Title: Mentalization-Based Therapy Improves Executive Dysfunction and Modulates Emotion Dysregulation in Patients with Major Depressive Disorder

Running Title: MBT Improves Executive Dysfunction

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ABSTRACT

Purpose: Major Depressive Disorder (MDD) is associated with significant impairments in emotion regulation and executive functioning. Emerging evidence suggests that Mentalization-Based Therapy (MBT) may improve emotional functioning and depressive symptoms by enhancing reflective functioning and cognitive-emotional integration. However, limited research has simultaneously examined the effects of MBT on executive functions and adaptive/maladaptive emotion regulation strategies in individuals with MDD.

Methods: This study employed a pre-test–post-test–follow-up experimental design with control and intervention groups. Twenty individuals diagnosed with MDD were randomly assigned to either an MBT group (n = 10) or a waitlist control group (n = 10). Participants completed the Beck Depression Inventory-II (BDI-II), Difficulties in Emotion Regulation Scale (DERS), Cognitive Emotion Regulation Questionnaire (CERQ), Emotion Regulation Questionnaire (ERQ), Reflective Functioning Questionnaire (RFQ), and a computerized Stroop task at baseline, post-intervention, and two-month follow-up. The intervention consisted of a standardized 12-session individual MBT program developed by the Anna Freud Centre. Data were analyzed using repeated measures ANOVA (RANOVA).

Results: MBT significantly reduced depressive symptoms and improved several dimensions of emotion regulation and executive functioning. Significant improvements were observed in overall emotion dysregulation, emotional awareness, emotional clarity, impulsivity control, positive reappraisal, positive refocusing, rumination, self-blame, and expressive suppression. In addition, participants receiving MBT demonstrated enhanced Stroop task performance, particularly in interference control, response accuracy, and incongruent processing conditions. Although MBT led to a significant decrease in BDI scores, it failed to moderate reflective functioning and cognitive reappraisal compared to the pretest group.

Conclusion: The findings suggest that MBT effectively improves both emotional and executive functioning but does not significantly affect reflective functioning and cognitive reappraisal in individuals with MDD. By targeting maladaptive cognitive-emotional processes, MBT may facilitate adaptive emotion regulation and cognitive control. These results support the integration of mentalization-focused interventions in the treatment of depression and highlight the close interaction between executive functions and emotion regulation mechanisms.

Keywords: Major Depressive Disorder, Mentalization-Based Therapy, Emotion Regulation, Executive Functioning

Introduction

Emotions play a fundamental role in human adaptation by providing essential information that enables individuals to respond effectively to changing environmental demands. However, emotional experiences can become problematic when they are contextually inappropriate or excessively intense (1). In such situations, individuals typically rely on emotion regulation (ER) strategies to manage their emotional responses. Emotion regulation refers to the processes through which individuals monitor, evaluate, and modify their emotional reactions in accordance with internal goals and external demands (2). A substantial body of research has highlighted the critical role of executive functions—including attentional control, cognitive flexibility, response inhibition, working memory, and goal-directed behavior—in facilitating effective emotion regulation (3–5). These cognitive capacities are not static; rather, they fluctuate across different mood states (6), and the use of emotion regulation or dysregulation strategies may lead to temporary improvements or impairments in executive functioning (7, 8). Conversely, stronger executive functioning has been shown to predict greater emotion regulation capacity (9, 10). Therefore, understanding the relationship between emotion regulation and executive functions is essential, as it may provide insights into the mechanisms underlying adaptive functioning and inform intervention strategies.

According to the process model of emotion regulation, regulatory processes occur in parallel with emotion generation, and different strategies can be implemented at various stages of the emotional response (11, 12). Importantly, the timing of regulation plays a crucial role in determining its effectiveness. Early-stage strategies, such as cognitive reappraisal, are generally more effective and less cognitively demanding, whereas later-stage strategies, such as suppression, tend to be less efficient and require greater effort (12). Emotion regulation strategies are commonly categorized as adaptive or maladaptive based on their functional outcomes. Adaptive strategies, including cognitive reappraisal, problem-solving, and mindfulness, are associated with reductions in maladaptive emotions and improvements in psychological well-being (13–17). In contrast, maladaptive strategies, such as rumination, emotional suppression, and avoidance, are linked to increased emotional distress and negative

psychological outcomes (13, 16, 18, 19). For the purposes of the present study, emotion regulation strategies are conceptualized within this adaptive–maladaptive framework.

Adaptive emotion regulation requires awareness of emotional states, recognition of the need for regulation, and the flexible selection and implementation of appropriate strategies based on situational demands (20). These processes rely heavily on core executive functions, particularly set shifting (SS), response inhibition (RI), and working memory updating (WMU) (3, 5). Set shifting refers to the ability to flexibly shift attention between tasks or stimuli, enabling individuals to adapt regulation strategies across varying emotional contexts (3). Response inhibition involves suppressing inappropriate emotional reactions and maladaptive regulatory responses (5, 21). Working memory updating supports the maintenance of regulatory goals and allows individuals to monitor ongoing emotional processes to ensure alignment with these goals (5, 21).

Given the shared cognitive resources underlying emotion regulation and executive functions, it is reasonable to assume a bidirectional relationship between these constructs. Individuals with stronger executive functioning are generally more effective in regulating their emotions, and vice versa. Empirical evidence supports this assumption, indicating that higher executive function capacity is associated with better emotion regulation across different age groups (23). Additionally, the repertoire and complexity of emotion regulation strategies tend to increase with the development of executive functions (8). Executive functions have also been found to correlate positively with adaptive emotion regulation and negatively with maladaptive strategies (24). However, because these processes rely on shared cognitive resources, engagement in one process may reduce the resources available for the other, potentially impairing performance in both domains (25, 26). For example, Cohen et al. (2016) demonstrated that prolonged exposure to risk-related conditions reduces executive functioning, whereas induced arousal can enhance cognitive control (6). One possible explanation is that regulating negative emotions requires greater cognitive effort compared to regulating positive emotions, which may not require regulation at all (6, 27, 28). Furthermore, emotional states have been shown to influence the availability of cognitive resources for other forms of information processing (29). Given that both emotion regulation and executive functions play key roles in social cognition and decision-making, their interaction has significant implications for overall functioning and well-being (30).

Moreover, maladaptive emotion regulation has been consistently implicated in the development and maintenance of various forms of psychopathology, including depression and anxiety (14, 31).

Major depressive disorder (MDD) is a prevalent and complex psychological condition characterized by persistent negative affect and diminished positive affect, as well as impairments in both emotion regulation and executive functioning. While it remains unclear whether deficits in these domains are causes or consequences of depression, theoretical accounts suggest that vulnerable individuals differ from non-vulnerable individuals not in their initial emotional responses to negative events, but in their ability to recover from these experiences (32). From this perspective, factors that facilitate or hinder emotional recovery are of particular importance. Individual differences in the use of emotion regulation strategies may therefore play a critical role in the onset and maintenance of depression. Numerous studies have demonstrated that individuals with MDD exhibit deficits in emotion regulation, including frequent use of maladaptive strategies such as rumination, thought suppression, expressive suppression, and catastrophizing, alongside reduced use of adaptive strategies such as cognitive reappraisal and self-disclosure (33–36). Importantly, these deficits appear to persist even after remission (37). Furthermore, individuals with MDD show impairments in reappraisal and inhibitory control over negative material, which are associated with increased rumination and suppression (38). Consistent findings indicate significant differences between depressed individuals and healthy controls in both adaptive and maladaptive emotion regulation strategies (20, 38–42). Neuroimaging studies suggest that successful emotion regulation depends on the functioning of prefrontal regions—including the dorsolateral and ventrolateral prefrontal cortex and anterior cingulate cortex—which modulate emotional responses in subcortical structures such as the amygdala, ventral striatum, and insula (43). In addition, individuals with MDD exhibit deficits in multiple domains of executive functioning, including response inhibition, working memory, attentional control, and cognitive flexibility (3, 5, 16, 17, 21, 44–49).

