.141 | -12.588 | 142 | <0.001             |
|                               | M     | 14.99  | 0.147 |         |     |                    |

Student *t* test

<sup>a</sup>Brown–Forsythe test is significant (*P* < 0.05), suggesting a violation of the equal variance assumption

Table 3 displays the results of the Student *t* test comparing the educational attainment of male and female patients. It indicates that males with a primary education have significantly higher mean BMI compared to females with the same level of education.

Table 4 displays information on how participants' marital status affected several clinical markers for both male and female individuals. Based on their marital status, the participants are divided into four groups: widow, single, married, and divorced. For both genders, the *P* values of 0.011 and 0.001 show a significant difference in the mean age between the single and married populations.

Table 5 presents information on the associations between the socioeconomic settings of the participants and several clinical characteristics for both males and females. The participants were grouped into four residential and socioeconomic categories: overcrowded, homeless, rural, and urban. A *P* value of 0.001 within the BMI category suggests a significant difference in the mean BMI of females living in rural and urban locations. Compared to those who reside in rural or urban environments, persons who live in highly populated areas usually have longer educational backgrounds.

Table 6 presents information on the correlation between different types of antidepressants and clinical factors among male and female participants. Three

**Table 3: The educational levels and corresponding clinical parameters of the enrolled patients with MDD in terms of gender**

| Variables | Levels of education | Males (84) |       |      |       | Females (114) |      |      |       |
|-----------|---------------------|------------|-------|------|-------|---------------|------|------|-------|
|           |                     | N          | Mean  | SE   | P     | N             | Mean | SE   | P     |
| Age       | Illiterate          | 4          | 62.5  | 1.4  | 0.026 | 18            | 45.8 | 5.7  | >0.05 |
|           | Primary             | 20         | 37.3  | 2.1  |       | 36            | 40.1 | 2.1  |       |
|           | Secondary           | 40         | 34.3  | 2.6  |       | 30            | 36.9 | 2.4  |       |
|           | College             | 20         | 35.7  | 3.1  |       | 30            | 43.8 | 2.9  |       |
| BMI       | Illiterate          | 4          | 33.1  | 0.3  | 0.05  | 18            | 33.6 | 1.4  | 0.04  |
|           | Primary             | 20         | 43.1  | 10.3 |       | 36            | 35.1 | 1.5  |       |
|           | Secondary           | 40         | 29.0  | 0.7  |       | 30            | 30.1 | 1.1  |       |
|           | College             | 20         | 26.8  | 0.6  |       | 30            | 31.0 | 0.8  |       |
| CRP       | Illiterate          | 4          | 6.7   | 2.7  | >0.05 | 18            | 11.5 | 2.0  | >0.05 |
|           | Primary             | 20         | 7.7   | 1.6  |       | 36            | 11.1 | 1.8  |       |
|           | Secondary           | 40         | 10.0  | 1.6  |       | 30            | 6.0  | 1.4  |       |
|           | College             | 20         | 5.9   | 0.9  |       | 30            | 11.7 | 2.0  |       |
| Hb        | Illiterate          | 4          | 14.7  | 0.5  | 0.037 | 18            | 12.5 | 0.2  | >0.05 |
|           | Primary             | 20         | 15.7  | 0.3  |       | 36            | 12.9 | 0.3  |       |
|           | Secondary           | 40         | 15.0  | 0.2  |       | 30            | 11.9 | 0.2  |       |
|           | College             | 20         | 14.4  | 0.3  |       | 30            | 12.1 | 0.3  |       |
| WBC       | Illiterate          | 4          | 9.7   | 0.5  | >0.05 | 18            | 8.7  | 0.6  | >0.05 |
|           | Primary             | 20         | 7.0   | 0.3  |       | 36            | 8.7  | 0.5  |       |
|           | Secondary           | 40         | 8.1   | 0.5  |       | 30            | 8.2  | 0.5  |       |
|           | College             | 20         | 8.0   | 0.3  |       | 30            | 7.8  | 0.4  |       |
| Duration  | Illiterate          | 4          | 120.0 | 34.6 | >0.05 | 18            | 23.3 | 9.6  | >0.05 |
|           | Primary             | 20         | 45.0  | 11.6 |       | 36            | 86.7 | 17.2 |       |
|           | Secondary           | 40         | 76.5  | 14.6 |       | 30            | 42.0 | 12.7 |       |
|           | College             | 20         | 75.0  | 15.8 |       | 30            | 42.0 | 12.0 |       |

