A comparative study of C-reactive protein levels in patients with **major depressive disorder with and without suicidal attempts**

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ABSTRACT

Introduction and aim. Major depressive disorder (MDD) is closely linked to suicidal behavior, and systemic inflammation – particularly elevated C-reactive protein (CRP) – has been proposed as a contributing factor. However, evidence comparing CRP patterns separately in suicide attempters and non-attempters remains limited, especially in underrepresented populations. The aim of this study was to compare serum CRP levels in patients with MDD with and without a history of suicide attempts.

Material and methods. This cross-sectional analytical study included 60 adults diagnosed with MDD according to ICD-10 criteria. Participants were divided into two groups: those with a history of suicide attempts (n=30) and those without such a history (n=30). Depression severity was assessed using the Hamilton Depression Rating Scale (HAM-D). Serum CRP levels were measured using a turbidimetric method. Statistical analyses included Student's t-test, Mann-Whitney U-test, and Pearson's correlation.

Results. CRP levels were significantly higher among suicide attempters compared with non-attempters (4.47±3.53 mg/L vs 2.50±3.59 mg/L; p=0.03). A significant positive correlation between HAM-D scores and CRP levels was observed in the suicide-attempt group (R=0.52; p=0.003), whereas no such correlation was found in non-attempters (R=0.12; p=0.52). Severe depression was more common among suicide attempters (30/44 cases).

Conclusion. This study provides novel evidence that the association between inflammation and depressive symptom severity is present only in patients with a history of suicidal behavior. Elevated CRP may therefore represent a potential marker for identifying MDD patients at increased risk of suicide.

Introduction

Major depressive disorder (MDD) is one of the leading causes of disability worldwide, ranking second globally in 2020, with 53.2 million anxiety cases and 76.2 million MDD cases.[1,2] Suicidal behavior is a co-morbidity of several neuropsychiatric disorders, including schizophrenia, bipolar disorder, and borderline personality disorder. Among people with mental illnesses, MDD is one of the main preventable causes of death.[3] MDD is a common psychiatric condition with a global point prevalence of 4.7% that causes severe physical health and mental well-being.[4]

Recent studies have demonstrated a clear association between elevated CRP levels and both suicidal behavior and MDD severity. Moslemi et al. studied that increased CRP levels are significantly linked to suicidal behavior in individuals with depression.[5] For instance, elevated CRP levels have been linked to depression and poor antidepressant responses, including treatment resistance. Systemic inflammation raises CRP, a non-specific acute-phase protein. These data imply that CRP may be a distinct predictor for antidepressant therapy response and that anti-inflammatory drugs may help people with high CRP.[6]

Activated immune-inflammatory pathways, including CRP elevation, have been linked to mood disorders like MDD, bipolar disorder (BD), schizophrenia, and suicidal behavior (SB), but studies on CRP's role in SBs have yielded conflicting results. After recent and faraway suicide attempts, pro-inflammatory cytokines and CRP have increased in several studies.[6]

The MDD and CRP are correlated based on the idea that inflammation is a significant factor in MDD pathophysiology. Given that CRP is an inflammatory biomarker, it is increased in patients suffering from MDD, indicating systemic inflammation. This inflammation might disrupt neurotransmitter pathways, particularly those in which serotonin and dopamine are components of mood regulatory circuits. In addition, more severe suicidal ideation and depression have been associated with higher levels of CRP. It may suggest that inflammatory conditions are the ones that exacerbate symptoms in patients with MDD, particularly among those who are suicidal via the triggering of pathways involving processes of both stress and immunity.