From a clinical perspective, Mentalization-Based Treatment (MBT) has emerged as a promising intervention for addressing deficits in emotion regulation and executive functioning in individuals with depression. Mentalization refers to the capacity to understand one's own and others' mental states—including thoughts, feelings, and intentions—that underlie behavior (50).

Empirical studies have demonstrated that enhancing mentalization abilities may lead to improvements in emotional functioning and reductions in depressive symptoms. For instance, Moran-Kneer et al. (2024) found that a 12-session MBT-A intervention significantly improved emotion regulation and reduced depressive symptoms in adolescents (51). Similarly, Halstensen et al. (2024) reported moderate improvements in depressive symptoms following the enhancement of mentalization skills (52). Deficits in mentalization have been consistently observed in individuals with MDD (53), although findings are mixed when comparing first-episode and recurrent depression (54, 55). Neurocognitive research indicates that mentalization processes involve brain regions such as the temporoparietal junction (TPJ), middle temporal gyrus, precuneus, and prefrontal cortex, and that disruption in these areas—particularly the TPJ—impairs the ability to distinguish between self and others' mental states (56–58). Furthermore, Fischer-Kern et al. (2013) reported that individuals with MDD exhibit significantly reduced mentalization capacity, which is associated with illness severity and cognitive impairments (59).

Despite the growing body of research on MBT, limited studies have simultaneously examined its effects on both emotion regulation strategies (adaptive and maladaptive) and executive functions, as well as their interaction with mentalization capacity. Most previous research has focused on isolated components of these processes. We Hypothesised that whether MBT can improves adaptive and maladaptive emotion regulation strategies and executive functions with a bidirectional relationship between these constructs and leads to reductions in depressive symptoms. The present study is expected to contribute novel insights into the mechanisms underlying therapeutic change in depression.

Methods

Study Design

The present study employed an interventional, experimental design using a Pre-test_Post-test_Follow-up (two-month) framework with control and experimental groups.

Participants and Sampling

The sample consisted of 20 participants aged between 20 and 50 years, all diagnosed with major depressive disorder (MDD). Participants were recruited from a psychiatric hospital (AJA Psychiatric Hospital) using a combination of convenience sampling and simple random assignment. Eligibility was determined based on scores above 30 on the Beck Depression Inventory-II (BDI-II), indicating severe depressive symptoms. Participants were randomly assigned into two equal groups: an experimental group (n = 10), which received the intervention, and a control group (n = 10), which remained on a waitlist and did not receive treatment during the main phase of the study. The sample size was calculated using the formula for quantitative studies with an unknown population size. A significance level of 5% ($\alpha = 0.05$) and a confidence level of 95% were assumed, yielding a Z value of 1.96. The margin of error (d) was set at 0.05, and the variance was estimated at 0.0065 based on prior research. Accordingly, the calculated sample size was:

n= $(3.8416 \times 0.0065) \div 0.0025 = 9.98 \approx 10$

Procedure

Following initial recruitment, participants underwent a structured clinical interview for DSM-5 personality disorders (SCID-5-PD) to confirm diagnostic eligibility. Afterward, demographic information was collected. All participants completed baseline assessments (Pre-test), post-intervention assessments (Post-test), and a two-month Follow-up. Measures included the Beck Depression Inventory-II (BDI-II), Difficulties in Emotion Regulation Scale (DERS), Cognitive Emotion Regulation Questionnaire (CERQ), Emotion Regulation Questionnaire (ERQ), Reflective Functioning Questionnaire (RFQ), and a computerized Stroop task to assess executive functions. The intervention was administered individually in the experimental group following baseline assessment. The control group did not receive treatment during the study period but was offered several sessions of the intervention after the completion of the study to ensure ethical compliance.

Measures

Mood and Emotion Regulation Measures

Beck Depression Inventory-II (BDI-II)

The BDI-II questionnaire is a widely used 21-item self-report measure assessing the severity of depressive symptoms. Each item is rated on a 4-point Likert scale ranging from 0 to 3, with total scores ranging from 0 to 66. Higher scores indicate greater severity of depression.

Difficulties in Emotion Regulation Scale (DERS)

The DERS assesses emotion regulation difficulties across six domains: non-acceptance of negative emotions, difficulties engaging in goal-directed behaviors, difficulties controlling impulsive behaviors, limited access to effective emotion regulation strategies, lack of emotional awareness, lack of emotional clarity, and total DERS Scale. Items are rated on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always), with higher scores indicating greater DERS (60).

Cognitive Emotion Regulation Questionnaire (CERQ):

The CERQ evaluates cognitive coping strategies following negative or stressful events. It consists of multiple subscales, including acceptance, rumination, positive refocusing, positive reappraisal, catastrophizing, self-blame, and blaming others. Items are rated on a 5-point Likert scale, with higher scores indicating greater use of the respective strategy (61).

Emotion Regulation Questionnaire (ERQ):

The ERQ measures two key emotion regulation strategies: cognitive reappraisal (6 items) and expressive suppression (4 items). Responses are provided on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7) (62).

Mentalization Measure

Reflective Functioning Questionnaire (RFQ)

The RFQ assesses mentalization capacity, defined as the ability to understand one's own and others' mental states, including thoughts, feelings, and intentions. This capacity is essential for effective social functioning and emotional regulation (63).

Executive Function Measure

Computerized Stroop Task

Executive functions, including selective attention, cognitive flexibility, and response inhibition, were assessed using a computerized Stroop task (64). Stimuli were presented for 2 seconds, with an interstimulus interval of 800 milliseconds. Interference scores were calculated based on differences in accuracy and response times between congruent and incongruent trials.

Intervention

Mentalization-Based Treatment (MBT)

The intervention consisted of a standardized 12-session MBT program developed by the Anna Freud Centre. Sessions were conducted twice weekly in an individual format by a trained and experienced therapist who was not involved in data collection to minimize bias. The intervention covered topics such as understanding mentalization, emotional awareness, attachment, personality disorders, and the application of mentalization in emotional regulation.

Inclusion and Exclusion Criteria

Inclusion criteria were: (a) a BDI-II score above 30, and (b) absence of neurological abnormalities. Participants were selected to ensure comparable age ranges across groups to minimize confounding effects. Exclusion criteria included a history of neurological disorders or other severe medical conditions.

Ethical Considerations

To ensure ethical standards, the control group (waitlist group) received the intervention after the completion of the study. Additionally, the intervention was delivered by an independent therapist to avoid potential researcher bias. All methods were conducted in accordance with the relevant guidelines and regulations outlined in the study protocol approved by the Research Ethics Committee of Faculty of Psychology and Education of University of Tehran (Ethics code: IR.UT.PSYEDU.REC.1404.104).

Statistical Analysis

Results are presented as the mean ± standard error of the mean (Mean±SEM). Data were analyzed using repeated measures ANOVA (RANOVA) in SPSS 27. RANOVA were conducted separately for each group to determine the within-group comparison and whether each separate group presented a significant change from the Pre-test to the Post-test and from the Post-test to the follow-up. P values less than 0.05 were considered statistically significant.

Results

Table 1 presents baseline demographic characteristics of participants across two intervention groups. The participants in control and mentalization groups had a mean age of 31.20 and 34.30 years (SD = 2.43 and 2.97), respectively. Data are presented as mean ± SD. Education indicates the number of years of formal education completed. p-values were obtained from one-way ANOVA to compare differences across groups. No significant differences were observed between groups for age or education, indicating successful randomization.