**Table 4: Effect of marital status on clinical parameters in MDD participants (both males and females)**

| Variables | Marital status | Males (84) |      |      |       | Females (114) |      |      |       |
|-----------|----------------|------------|------|------|-------|---------------|------|------|-------|
|           |                | N          | Mean | SE   | P     | N             | Mean | SE   | P     |
| Age       | Single         | 20         | 19.4 | 1.0  | 0.011 | 12            | 20.8 | 1.1  | 0.001 |
|           | Married        | 62         | 42.1 | 1.7  |       | 88            | 41.7 | 1.5  |       |
|           | Divorced       | 2          | 42.0 | 0.0  |       | 4             | 33.5 | 3.8  |       |
|           | Widow          |            |      |      |       | 10            | 63.8 | 3.9  |       |
| BMI       | Single         | 20         | 27.6 | 0.9  | >0.05 | 12            | 26.1 | 1.0  | >0.05 |
|           | Married        | 62         | 33.6 | 3.4  |       | 88            | 33.4 | 0.8  |       |
|           | Divorced       | 2          | 28.1 | 0.0  |       | 4             | 35.1 | 2.9  |       |
|           | Widow          |            |      |      |       | 10            | 31.3 | 1.9  |       |
| CRP       | Single         | 20         | 9.4  | 2.4  | >0.05 | 12            | 7.5  | 2.1  | >0.05 |
|           | Married        | 62         | 8.1  | 0.9  |       | 88            | 10.2 | 1.1  |       |
|           | Divorced       | 2          | 2.4  | 0.0  |       | 4             | 6.8  | 2.5  |       |
|           | Widow          |            |      |      |       | 10            | 12.4 | 3.7  |       |
| Hb        | Single         | 14         | 14.9 | 0.3  | >0.05 | 8             | 12.3 | 0.3  | >0.05 |
|           | Married        | 42         | 15.1 | 0.2  |       | 66            | 12.3 | 0.2  |       |
|           | Divorced       | 2          | 13.8 | 0.0  |       | 4             | 12.2 | 0.2  |       |
|           | Widow          |            |      |      |       | 8             | 13.0 | 0.4  |       |
| WBC       | Single         | 14         | 6.5  | 0.5  | 0.015 | 8             | 8.1  | 0.6  | >0.05 |
|           | Married        | 42         | 8.3  | 0.3  |       | 66            | 8.4  | 0.3  |       |
|           | Divorced       | 2          | 9.3  | 0.0  |       | 4             | 9.8  | 1.5  |       |
|           | Widow          |            |      |      |       | 8             | 7.2  | 0.5  |       |
| Duration  | Single         | 20         | 72.0 | 20.2 | >0.05 | 12            | 70.0 | 23.7 | 0.001 |
|           | Married        | 62         | 69.7 | 9.8  |       | 88            | 58.6 | 9.0  |       |
|           | Divorced       | 2          | 90.0 | 0.0  |       | 4             | 0.0  | 0.0  |       |
|           | Widow          |            |      |      |       | 10            | 6.0  | 4.0  |       |

types of antidepressants are given to the participants: SSRIs, tricyclic antidepressants (TCAs), and atypical antidepressants. Male and female patients using TCAs and SSRIs had significantly different mean CRP levels, as indicated by a *P* value of 0.001 in the CRP category.

Table 7 presents information on the relationship between several clinical characteristics and the degree of depression experienced by both male and female individuals. A *P* value of 0.001 in the CRP category indicates a significant difference in mean CRP levels between those with mild depression and those with moderate to severe depression in both males and females. Additionally, patients experiencing moderate to severe depressive symptoms, irrespective of gender, generally had inferior mean Hb measures and longer durations of depressive manifestations compared to subjects with mild depression.

## DISCUSSION

This study analyses a wide range of characteristics, including depression severity, antidepressant use, marital status, wealth, and housing style, which may influence clinical qualities in individuals with severe depression disorders. Consequently, the study clarifies the complex interactions between these factors and their effects on physiological markers.

The results suggest that a person's age, BMI, CRP levels, Hb levels, and WBC count may be influenced by their marital status. Research findings highlighting the importance of considering gender differences in MDD prevalence, clinical characteristics, and neurobiological components have been published in some academic journals. These results underscore the necessity of individualized methods for MDD diagnosis and therapy. Consistent relationships have been observed between lifestyle choices, socioeconomic status, and differences in age, BMI, CRP, Hb, WBC, and level of education. Antidepressants may have varied effects on various clinical signs depending on whether their classification is atypical, TCA, or SSRI. Moreover, there seems to be a substantial correlation between age changes, CRP levels, BMI, WBC count, Hb levels, educational attainment, and the severity of depression.