The hypothesis that newly diagnosed "drug-naive patients with non-affective psychosis would have higher serum CRP levels than healthy controls and have more severe psychopathology, suicide risk, and alexithymia" was tested by De Beradis et al.[7] Thirty adult CRP levels were measured. Compared to healthy controls and patients at lower risk, those at higher risk for suicide had higher CRP levels. Regardless of psychopathology or depressive symptoms, the current study shows a correlation between CRP, suicide risk and alexithymia, in newly diagnosed, drug-naive patients with non-affective psychosis. Loas et al.

examined the relationship between mood or anxiety disorders, alexithymia, anhedonia, recent suicide attempts, suicidal thoughts, impulsivity, CRP, and cholesterol.[8]

As the CRP level spiked, patients were more likely to be in the suicide attempt group compared to the odds of being in the inpatient psychiatric control and/or suicide ideation groups [CI=(1.29, 3.38), OR=2.09 and CI=(1.15, 2.66), OR=1.75 respectively]. Furthermore, compared to people without depression or with mania, those with depression had a considerably higher probability of attempting suicide [CI=(1.97, 54.70), OR=10.38]. Based on CRP levels, there appears to be a gradient in inflammation between mental controls, suicidal ideators, and recent suicide attempters.[9] Miola et al. found suicidal ideation [SI]/behavior factors that could help us understand suicide's pathophysiology and prevent it.[10] Suicidality and CRP levels were shown to be significantly correlated (95% CI 0.476–0.9, SMD 0.688, p<0.001). As a result, CRP is a positive inflammatory protein that is produced by the liver's Kupffer cells in reaction to an acute inflammatory event and is readily detectable in plasma by extremely sensitive assays.[11]

Fernández-Sevillano et al. investigated the role of cytokines in suicide attempts as well as how they relate to the psychological components of this intricate, multifaceted occurrence.[12] Participants included 33 MDD patients who have attempted suicide at some point in their lives, 23 non-attempter MDD patients, 20 individuals with an MDD diagnosis and a history of suicide attempts, and 20 healthy controls. Depressive symptoms, aggressive behavior, global functioning, presence of abuse, and attention performance were evaluated in 96 participants. Every participant also had blood extracted for measurement of TNF-α plasma levels, IL2-R, IL-2, IL-6, and IL-4.

Depression can lead to suicidal thoughts, particularly if there are causes for the person to feel pessimistic about the future. Suicidal thoughts is more prevalent in patients with MDD. Suicidal ideation is a significant risk factor for completed suicide in persons with MDD and seems to be a prerequisite for suicide attempts. The prevalence of suicide ideation has been rising in recent years. The 12-month prevalence has varied from 2.3% to 58%, depending on the specific study environment. A number of risk factors for suicidal ideation have also been suggested by earlier research. Suicidal thoughts are linked to low social support, substance use disorder, past suicide attempts, depression and sleep issues, and increased inflammation. Suicidal ideation in MDD patients has also been examined in the studies we mentioned above. In recent years, the relationship between MDD and suicide conduct has gained significant attention. There is currently very few research on the prevalence of suicidal ideation and the factors that are linked to it in MDD patients in Ethiopia.[13,14] Suicidal thoughts that are specific, present, and ongoing are referred to as active suicidal ideation. When someone has a conscious intention to damage himself and some degree of desire – above zero – for death to follow, that person is said to have active SI.[15] According to contemporary views, complex interplay between cultural, environmental, biological and psychological factors can lead to suicidal thoughts and actions.[16]

Orsolini et al. used PubMed to conduct a systematic review on 'CRP' and 'depression.' This evaluation included 56 identified studies.[17] Depression was linked to inflammatory system dysfunction. This study adds to the evidence that CRP and blood levels may be linked to depression. These findings may help develop new treatments and determine if CRP is a depression biomarker. Savita et al. examined the levels of hs-CRP in depressive individuals with and without suicidal thoughts in 2023.[18] The Hamilton Depression Rating Scale (HDRS17), SBQ-R, and BSSI were used to assess depression and suicidality. Hs-CRP levels are positively correlated with BSSI, HAM-D and SBQ-R scores in depressed and suicidal patients. Similar to this, Grudet et al.[19] calculated the five suicide-related items listed above were part of the suicide composite score. The median of the suicide composite score (6 points) was then used to identify high-grade suicidal ideation (n=100, hg-SI>6 points) and low-grade suicidal ideation (n=99, lg-SI≤6 points). Additionally, recent research has shown a correlation between the lethality of suicide attempts among psychiatric inpatients and the platelet-to-lymphocyte ratio.[20] The association between elevated CRP levels and a higher chance of suicide reattempts highlights the part inflammatory indicators play in suicidal behavior.[21]