Table 1 Baseline demographic characteristics of participants.

variables	Control (n=10)	Mentalization (n=10)	p-value
Education (years)	16.20±1.05	14.00±0.84	0.12
Age (years)	31.20±2.43	34.30±2.97	0.43

The effects of MBT on BDI, RFQ, and ERQ

To determine whether the observed changes from the Pre-test to the Post-test and from the Post-test to the follow-up were statistically significant and whether they differed significantly between groups, RANOVA was conducted separately for BDI-II, RFQ, and ERQ scores.

There was a significant main effect of Group ($p = 0.001$, $\eta^2p = 0.954$) for BDI-II scores, indicating that the groups differed in their overall scores (averaged across time). There was also a significant main effect of Time ($p = 0.001$, $\eta^2p = 0.629$), indicating that scores changed significantly from the Pre-test to the Post-test and from the Post-test to the follow-up across all groups combined. Most importantly, there was a significant Time × Group interaction ($p = 0.001$, $\eta^2p = 0.531$). This

large interaction effect ($\eta^2p = 0.531$) indicates that the magnitude of change significantly differed from the Pre-test to the Post-test and from the Post-test to the follow-up differed significantly between the two groups (Figure 1). In other words, the interventions had differential effects on depressive symptom reduction. Regarding RFQ scores, although the main effect of group was significant ($p = 0.001$, $\eta^2p = 0.641$), the main effect of time ($p = 0.096$, $\eta^2p = 0.122$) and the interaction effect of time × group ($p = 0.154$, $\eta^2p = 0.099$) were not significant (Figure 1). Thus, MBT led to a significant decrease in BDI scores but failed to moderate RFQ scores compared to the pretest group (Figure 1). However, RFQ scores at the follow-up phase showed some moderation compared to the posttest phase.

For the ERQ subscales, the results showed different patterns for Cognitive Reappraisal and Expressive Suppression. For Cognitive Reappraisal, the main effect of Group was not significant ($p = 0.729$, $\eta^2p = 0.007$), indicating that the groups did not differ in their overall scores across time. Likewise, the main effect of Time was not significant ($p = 0.594$, $\eta^2p = 0.029$), suggesting that Cognitive Reappraisal scores did not significantly change from the Pre-test to the Post-test and from the Post-test to the follow-up across all participants. In addition, the Time × Group interaction was not significant ($p = 0.396$, $\eta^2p = 0.050$), indicating that the pattern of change over time did not differ significantly between the two groups. Therefore, the intervention did not produce significant changes in Cognitive Reappraisal abilities (Figure 1).

By contrast, the results for Expressive Suppression demonstrated several significant effects. A significant main effect of Group was observed ($p = 0.001$, $\eta^2p = 0.733$), reflecting notable differences between the groups in overall Expressive Suppression scores. In addition, the significant main effect of Time ($p = 0.002$, $\eta^2p = 0.300$) indicated that participants' scores changed meaningfully across the three assessment phases. Although the Time × Group interaction reached statistical significance ($p = 0.035$, $\eta^2p = 0.171$), the effect size was relatively modest, suggesting that the pattern of improvement over time was not markedly different between the two groups (Figure 1). Collectively, these findings imply that the intervention was associated with changes in Expressive Suppression, while the temporal trend of these changes remained relatively comparable across groups.

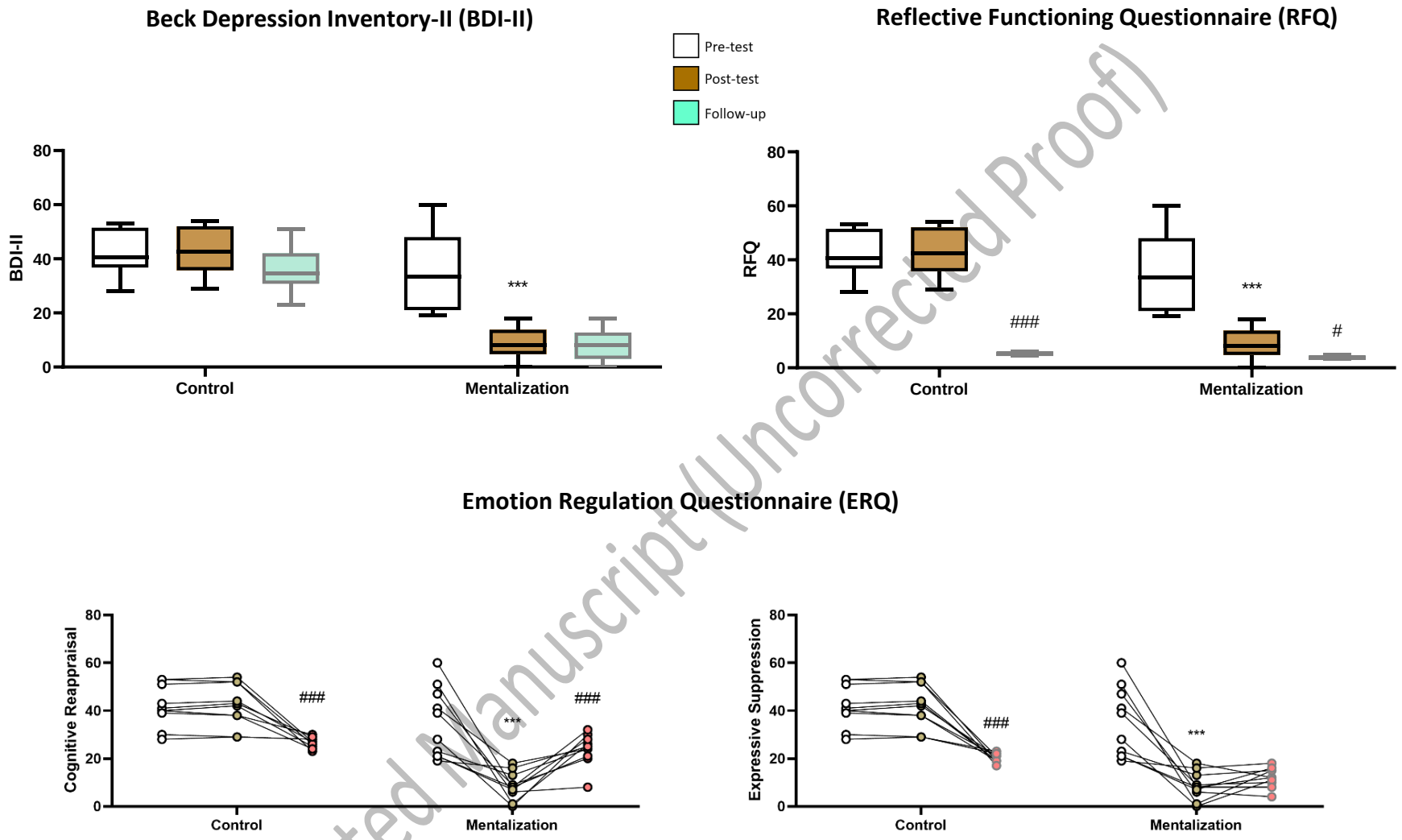

Figure 1. Changes in Beck Depression Inventory-II (BDI-II), Reflective Functioning Questionnaire (RFQ), and Emotion Regulation Questionnaire (ERQ). Bars represent Mean ± SD for each group. ***p<0.001 is in comparison with Pre-test. ###p<0.001 is comparison with post-test.