Numerous investigations have focused on the relationship between MDD and socioeconomic status (SES). A study evaluated the several SES characteristics that influence the onset of MDD, such as wealth, education, and professional position. It also examined the interrelation of these variables with the onset of MDD.<sup>[8]</sup> In the study, a Mendelian randomization technique was employed to examine the reciprocal causal relationship between schizophrenia and MDD. The finding that SES demonstrated indicated the significance of SES determinants on mental health outcomes.<sup>[9]</sup>

**Table 5: Socioeconomic environment's effect on clinical parameters in MDD individuals (both males and females)**

| Variables | Socioeconomic environment | Males (84) |       |      |       | Females (114) |       |      |       |
|-----------|---------------------------|------------|-------|------|-------|---------------|-------|------|-------|
|           |                           | N          | Mean  | SE   | P     | N             | Mean  | SE   | P     |
| Age       | Rural                     | 38         | 36.2  | 1.9  | >0.05 | 20            | 39.2  | 3.8  | >0.05 |
|           | Urban                     | 30         | 34.6  | 3.1  |       | 52            | 40.7  | 2.2  |       |
|           | Overcrowded               | 16         | 41.6  | 4.6  |       | 40            | 42.5  | 2.5  |       |
|           | Homeless                  |            |       |      |       | 2             | 45.0  | 0.0  |       |
| BMI       | Rural                     | 38         | 27.2  | 0.5  | >0.05 | 20            | 31.2  | 1.3  | 0.001 |
|           | Urban                     | 30         | 38.5  | 6.9  |       | 52            | 31.0  | 0.9  |       |
|           | Overcrowded               | 16         | 31.4  | 1.1  |       | 40            | 33.9  | 1.1  |       |
|           | Homeless                  |            |       |      |       | 2             | 54.7  | 0.0  |       |
| CRP       | Rural                     | 38         | 8.5   | 1.6  | >0.05 | 20            | 5.5   | 0.7  | 0.002 |
|           | Urban                     | 30         | 7.8   | 1.3  |       | 52            | 11.1  | 1.5  |       |
|           | Overcrowded               | 16         | 8.8   | 1.3  |       | 40            | 9.8   | 1.5  |       |
|           | Homeless                  |            |       |      |       | 2             | 28.4  | 0.0  |       |
| Hb        | Rural                     | 28         | 15.0  | 0.2  | >0.05 | 20            | 12.2  | 0.3  | >0.05 |
|           | Urban                     | 20         | 15.0  | 0.3  |       | 52            | 12.4  | 0.2  |       |
|           | Overcrowded               | 10         | 15.1  | 0.3  |       | 40            | 12.3  | 0.2  |       |
|           | Homeless                  |            |       |      |       | 2             |       |      |       |
| WBC       | Rural                     | 28         | 7.5   | 0.2  | 0.021 | 20            | 7.0   | 0.4  | 0.015 |
|           | Urban                     | 20         | 7.8   | 0.6  |       | 52            | 8.6   | 0.3  |       |
|           | Overcrowded               | 10         | 9.2   | 0.6  |       | 40            | 8.7   | 0.5  |       |
|           | Homeless                  |            |       |      |       | 2             |       |      |       |
| Duration  | Rural                     | 38         | 48.9  | 11.0 | 0.001 | 20            | 33.0  | 12.9 | 0.002 |
|           | Urban                     | 30         | 58.0  | 13.4 |       | 52            | 45.0  | 9.3  |       |
|           | Overcrowded               | 16         | 146.3 | 17.9 |       | 40            | 66.0  | 15.4 |       |
|           | Homeless                  |            |       |      |       | 2             | 210.0 | 0.0  |       |