Some meta-analyses focused primarily on depressed people and aggregated CRP and suicidality data.[5,22-26] Studies looking at the relationship between CRP and MDD have found a strong link between high CRP levels and both an increased likelihood of suicidal thoughts and actions and the intensity of depressed symptoms.[27] The CRP is associated with suicidality in non-depressed people, as well as suicide thoughts and SB remains unclear. To the best of our knowledge, this is one of the few studies from South India directly comparing CRP levels and depression severity between suicide attempters and non-attempters using standardized ICD-10 and HAM-D assessments. Unlike previous studies, our analysis evaluates the relationship between CRP and depressive symptom severity separately in both groups

Aim

This cross-sectional study aimed to (1) compare serum CRP levels between patients with MDD with and without previous suicide attempts, and (2) evaluate the association between CRP levels and depression severity assessed with the Hamilton Depression Rating Scale (HAM-D).

Material and methods

Assessing CRP levels in depressed patients with and without a history of suicidal thoughts is the goal of this cross-sectional analytical investigation. The potential link between depression, CRP, and suicidal behavior is investigated in this study. The research was carried out at Pondicherry's Sri Lakshmi Narayanan Institute of Medical Science and Hospital (SLIMS) including both outpatient (OP) and inpatient (IP) settings within the Psychiatry Department.

The study population consisted of adult individuals (above the age of 18 years) from the IP and OP services of SLIMS, who were diagnosed with depressive disorder and either had or did not have a history of suicidal attempts during the period under study from July 2022 to January 2024. The source of data included patients diagnosed with depression, categorized into two groups:

- Group A: Patients diagnosed with depression who had a history of suicidal attempts, as per ICD-10 criteria.
- Group B: Patients diagnosed with depression without any history of suicidal attempts, were also diagnosed based on ICD-10 criteria. The study period extended from August 2022 to January 2024.

Sampling method

A convenient sampling method was used to select the participants. According to the sample size calculation, 60 participants in total (30 in each group) would be required to achieve the study's objectives.

Inclusion criteria

- Patients are willing to cooperate in the study.
- Patients with a diagnosis of depression based on the ICD-10 criteria.
- Adults (age >18 years) of both genders.
- Individuals having a history of attempted suicide.

Exclusion criteria

- Patients with co-morbid conditions such as autoimmune diseases, diabetes mellitus, renal insufficiency, pregnancy, tuberculosis, or other disorders known to cause elevated CRP levels.
- Patients presenting with any acute infection (bacterial, viral, or fungal).
- Patients currently taking medications known to affect CRP levels, including anti-inflammatory drugs and oral contraceptives.
- Patients diagnosed with any psychiatric illness other than depression.
- Patients with substance use disorders.
- Patients who did not provide informed consent.

Sample size calculation

The following formula was used to determine the sample size:

$$N = \frac{PQ}{Z\left(1 - \frac{\alpha}{2}\right)}$$

where $Z(1 - \alpha/2) = 1.96$ at P=Prevalence=12%, 95% confidence interval, $Q = 100 - P) = 88\%$, d=precision=3%, with an additional 5% accounted for potential dropout. The calculated sample size indicated that 30 participants were needed in each group, totaling 60 participants for the study.

Method of data collection

This research was clarified to respondents and informed written consent was acquired before their inclusion. Data were collected through direct interviews conducted in person with a standardized questionnaire that gathered socio-demographic details and assessed depression severity. CRP levels were measured using blood samples analyzed in the laboratory.