The effects of MBT on the Stroop test

For the Stroop test variables, the analyses revealed mixed patterns of significant and non-significant findings across the congruent, incongruent, and interference conditions (Figure 2).

Regarding TaskTimeCongruent, no significant main effect of Group was observed ($p = 0.163$, $\eta^2p = 0.105$), suggesting comparable overall performance between groups. However, the main effect of Time was significant ($p = 0.002$, $\eta^2p = 0.300$), indicating that task completion time changed across the assessment phases. The Time × Group interaction was not significant ($p = 0.904$, $\eta^2p = 0.006$), demonstrating that both groups followed a similar temporal pattern of change. For ErrorNumberCongruent, both the main effect of Group ($p = 0.015$, $\eta^2p = 0.286$) and the main effect of Time ($p = 0.001$, $\eta^2p = 0.345$) were significant, reflecting overall group differences as well as changes over time. In addition, a significant Time × Group interaction was identified ($p = 0.001$, $\eta^2p = 0.346$), suggesting that the reduction in errors differed between the groups across the evaluation periods. The findings for NoResponseCongruent demonstrated a non-significant Group effect ($p = 0.064$, $\eta^2p = 0.178$), while the main effect of Time reached significance ($p = 0.032$, $\eta^2p = 0.175$), indicating temporal changes in the number of omitted responses. Nevertheless, the interaction effect was not significant ($p = 0.206$, $\eta^2p = 0.084$), implying that both groups changed similarly over time. For TrueNumberCongruent, the main effect of Group was not statistically significant ($p = 0.431$, $\eta^2p = 0.035$). In contrast, the main effect of Time was significant ($p = 0.001$, $\eta^2p = 0.359$), and the significant Time × Group interaction ($p = 0.002$, $\eta^2p = 0.301$) indicated that the pattern of improvement in correct responses varied between the groups across the different assessment points. Similarly, ResponseTimeCongruent showed a non-significant Group effect ($p = 0.094$, $\eta^2p = 0.148$), whereas the effect of Time was highly significant ($p = 0.001$, $\eta^2p = 0.662$), reflecting substantial changes in response speed over time. Moreover, the significant interaction effect ($p = 0.004$, $\eta^2p = 0.265$) suggested differential rates of improvement between the two groups. For TaskTimeIncongruent, the main effect of Group was negligible ($p = 0.922$, $\eta^2p = 0.001$). Nonetheless, a significant Time effect ($p = 0.049$, $\eta^2p = 0.154$) demonstrated changes across measurement stages, while the significant Time × Group interaction ($p = 0.002$, $\eta^2p = 0.296$) revealed distinct temporal trends between the groups. The ErrorNumberIncongruent variable yielded robust findings, with significant effects for Group ($p = 0.001$, $\eta^2p = 0.599$), Time ($p = 0.001$, $\eta^2p = 0.529$), and the Time × Group interaction ($p = 0.001$, $\eta^2p = 0.623$). These results indicate marked differences between groups, considerable changes across time, and

substantially different trajectories of error reduction between the intervention conditions. In the case of NoResponseIncongruent, none of the effects reached statistical significance. The main effect of Group ($p = 0.194$, $\eta^2p = 0.092$), the main effect of Time ($p = 0.469$, $\eta^2p = 0.041$), and the interaction effect ($p = 0.083$, $\eta^2p = 0.129$) all suggested relatively stable omission rates across time and between groups. For TrueNumberIncongruent, highly significant effects were observed for Group ($p = 0.001$, $\eta^2p = 0.991$), Time ($p = 0.001$, $\eta^2p = 0.413$), and the Time × Group interaction ($p = 0.001$, $\eta^2p = 0.549$). These findings demonstrate strong overall group differences and substantial improvements over time, with the intervention groups exhibiting distinct patterns of change in correct responses.

ResponseTimeIncongruent did not show statistically significant effects for Group ($p = 0.173$, $\eta^2p = 0.101$), Time ($p = 0.405$, $\eta^2p = 0.413$), or the interaction term ($p = 0.287$, $\eta^2p = 0.067$), indicating that response latency in the incongruent condition remained relatively unchanged across groups and assessment periods. For InterferenceNumber, significant main effects of Group ($p = 0.019$, $\eta^2p = 0.270$) and Time ($p = 0.005$, $\eta^2p = 0.255$) were identified, alongside a significant Time × Group interaction ($p = 0.001$, $\eta^2p = 0.323$). This pattern suggests that interference-related errors decreased over time, with the magnitude of change differing between groups. Finally, InterferenceTime demonstrated significant effects for Group ($p = 0.001$, $\eta^2p = 0.483$), Time ($p = 0.003$, $\eta^2p = 0.278$), and the interaction between Time and Group ($p = 0.001$, $\eta^2p = 0.479$). These results indicate that interference processing speed changed significantly across time and that the intervention conditions produced different trajectories of improvement (Figure 2).

Overall, the Stroop test findings suggest that the interventions had a more pronounced influence on variables related to interference control, response accuracy, and incongruent processing than on omission-related measures. Significant interaction effects observed in several key indicators, particularly ErrorNumberIncongruent, TrueNumberIncongruent, InterferenceNumber, and InterferenceTime, imply that the groups differed meaningfully in their cognitive performance trajectories over time. Collectively, these findings support the notion that the interventions contributed to improvements in executive functioning and attentional control, especially under cognitively demanding conditions (Figure 2).