**Table 6: Antidepressant effects on clinical parameters in male and female MDD participants**

| Variables | Antidepressants | Males (84) |      |      |       | Females (114) |      |      |       |
|-----------|-----------------|------------|------|------|-------|---------------|------|------|-------|
|           |                 | N          | Mean | SE   | P     | N             | Mean | SE   | P     |
| Age       | SSRI            | 54         | 37.4 | 2.4  | >0.05 | 72            | 42.3 | 2.0  | >0.05 |
|           | TCA             | 10         | 30.6 | 1.6  |       | 24            | 40.4 | 3.0  |       |
|           | Atypical        | 14         | 40.9 | 2.3  |       | 14            | 36.4 | 3.3  |       |
| BMI       | SSRI            | 54         | 28.6 | 0.6  | >0.05 | 72            | 32.5 | 0.7  | >0.05 |
|           | TCA             | 10         | 60.6 | 19.5 |       | 24            | 32.1 | 1.8  |       |
|           | Atypical        | 14         | 27.0 | 0.2  |       | 14            | 32.3 | 2.1  |       |
| CRP       | SSRI            | 54         | 10.6 | 1.2  | 0.001 | 72            | 10.7 | 1.3  | 0.001 |
|           | TCA             | 10         | 5.5  | 0.9  |       | 24            | 10.2 | 1.5  |       |
|           | Atypical        | 14         | 2.7  | 0.6  |       | 14            | 8.1  | 2.8  |       |
| Hb        | SSRI            | 54         | 14.7 | 0.2  | >0.05 | 56            | 12.3 | 0.2  | >0.05 |
|           | TCA             | 10         | 15.1 | 0.2  |       | 14            | 12.7 | 0.2  |       |
|           | Atypical        | 14         | 14.9 | 0.3  |       | 12            | 12.5 | 0.3  |       |
| WBC       | SSRI            | 54         | 8.1  | 0.5  | >0.05 | 56            | 8.3  | 0.3  | >0.05 |
|           | TCA             | 10         | 8.0  | 0.5  |       | 14            | 8.9  | 0.5  |       |
|           | Atypical        | 14         | 8.2  | 0.3  |       | 12            | 8.5  | 0.9  |       |
| Duration  | SSRI            | 54         | 81.1 | 11.1 | >0.05 | 72            | 40.8 | 7.5  | >0.05 |
|           | TCA             | 10         | 60.0 | 27.6 |       | 24            | 70.0 | 23.7 |       |
|           | Atypical        | 14         | 55.7 | 18.6 |       | 14            | 77.1 | 19.3 |       |

Previous research has explored the impact of childhood SES on an adult's total risk of MDD. It was discovered that a lower childhood SES, as determined by parents'

occupation, was strongly correlated with an increased risk of severe depression in adulthood. This research emphasizes how early socioeconomic circumstances can

**Table 7: Impact of severity of depression on clinical characteristics among male and female MDD applicants**

| Variables | Severity           | Males (84) |       |      |       | Females (114) |      |      |       |
|-----------|--------------------|------------|-------|------|-------|---------------|------|------|-------|
|           |                    | N          | Mean  | SE   | P     | N             | Mean | SE   | P     |
| Age       | Mild               | 26         | 40.7  | 0.4  | 0.02  | 36            | 37.7 | 7.7  | >0.05 |
|           | Moderate to severe | 58         | 36.4  | 1.8  |       | 78            | 41.3 | 1.5  |       |
| CRP       | Mild               | 26         | 1.9   | 0.2  | 0.001 | 36            | 3.9  | 1.1  | 0.001 |
|           | Moderate to severe | 58         | 8.8   | 0.9  |       | 78            | 10.3 | 1.0  |       |
| BMI       | Mild               | 26         | 26.4  | 0.0  | 0.028 | 36            | 34.0 | 1.4  | >0.05 |
|           | Moderate to severe | 58         | 32.5  | 2.7  |       | 78            | 32.4 | 0.7  |       |
| WBC       | Mild               | 26         | 7.0   | 0.0  | 0.001 | 36            | 8.7  | 0.6  | >0.05 |
|           | Moderate to severe | 58         | 8.0   | 0.3  |       | 78            | 8.3  | 0.3  |       |
| Hb        | Mild               | 26         | 14.0  | 0.0  | 0.001 | 36            | 13.6 | 0.2  | 0.001 |
|           | Moderate to severe | 58         | 15.1  | 0.2  |       | 78            | 12.3 | 0.1  |       |
| Duration  | Mild               | 26         | 100.0 | 31.6 | >0.05 | 36            | 50.0 | 12.6 | >0.05 |
|           | Moderate to severe | 58         | 68.5  | 9.0  |       | 78            | 53.3 | 7.9  |       |

have a lasting impact on mental health outcomes.<sup>[10]</sup> There is a strong association between SES and depression, as demonstrated by a recent large cohort study in Germany. Education and household net income play a crucial role in the socioeconomic differences associated with depression. Studies have demonstrated that individuals with lower socioeconomic status are more likely to have depressive symptoms, highlighting the significance of socioeconomic factors in determining mental health outcomes.<sup>[11]</sup> An earlier study examined the relationship between individuals, communities, and their financial situations and depressive symptoms. The study demonstrated a complex relationship between socioeconomic status and mental health outcomes, with a higher community-level prevalence of depressed symptoms substantially correlated with a higher economic position.<sup>[12]</sup>