CRP analysis

Acute-phase protein CRP is found in normal serum but rises drastically in response to infections, inflammation, and tissue damage. Under such circumstances, the CRP levels can increase to 300 mg/L in 12–24 hours. The anti-CRP-coated latex particles used in the CRP analysis procedure agglutinate when they come into contact with CRP-containing samples. This agglutination is proportional to the CRP concentration and can be measured by turbidimetry.

Analytical procedure

- Preheat the photometer (cuvette holder) and working reagent to 37°C.
- Zero the instrument at 540 nm using distilled water.
- Prepare the cuvette by blending 5.0 μL of the calibrator or sample with 1.0 mL of the working reagent.
- Immediately after adding the sample (A1) and two minutes later (A2), mix thoroughly and record the absorbance.

Methodology

The SLIMS Institutional Ethics Committee gave its clearance for the study to be carried out (IEC/C-P/13/2022). The researcher performed comprehensive mental health assessments, collected detailed histories of depressive disorders, and discussed each case with departmental teaching staff. Prior to starting any medication, baseline CRP levels were measured. Depression diagnosis followed ICD-10 guidelines, and HAM-D was used to measure depression severity. Two independent specialists verified the diagnosis for accuracy.

Statistical methods

SPSS version 21 was used to evaluate the data after it was imported into Microsoft Excel (IBM, Armonk, NY, USA). The data were coded and entered into Epidata software before analysis. Comparisons of qualitative data (frequencies and proportions) were carried out utilizing the Mann-Whitney U-test. Quantitative data were reported as mean and SD, with statistical significance being assessed using t-tests. Odds ratios with 95% confidence intervals were calculated to ascertain the degree of association between variables. A p-value of ≤ 0.05 was considered statistically significant.

Expected outcomes

The expected outcomes of our proposed study are

- CRP levels may serve as a biomarker to identify depressive patients at risk of suicidal attempts.
- Establishing correlations between CRP levels, depression severity, and suicidality could inform early identification and intervention strategies.

Experimental results

Numerous studies have indeed linked inflammation, including elevated levels of CRP, to depression and treatment resistance. Inflammation is believed to play a role in the progression and development of depressive symptoms. Increased levels of CRP, an inflammatory marker, have been linked to an increased risk of depression and poorer response to traditional antidepressant medications.

The following results exhibited the CRP levels in depression patients who have attempted suicide and those who have not can provide valuable insights into this aspect. By examining these associations, we can gain a better understanding of the potential role of inflammation in suicidal behavior and develop targeted interventions to address this complex issue. These findings highlight the importance of monitoring CRP levels in depressive patients, particularly those undergoing suicidal attempts. Hence, the present study created groups among the study cases. Groups include:

- Group A – suicidal attempts
- Group B – no suicidal attempts

Age and gender were sociodemographic profiles in this investigation. In our study, there was a female predominance with 19 cases of suicide attempts and 18 cases of No-suicide attempts. Approximately 11 cases of males were seen in suicide attempts and 12 cases in No-suicide attempts.

Table 1 depicts the 30 attempted suicide instances, patients aged <18–20 (33.3%) were the most prevalent, followed by those aged 31–40 (30%). Over 51–60 had 3% of cases, 41–50 had 7%, and 61–70 had the lowest number (3%). The group with 30 non-suicide cases had the most 41–50 (30%) and 51–60 (26.6%) patients. About 20% were 31–40. Cases were lowest in the age groups <18–20 (10%) and 61–70 (10%).

Table 1. Distribution of age in years

Age categories	Suicide attempt		No suicide attempt	
	Frequency	**Percentage**	**Frequency**	**Percentage**
<18–20	10	33.33%	3	10%
21–30	7	23.3%	1	3.3%
31–40	9	30%	6	20%
41–50	2	6.6%	9	30%
51–60	1	3.3%	8	26.6%
61–70	1	3.3%	3	10%

Comparison between HAM-D scores among study groups

The present study compared the HAM-D scores between suicide attempts and non-suicide attempts using a student's t-test. The mean/SD range of HAM-D scores among group A was 23.8/2.41, and for group B was 22.36/7.16. The calculated t-score was noted as 1.0440, and the p-value showed 0.3008 (Table 2). This implies that the comparison between HAM D and study groups was statistically insignificant (Fig. 2).