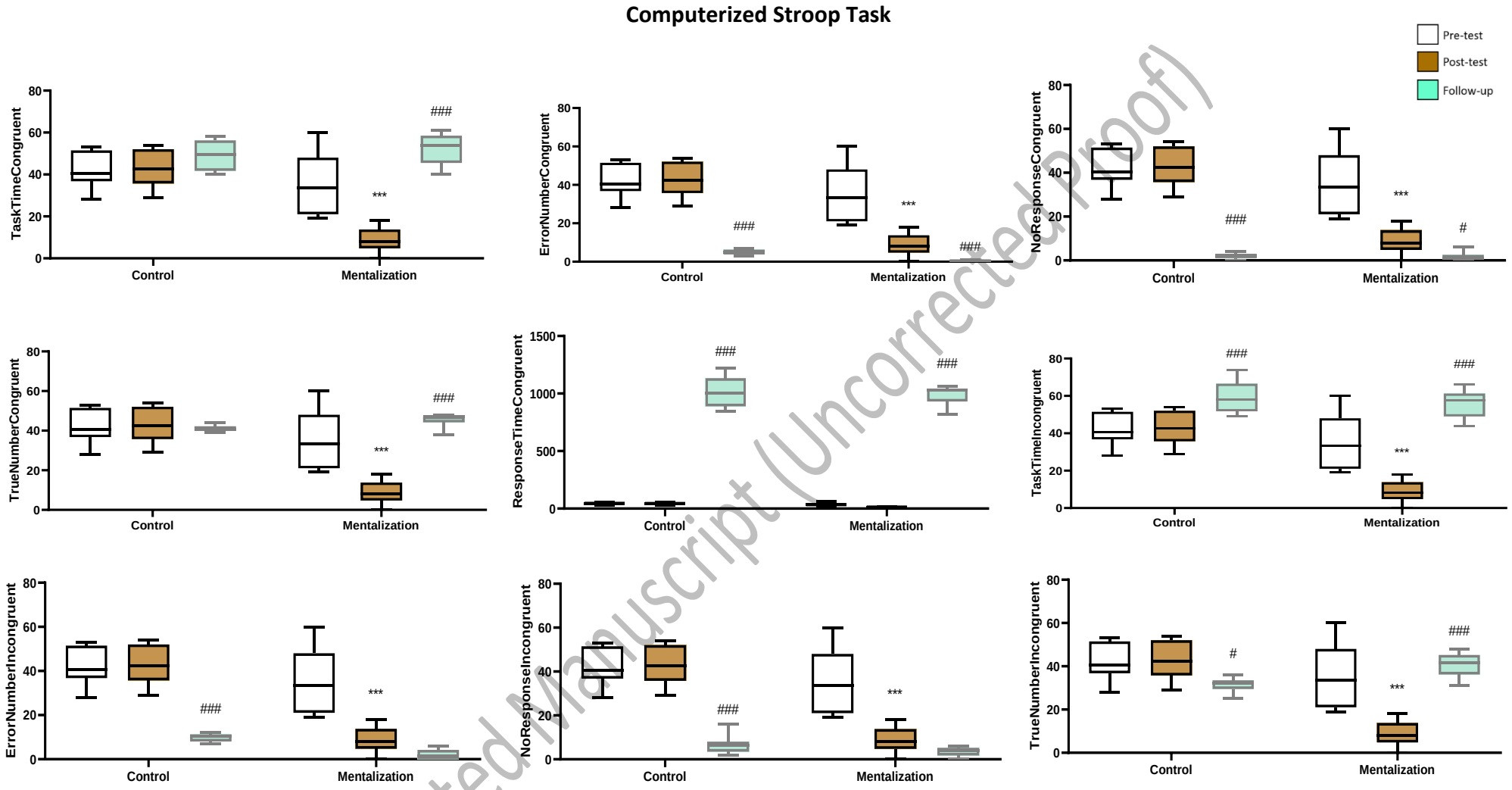

Figure 2. Changes in Computerized Stroop Task Scores. Bars represent Mean ± SD for each group. ***p<0.001 is in comparison with Pre-test. #p<0.05 and ###p<0.001 is comparison with post-test.

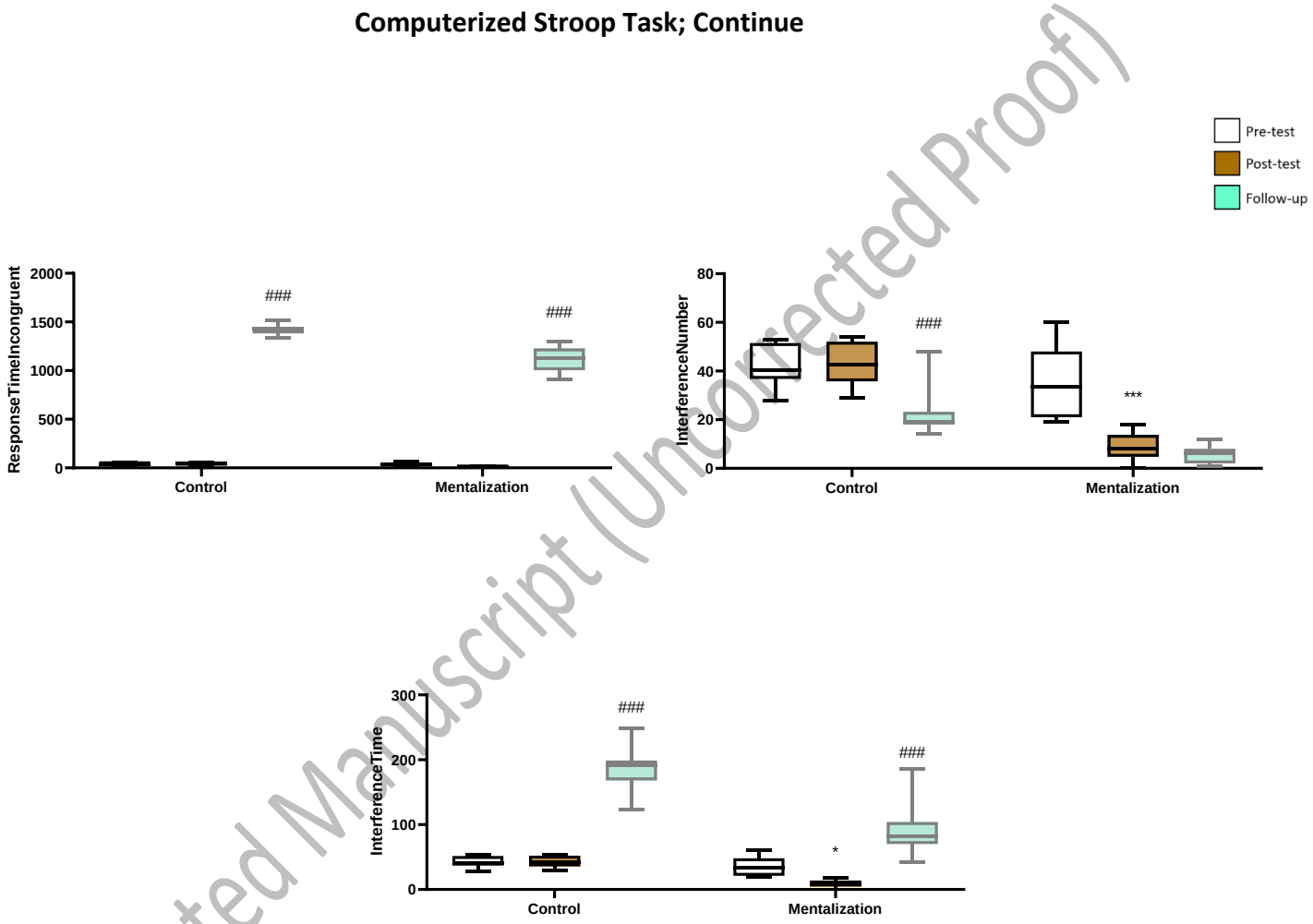

Figure 2. Changes in Computerized Stroop Task Scores (Continue). Bars represent Mean ± SD for each group. ⁎ p<0.05 and p<0.001 is in

The effects of MBT on the Difficulties in Emotion Regulation Scale (DERS) parameters

The analyses of the DERS revealed broadly significant effects across most dimensions of emotion dysregulation, indicating meaningful changes over time and notable differences between the intervention groups (Figure 3).

For Non-Acceptance of Negative Emotions, significant main effects of Group ($p = 0.001$, $\eta^2p = 0.566$) and Time ($p = 0.012$, $\eta^2p = 0.216$) were identified, suggesting both overall group differences and significant changes across the assessment periods. Moreover, the significant Time × Group interaction ($p = 0.001$, $\eta^2p = 0.448$) demonstrated that the extent of improvement differed substantially between the two groups over time. Regarding Difficulties Engaging in Goal-Directed Behaviors, the main effect of Group did not reach statistical significance ($p = 0.050$, $\eta^2p = 0.197$), indicating relatively comparable overall scores between groups. However, the significant main effect of Time ($p = 0.001$, $\eta^2p = 0.370$) reflected noticeable changes throughout the study period. In addition, the significant interaction effect ($p = 0.001$, $\eta^2p = 0.389$) suggested that the trajectory of change was not uniform across groups, with one intervention showing greater improvement in goal-directed functioning. For Difficulties Controlling Impulsive Behaviors, the analyses demonstrated significant effects for Group ($p = 0.001$, $\eta^2p = 0.542$), Time ($p = 0.006$, $\eta^2p = 0.248$), and the Time × Group interaction ($p = 0.001$, $\eta^2p = 0.411$). These findings indicate that impulsivity-related difficulties decreased over time and that the rate of reduction varied significantly between the intervention conditions. The subscale assessing Limited Access to Effective Emotion Regulation Strategies showed a non-significant Group effect ($p = 0.898$, $\eta^2p = 0.001$), suggesting no meaningful overall difference between groups. Nevertheless, both the main effect of Time ($p = 0.028$, $\eta^2p = 0.181$) and the interaction effect ($p = 0.002$, $\eta^2p = 0.293$) were significant, indicating that participants improved across time and that the pattern of these improvements differed between groups. For Lack of Emotional Awareness, highly significant effects were found for Group ($p = 0.001$, $\eta^2p = 0.538$), Time ($p = 0.003$, $\eta^2p = 0.273$), and the interaction between Group and Time ($p = 0.001$, $\eta^2p = 0.382$). This pattern suggests substantial reductions in emotional awareness difficulties, accompanied by distinct improvement trajectories across the intervention groups. Similarly, Lack of Emotional Clarity demonstrated significant main effects of Group ($p = 0.002$, $\eta^2p = 0.426$) and Time ($p = 0.014$, $\eta^2p = 0.212$). The significant Time × Group interaction ($p = 0.007$, $\eta^2p = 0.238$) further indicated that the groups differed in the extent to which emotional clarity improved during the course of the intervention (Figure 3).