Research suggests that, although there are variations across investigations, the average age at which MDD manifests itself is often between late adolescence and early adulthood. These results support our findings regarding the average age of MDD patients. One study reported the average age of initial MDD occurrence as 26 years old.<sup>[13]</sup> Another study<sup>[7,14,15]</sup> indicated that depression typically first appears between the ages of 30 and 40. Further investigation suggests that the age range of 18–30 years is critical for the onset of adult MDD, with the typical age for the initial appearance of mood disorders falling between 25 and 32 years.<sup>[16]</sup>

The current investigation assessed several markers, including BMI, WBC, and Hs-CRP levels. However, caution is advised when interpreting the Hs-CRP level results, given the published data highlighting the inflammatory impact in MDD.<sup>[1,7]</sup> The results of the Brown–Forsythe test indicate a potential violation of the equal variance assumption about the Hs-CRP value in this investigation. CRP, a liver “nonspecific acute phase reactant,” serves as a crucial indicator of low-grade inflammation in the body.<sup>[7,17–19]</sup> While it is still unclear whether CRP regulates

or strengthens the immune response,<sup>[17,19]</sup> research has established a link has been found between inflammation, CRP, and depression. However, the specific mechanism underlying this association remains unknown. Some scientists speculate that there may be a neuroimmune psychological connection between inflammatory reactions and negative outcomes, such as poor prosperity, wrath, depression, and anxiety.<sup>[7,15]</sup>

The analysis provided in Table 3 indicates trends that point to a higher prevalence of somatic complaints in females compared to males, particularly when considering the mean values across different educational levels. For example, in the BMI category, women across all educational levels tend to have higher mean BMI values than men. This observation suggests the possibility of variations in body composition or metabolic characteristics that may be associated with physical complaints. Similarly, changes in mean CRP levels among educational levels may indicate distinct inflammatory processes or immunological responses, which are often correlated with somatic symptoms in MDD.

Furthermore, changes in Hb, WBC, and the duration of the disease may be associated with physical health issues that MDD patients frequently face, suggesting that these indicators may also indirectly represent somatic symptomatology. Therefore, the observed differences in mean clinical parameters between male and female MDD patients across all educational levels reflect the findings that somatic symptoms are more common in females compared to males. Further research on the specific nature and processes of these somatic symptoms in MDD, as well as their impact on treatment outcomes and prognosis, would help gain a comprehensive understanding of sex-related variations in symptom presentation and management.

Significant alterations were observed in CRP measures between female and male MDD cases across various subgroups in the present investigation. Specifically, CRP levels display a *P* value of 0.244, signifying that there is no

visible variation between the two sexes [Table 2]. However, a significant difference with a *P* value of 0.001 is seen when looking at how antidepressants affect CRP levels [Table 6]. This suggests that there were significant differences in Hs-CRP levels between male and female patients on TCA and SSRIs. These outcomes propose that there may be sex-related reactions to antidepressants, which might have an impression on monitoring practices and treatment efficacy. Additional research into the biological mechanisms beyond these disparities in Hs-CRP concentrations between male and female patients is required to enhance therapeutic policies and augment clinical results.

Several scholarly studies have demonstrated a negative correlation between the number of years of education and the risk of MDD. MDD is more prevalent in those with lower levels of education than in individuals with higher levels of education. This inverse tandem raises the prospect that education might delay the onset of MDD. The frequency and clinical features of MDD are impacted by a more anxious phenotype associated with higher neuroticism and comorbid anxiety scores, which are correlated with higher educational attainment.<sup>[20]</sup> Similarly, research has correlated greater BMI to certain pathological brain variations among MDD patients. As abnormal neuronal ultrastructural changes in prefrontal brain areas are analogous, the duration of illness may be extended in overweight individuals with MD.<sup>[21]</sup>

The findings of our study indicate a statistically significant difference in BMI between the sexes who have completed primary school education. Any potential predispositions or confusing factors that may affect the observed associations should be taken into consideration. The study sample size in each education level should also be considered while interpreting the results.

## CONCLUSION

This study highlights the importance of considering sex variations in the clinical features of MDD. Women tend to report somatic symptoms more frequently. On the other hand, men exhibit other physiological reactions, such as high Hb levels. Sociodemographic factors, including residence, marital status, and educational background, also influenced the sex-associated differences in MDD presentation. These conclusions advocate that healthcare for MDD cases should be tailored to their precise requests, taking into account sex-related differences in symptoms and responses to treatment.

Additional future studies are essential to understand the specific primary mechanisms underlying these disparities fully and to develop more effective psychotherapies for patients of both sexes.

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## Conflicts of interest

There are no conflicts of interest.

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