Table 2. Mean and SD distribution of HAM D scores among study groups

| Group	Mean	SD	T score	p
Suicide attempt	23.8	2.41	1.0440	0.3008
No suicide attempt	22.36	7.16		

Association between HAMD versus CRP among study groups

The present study found the relation between HAMD versus CRP in suicide attempts and No-suicide attempts using the Karl Pearson correlation. The R^2 among group A was 0.2732. The calculated R value was noted as 0.5227 and the p-value showed 0.003. This implies that the association between HAMD versus CRP among suicidal attempt groups was statistically significant. The R^2 among group B was 0.0149. The calculated R-value was noted as 0.1222, and the p-value showed 0.52 (Table 3). Figures 1 and 2 show the positive and negative correlation between HAMD versus CRP among group A and group B. This implies that the association between HAMD versus CRP among No-suicidal attempt groups was statistically not
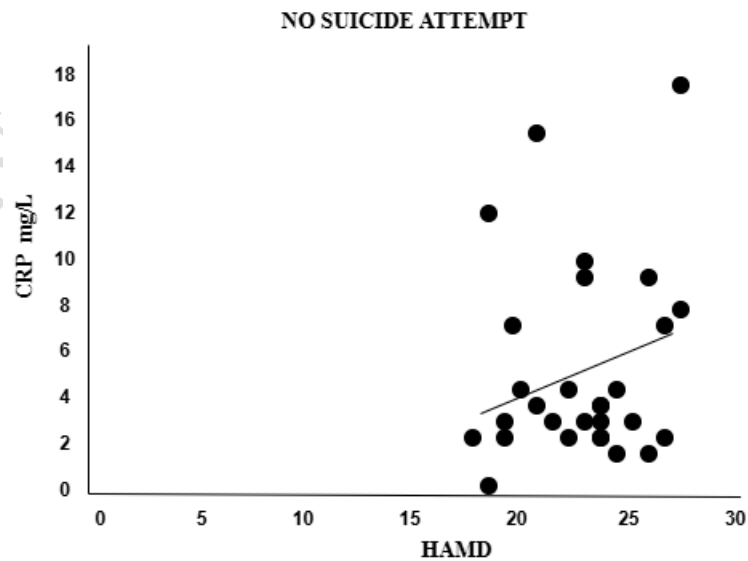
significant.

Table 3. Karl Pearson's correlation between HAMD versus CRP among study groups

Group	R^2	R	p
Suicide attempt	0.2732	0.5227	0.003
No suicide attempt	0.0149	0.1221	0.52
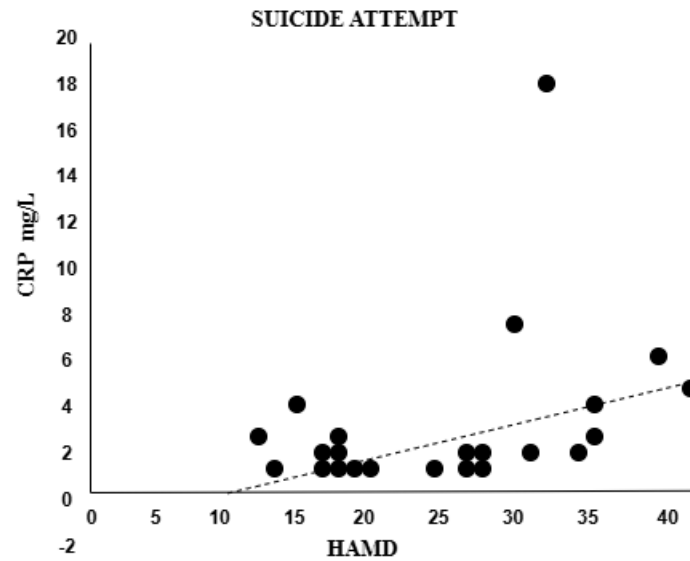
Fig. 1. Positive correlation between HAMD versus CRP among group A

Fig. 2. Negative correlation between HAMD versus CRP among group B

Diagnosis

According to the present study results, Table 4 shows a total of 16 research participants with moderate depression, and no suicidal attempts were seen among all 16 cases. Of the 44 participants with severe depression, about 30 cases were seen with suicidal attempts, and 14 cases were seen with no-suicidal attempts.