Finally, the Total DERS Scale showed robust and consistent effects across all statistical indicators. Significant main effects of Group ($p = 0.001$, $\eta^2p = 0.591$) and Time ($p = 0.001$, $\eta^2p = 0.337$) revealed overall group differences and meaningful reductions in emotion regulation difficulties across the assessment stages. Additionally, the significant interaction effect ($p = 0.001$, $\eta^2p = 0.472$) indicated that the magnitude of overall improvement varied considerably between the two groups. Overall, the DERS findings indicate that the interventions were associated with substantial improvements in multiple aspects of emotion regulation. The consistent presence of significant Time × Group interactions across nearly all subscales suggests that the interventions differed in their effectiveness over time, particularly in reducing impulsivity, emotional non-acceptance, and overall emotion regulation difficulties. Collectively, these results support the effectiveness of the interventions in enhancing adaptive emotional functioning and reducing emotion dysregulation (Figure 3).

The effects of MBT on the Cognitive Emotion Regulation Questionnaire (CERQ) parameters

The analyses of the CERQ demonstrated diverse patterns across cognitive emotion regulation strategies, with several subscales showing meaningful interaction effects between Group and Time (Figure 4). For Rumination, a significant main effect of Group was observed ($p = 0.008$, $\eta^2p = 0.332$), indicating overall differences between the groups in rumination levels. However, the main effect of Time was not significant ($p = 0.086$, $\eta^2p = 0.127$), suggesting that rumination scores did not change uniformly across all participants over the assessment periods. Despite this, the significant Time × Group interaction ($p = 0.002$, $\eta^2p = 0.290$) revealed that the direction and magnitude of change differed significantly between the two groups. Similarly, the Acceptance subscale demonstrated a significant main effect of Group ($p = 0.001$, $\eta^2p = 0.440$), reflecting distinct overall acceptance levels between groups. The effect of Time was not statistically significant ($p = 0.216$, $\eta^2p = 0.082$), indicating relatively stable scores across time. Nevertheless, the significant interaction effect ($p = 0.001$, $\eta^2p = 0.370$) suggested that changes in acceptance followed different trajectories in the intervention groups. For Positive Reappraisal, the main effect of Group did not reach significance ($p = 0.056$, $\eta^2p = 0.188$), implying comparable overall scores between groups. In contrast, the main effect of Time was significant ($p = 0.001$, $\eta^2p = 0.315$), demonstrating meaningful improvements across the study period. Additionally, the highly significant Time × Group interaction ($p = 0.001$, $\eta^2p = 0.509$) indicated that the pattern of improvement in positive reappraisal differed substantially between the groups. The findings for Positive Refocusing revealed non-

significant main effects for both Group ($p = 0.451$, $\eta^2p = 0.032$) and Time ($p = 0.124$, $\eta^2p = 0.110$), suggesting no overall differences between groups and no consistent temporal changes across participants. However, the significant interaction effect ($p = 0.001$, $\eta^2p = 0.426$) demonstrated that the interventions produced distinct changes in positive refocusing over time. For Catastrophizing, significant main effects of Group ($p = 0.001$, $\eta^2p = 0.751$) and Time ($p = 0.001$, $\eta^2p = 0.325$) were observed, indicating both marked group differences and significant reductions across assessment stages. However, the Time × Group interaction did not reach significance ($p = 0.051$, $\eta^2p = 0.152$), suggesting that both groups exhibited relatively similar patterns of change over time. The Self-Blame subscale yielded significant effects for Group ($p = 0.001$, $\eta^2p = 0.631$), Time ($p = 0.002$, $\eta^2p = 0.299$), and the Time × Group interaction ($p = 0.002$, $\eta^2p = 0.303$). These findings indicate overall differences between groups, meaningful changes across time, and differential improvement trajectories following the interventions.

Finally, for Blaming Others, neither the main effect of Group ($p = 0.056$, $\eta^2p = 0.188$) nor the main effect of Time ($p = 0.107$, $\eta^2p = 0.117$) was statistically significant. Nonetheless, the significant Time × Group interaction ($p = 0.001$, $\eta^2p = 0.350$) indicated that the interventions influenced the pattern of change differently across groups despite the absence of overall group or time effects (Figure 4). Overall, the CERQ findings suggest that the interventions had meaningful effects on several cognitive emotion regulation strategies, particularly through differential changes over time between groups. Significant interaction effects were especially evident for Positive Reappraisal, Positive Refocusing, Acceptance, and Self-Blame, highlighting the role of the interventions in modifying adaptive and maladaptive cognitive coping styles. Collectively, these results indicate that the interventions contributed to improvements in cognitive emotion regulation processes, although the extent and pattern of change varied across specific strategies (Figure 4).