Table 4. Distribution of depression diagnosis among total cases and study groups

Diagnosis	Total research participants	Suicide attempt	To suicide attempt
Moderate depression	16	0	16
Severe depression	44	30	14

Mann-Whitney U-test

According to the information provided during statistical analysis, the present study compared the CRP values between moderate depression and severe depression patients using the Mann-Whitney U test. The calculated Z score was noted as 4.45, and the p showed 0.0001 (Table 5). This implies that the comparison between CRP and depression severity in the study population was statistically significant.

Table 5. Comparison between CRP levels and depression severity

Group	CRP	
	Z score	p
Moderate depression	4.45	<0.0001
Severe depression		

Student t-test

According to the information provided, the present study compared CRP between suicide attempts and No-suicide attempts using a student's t-test. The mean/SD range of CRP among group A was 4.47/3.53. The mean/SD range of CRP among group B was 2.5/3.59. The calculated T-score was noted as 2.14 and the p showed 0.03 (Table 6). This implies that the comparison between CRP and study groups was statistically significant.

Table 6. Variable comparison between CRP and study groups

Group	Mean	SD	T score	p
Suicide attempt	4.47	3.53	2.14	0.03

No suicide attempt	2.5	3.59

Correlation between CRP and study groups

Based on the Karl Pearson correlation, the R-value of CRP was found to be 0.867. Hence, this implies that the correlation between CRP and study groups was statistically significant with a $p < 0.05$ (Table 7). The positive association of CRP between study groups is depicted in Figure 3. This indicates that there was a strong relationship between CRP levels and the studied variables.

Table 7. Association between CRP and between study groups

Group	CRP	
	R	p
Suicide attempt	0.867	<0.05
No suicide attempt		
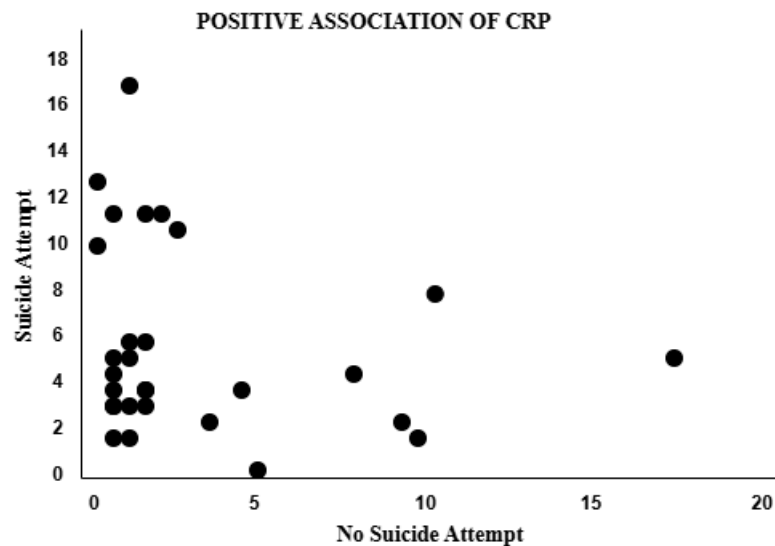
Fig. 3. Positive association of CRP between study groups

There is a high positive connection between the study groups and CRP levels, as indicated by the Pearson correlation coefficient of 0.867. This correlation is statistically significant if the p-value is less than 0.05. Thus, it can be determined that the study groups and CRP levels have a strong and significant correlation.