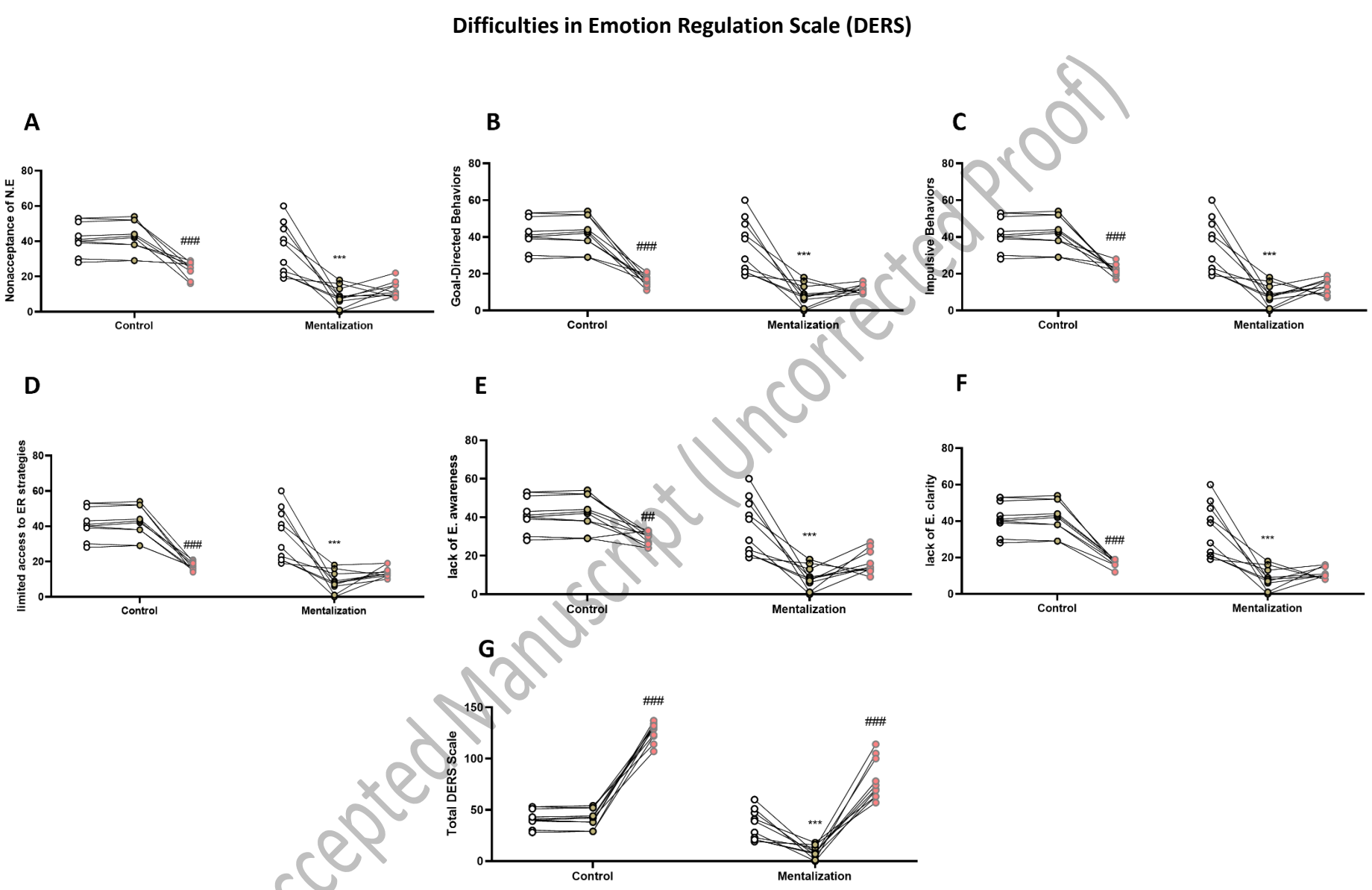

Figure 3. Changes in Difficulties in Emotion Regulation Scale (DERS). Bars represent Mean ± SD for each group. ***p<0.001 is in comparison with Pre-test. ###p<0.001 is comparison with post-test.

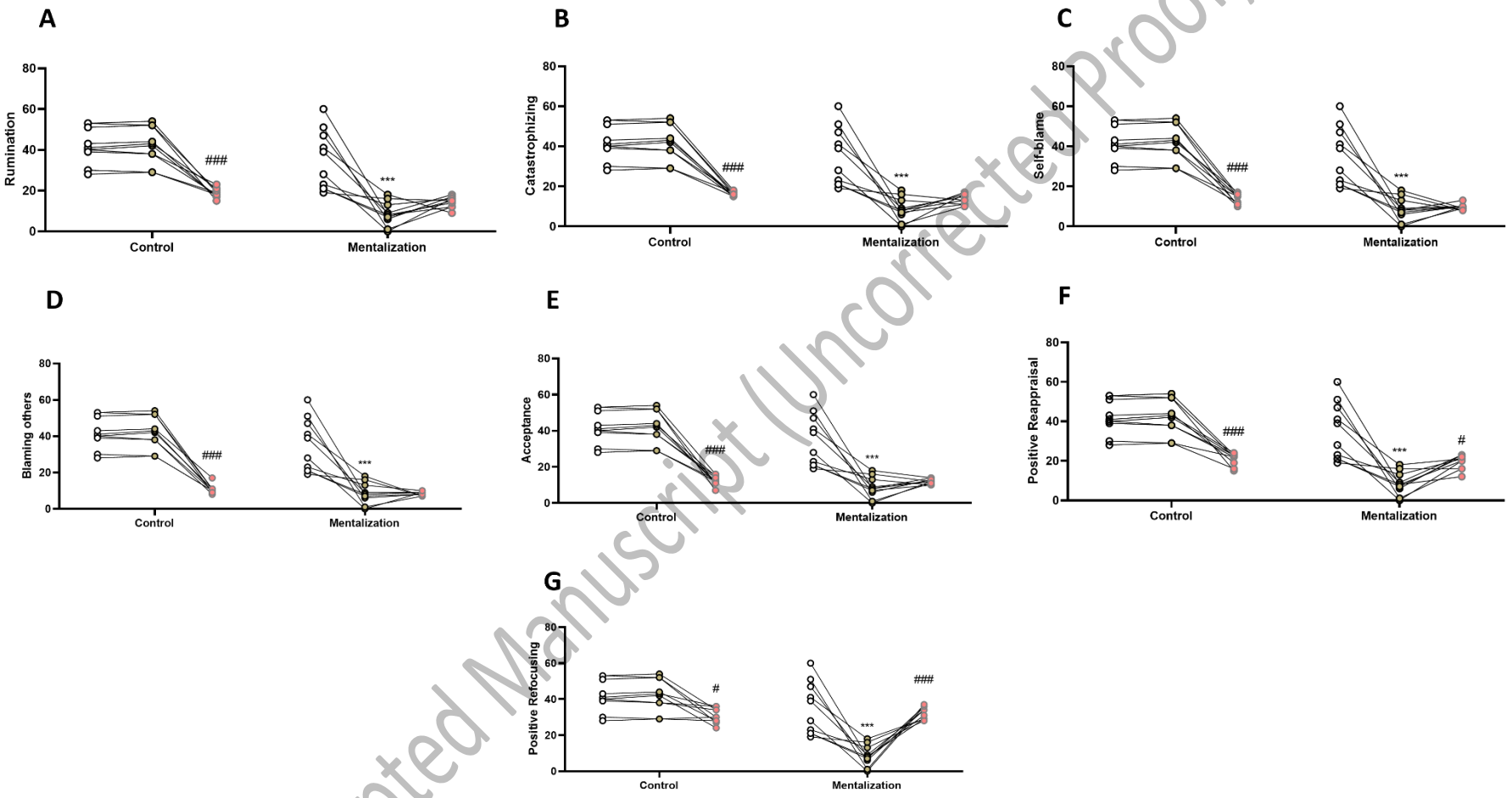

Figure 4. Cognitive Emotion Regulation Questionnaire (CERQ). Bars represent Mean ± SD for each group. ⁎⁎p<0.01 and ⁎⁎⁎p<0.001 is in comparison with Control.

Discussion

The present study investigated the effects of Mentalization-Based Therapy (MBT) on executive functioning, emotion regulation, and depressive symptoms in individuals with MDD. Overall, the findings demonstrated that MBT produced significant improvements in depressive symptom severity, several dimensions of emotion dysregulation, and multiple indices of executive functioning, particularly under cognitively demanding conditions. These findings support the hypothesis that enhancing mentalization capacity may contribute to both emotional and cognitive improvements in depression and further highlight the close bidirectional relationship between executive functions and emotion regulation processes. One of the most important findings of the present study was the significant reduction in depressive symptoms following MBT intervention. Participants in the experimental group demonstrated substantial decreases in BDI-II scores from pre-test to post-test, and these improvements were maintained at follow-up. These findings are consistent with previous research demonstrating the effectiveness of MBT in reducing depressive symptoms and improving emotional functioning (51,52,65). Mentalization refers to the capacity to understand one's own and others' mental states, and impairments in this ability have repeatedly been associated with depression severity and interpersonal dysfunction (53,59,67). By strengthening reflective functioning and increasing awareness of emotional and interpersonal experiences, MBT may help patients reinterpret negative emotional states more adaptively, thereby reducing depressive symptoms.