Discussion

The present study investigates the association between CRP (C-reactive protein) levels and depressive patients with and without a history of suicide attempts, aiming to understand the role of inflammation in suicidal behavior. These results add to the increasing amount of data demonstrating the connection between depression, inflammation, and suicidality, potentially leading to targeted interventions.

Acute-phase inflammatory marker CRP is postulated to be involved in the neuroinflammatory processes, possibly leading to the alterations of neurotransmitter systems, neuroplasticity, and dysregulation of the HPA axis. These mechanisms might explain why an elevated level of CRP correlates with suicidal behavior. Enhanced inflammation could contribute to serotonergic dysfunction, thus potentially leading to increased aggression, impulsivity, and dysregulated emotional processing – factors that are directly related to suicidal attempts and ideation.

Toffol et al. showed considerably higher CRP levels in recent suicide attempters than age- and sex-matched healthy adults.[28] CRP levels in attempted suicide cases were unrelated to background, metabolic, psychopathological, or suicide techniques. Group A had 22.8/3.41 mean/SD HAM-D scores, while group B had 23.36/6.16. The estimated t-score was 3.589 and p-value 0.005. This indicates a substantial comparison between HAM-D and research groups. The two groups' HAM-D symptom mean and SD were calculated. Two groups were compared using the t-test. No significant difference was found between attempters and non-attempters on HAM-D variables.[29] The present study found a significant connection between CRP levels and HAM-D scores in the suicidal attempt group, with an R=0.5227 and a p=0.003. The association between depressive symptoms and inflammation in suicide attempters is statistically significant. However, the no-suicidal attempt group had no significant association between HAM-D scores and CRP levels, with an R=0.1222 and a p=0.52. In non-suicide attempters, depressive symptoms and inflammation were not associated. The US study also found that avoidant-type coping behavior was positively connected with depression ratings for men, women, or both.[30]

In suicide attempters, Malone et al. found greater CRP levels, suicidal ideation, anger, hostility, and impulsivity. The study discovered a strong link between elevated CRP and suicide attempts. Botswick found a positive connection between CRP and suicidal thoughts.[31] These findings imply that elevated CRP levels may increase the risk of suicide in depressed people. Sachs-Ericsson et al. and Dumais et al. observed a substantial correlation between depression severity and suicidal behavior in patients attempting suicide.[32,33] In this research, the Karl Pearson correlation R of CRP is 0.867. Therefore, the connection between CRP and study groups is substantial (p<0.05). This suggests a high correlation between CRP levels and the factors. Another potential mechanism relates to the central nervous system and its activation through systemic inflammation leading to microglia activation and a potential increase in the production of pro-inflammatory cytokines that would adversely affect mood regulation and cognitive functioning, which is compromised among people with major depressive disorder as well as among suicide attempters.

A Pearson correlation coefficient of 0.867 shows a high positive association between CRP levels and study groups. A p below 0.05 indicates that this link is statistically significant. The correlation is not random. Thus, CRP levels and study groups are strongly correlated. However, Calati et al. observed no significant difference in CRP levels between individuals who attempted suicide more or less than a week before plasma collection or between high and low suicidal ideation.[34] Barzilay et al. found a correlation between CRP levels and suicidal ideation in schizophrenia patients, categorized by CRP levels at admission (CRP > 1 vs. <1 mg/dl).[35] Kim et al. validate that anxiety, CRP, and suicidal attempts are linked.[36] They compared suicide attempters' anxiety and CRP to non-attempters. This study adds to the evidence that inflammation, anxiety, and suicide may be interrelated.

These studies imply that inflammation, as evidenced by higher CRP levels, may increase the risk or severity of suicidal behaviors or thoughts and psychiatric illnesses such as schizophrenia, depression, and anxiety. Understanding these relationships can help identify, prevent, and treat suicide risk. A student's t-test was used to compare HAM-D scores between suicide attempters and non-suicide attempters. Group A had 22.8/3.41 mean/SD HAM-D scores, while group B had 23.36/6.16. The estimated t-score was 3.589 and p-value 0.005. This indicates a substantial HAM-D-study group comparison.

Karl Pearson correlation was used to compare HAM-D and CRP in non-suicide and suicide attempt patients. The computed R-value was 0.5227, 0.003 p-value and R^2 for group A was 0.2732. It was statistically significant to compare HAM-D and CRP in suicidal attempt groups. Similarly, the computed R was 0.1222, p-value 0.52 and R^2 for group B was 0.0149. This means that CRP and HAM-D were not significantly associated with patients without suicide attempts. The Karl Pearson correlation R-value of CRP is 0.867. Therefore, the connection between CRP and study groups is substantial (p<0.05). This suggests a high correlation between CRP levels and the factors. A Pearson correlation coefficient of 0.867 shows a high positive association between CRP levels and study groups. This correlation is statistically significant if the p-value is less than 0.05. Thus, CRP levels and study groups are strongly correlated. This would thus mean that considering inflammation as an etiopathogenic factor of suicidal behavior is crucial and would inform targeted therapeutic interventions. Systemic inflammation intensifies depressive symptoms and contributes to the severity of suicidal behavior. These findings agree with the hypothesis that inflammation is pivotal in mental health and its interplay with suicidal behavior.

The novelty of this study lies in demonstrating a significant correlation between CRP levels and depression severity exclusively in suicide attempters, but not in non-attempters. This differential pattern has been rarely reported and may indicate that inflammation plays a more prominent role specifically in the subgroup of MDD patients with suicidal behavior.

Study limitations

The positive association between CRP, depression, and suicidal behavior, though supported by the mentioned studies, is subject to several limitations. First, the predominantly cross-sectional design of these studies, including the one by Kim et al.[24], restricts the inference and highlights the need for longitudinal research to elucidate temporal dynamics and pathways. Elevated CRP levels in suicidal attempters could be due to chemical poisoning, which may mask the interpretation. Third, the sample size is small, limiting the findings' generalizability. Moreover, variations in the technique of measuring CRP, cutoff values, and depression assessment tools among studies contribute to methodological differences that limit the comparability of results. Finally, although CRP is a very common inflammatory marker, it gives a very limited view of inflammation; other markers, such as interleukins or tumor necrosis factor-alpha could be integrated to give a deeper vision into the mechanisms of inflammation that underlie depression and suicidal behavior.

Conclusion

This study demonstrated a strong positive association between the inflammatory marker CRP and depression exclusively among suicide attempters, while no such association was observed in non-attempters. This differential pattern represents a novel finding, suggesting that inflammation may play a more prominent role specifically in the subgroup of MDD patients with suicidal behavior. The results indicated that higher CRP levels were associated with increased depressive symptoms in suicide attempters, supporting the hypothesis that inflammatory activation contributes to the severity of depression and elevates suicide risk.

Understanding this interaction is essential for identifying high-risk individuals, guiding targeted interventions, and improving clinical prevention strategies. These findings highlight the potential utility of CRP as a supplementary clinical marker in assessing suicide risk. Further research is warranted to elucidate the biological mechanisms underlying this selective association and to explore whether anti-inflammatory approaches may benefit depressive patients with heightened suicidal vulnerability.

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Declarations

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Author contributions

Conceptualization, A.S. and K.S.; Methodology, K.S.; Software, K.S.; Validation, A.S., K.S. and R.T.; Formal Analysis, K.S.; Investigation, A.S.; Resources, R.T. and S.R.; Data Curation, K.S.; Writing – Original Draft Preparation, K.S.; Writing – Review & Editing, K.S.; Visualization, A.S.; Supervision, A.S.

Conflicts of interest

All authors clearly stated that they do not have any conflicts of interest.

Data availability

Usually, the sets of data are created during and/or analyzed throughout the entire study and are available from the corresponding author upon reasonable request.

Ethics approval

The ethical approval was acquired from the institutional ethical committee of Sri Lakshmi Narayana Institute of Medical Sciences IEC/C-P/13/2022.

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