The findings regarding emotion regulation further support the therapeutic role of MBT in depression. Significant improvements were observed across several dimensions of the DERS, including non-acceptance of emotions, impulsivity, goal-directed behavior difficulties, emotional awareness, emotional clarity, and overall emotion dysregulation. These results are highly consistent with previous studies indicating that individuals with depression commonly experience pervasive emotion regulation deficits characterized by emotional avoidance, rumination, suppression, and impaired emotional awareness (16,17,33,38). MBT may improve these deficits by promoting greater awareness and understanding of internal emotional experiences, thereby facilitating more adaptive emotional responses. The observed reductions in maladaptive cognitive emotion regulation strategies also align with prior theoretical and

empirical findings. Specifically, the intervention significantly influenced rumination, self-blame, catastrophizing, and blaming others. Rumination has long been identified as a central maintaining factor in depression and is associated with impaired inhibitory control and persistent negative affect (17,44,45). Similarly, self-blame and catastrophizing are strongly associated with depressive cognitions and emotional distress (14,34,42). The reductions observed in these maladaptive strategies MBT may enable individuals to disengage from rigid negative thinking patterns and adopt more flexible interpretations of emotional experiences. Importantly, MBT also enhanced several adaptive cognitive emotion regulation strategies, including positive reappraisal, positive refocusing, and acceptance. Positive reappraisal is considered one of the most effective adaptive emotion regulation strategies because it allows individuals to reinterpret stressful situations in less threatening ways (11,13). Previous research has shown that depressed individuals often exhibit deficits in cognitive reappraisal and rely more heavily on maladaptive strategies such as suppression and rumination (36,38). The improvements observed in the present study may therefore reflect increased cognitive flexibility and improved capacity to reinterpret emotional experiences after mentalization training. These findings are also consistent with the process model of emotion regulation proposed by Gross (11), which emphasizes the importance of early-stage regulatory strategies such as reappraisal in adaptive emotional functioning.

The results related to expressive suppression are also noteworthy. Although cognitive reappraisal measured by the ERQ did not show significant changes, expressive suppression decreased significantly following intervention. Therefore, our findings showed that MBT effectively improves emotional and executive functioning, but does not have a significant effect on reflective functioning and cognitive reappraisal in individuals with MDD. This discrepancy may indicate that MBT primarily targets maladaptive defensive emotional processes rather than directly enhancing deliberate cognitive reappraisal abilities. Suppression is generally considered a maladaptive strategy associated with increased physiological arousal, poorer interpersonal functioning, and greater depressive symptoms (18,36). By improving emotional awareness, MBT may reduce the need for defensive suppression and facilitate healthier emotional expression. The present findings also provide important evidence regarding the relationship between MBT and executive

functioning. Significant improvements were observed in several Stroop task indices, particularly those related to interference control, response accuracy, and incongruent processing. These findings suggest enhanced attentional control, cognitive flexibility, and inhibitory functioning following intervention. Executive dysfunction is one of the core cognitive impairments observed in depression and has been linked to difficulties in inhibitory control, attentional shifting, and working memory processes (3,5,44–47). The present results therefore suggest that MBT may indirectly improve executive functioning by reducing emotional interference and increasing cognitive control over emotionally salient stimuli. The improvements observed in interference-related Stroop variables are particularly important because inhibitory control deficits have consistently been implicated in depression-related rumination and maladaptive emotional processing (38,44). Joormann and Gotlib (38) proposed that depressed individuals exhibit impaired inhibition of negative emotional material, which contributes to persistent rumination and emotional dysregulation. By enhancing mentalization capacity and emotional awareness, MBT may reduce the cognitive load associated with unresolved emotional processing, thereby freeing executive resources necessary for attentional control and inhibitory functioning.

These findings support theoretical models proposing a bidirectional relationship between emotion regulation and executive functions (2,3,5). Executive functions provide the cognitive resources necessary for adaptive emotion regulation, while chronic emotional dysregulation may deplete cognitive resources and impair executive performance (24–26). The significant parallel improvements in both domains observed in the present study reinforce this reciprocal model. Improved executive functioning may facilitate more adaptive emotional regulation strategies, while reductions in emotional distress and maladaptive regulation may enhance cognitive efficiency and attentional control. From a neurocognitive perspective, the results are also consistent with evidence implicating prefrontal cortical networks in both emotion regulation and mentalization processes. Neuroimaging studies have demonstrated that adaptive emotion regulation depends heavily on prefrontal regions such as the dorsolateral prefrontal cortex, ventrolateral prefrontal cortex, and anterior cingulate cortex, which exert top-down modulation over limbic structures, including the amygdala (43). Similarly, mentalization involves activation of the temporoparietal junction, precuneus, and medial prefrontal regions (56–58). Because

these neural systems overlap substantially, improvements in mentalization capacity may facilitate more efficient integration of cognitive and emotional processing systems, ultimately enhancing both executive functioning and emotional regulation.

Another important finding was the relative stability of improvements during the follow-up period. The maintenance of reduced depressive symptoms and improved emotional functioning suggests that MBT may promote enduring cognitive-emotional changes rather than temporary symptom relief. This finding is clinically important because emotion regulation deficits often persist even after remission from depression and contribute to relapse vulnerability (37). Strengthening emotional awareness through MBT may therefore provide long-term protective effects against depressive recurrence. Despite these promising findings, several limitations should be acknowledged. First, the relatively small sample size limits the generalizability of the results and increases the possibility of Type II statistical errors for some variables. Second, the follow-up period was limited to two months, preventing evaluation of long-term treatment durability. Third, the study relied heavily on self-report measures, which may be influenced by response biases. Future studies should include larger samples, longer follow-up periods, and multimodal neuropsychological and neuroimaging assessments to further clarify the mechanisms underlying MBT-related improvements. Additionally, examining mediating variables such as attachment style, interpersonal functioning, and neural connectivity may provide deeper insight into how mentalization influences executive and emotional processes in depression.

Overall, the present study contributes to the growing literature highlighting the central role of mentalization in emotional and cognitive functioning in MDD. The findings suggest that MBT not only reduces depressive symptoms but also improves executive control and adaptive emotion regulation strategies. These results support integrative models of depression emphasizing the interaction between emotional dysregulation and executive dysfunction, and they underscore the therapeutic potential of MBT as a multidimensional intervention for depression.

Conclusion

The present study demonstrated that Mentalization-Based Therapy significantly reduced depressive symptoms and improved multiple aspects of emotion regulation and executive

functioning in individuals with Major Depressive Disorder. Although our findings showed that MBT effectively improves emotional and executive functioning, it does not have a significant effect on reflective functioning and cognitive reappraisal in individuals with MDD. MBT was associated with reductions in maladaptive emotion regulation strategies such as rumination, self-blame, and emotional suppression, alongside improvements in adaptive processes including positive reappraisal, emotional awareness, and attentional control. Furthermore, the intervention enhanced performance on executive function measures, particularly under cognitively demanding conditions involving inhibitory control and interference processing. These findings support the notion that mentalization plays a central role in integrating emotional and cognitive functioning. They suggest that MBT may be an effective therapeutic approach for addressing both affective and executive deficits in depression, although it may not improve reflective functioning or cognitive reappraisal. Future research with larger samples and longer follow-up periods is warranted to further examine the long-term neurocognitive and clinical effects of MBT in depressive disorders.

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Authors' contributions

AM (Alireza Mohammadi) coordinated the patients, analyzed the data after the assessments, conducted some psychotherapy sessions, and wrote the initial draft of the article. RS (Ramin Sepahvand) was responsible for the main part of the psychotherapy. AN (Azam Noferesti) and RR (Reza Rostami) supervised the project and finalized the article file.

Ethical Considerations

All methods were conducted in accordance with the relevant guidelines and regulations outlined in the study protocol approved by the Research Ethics Committee of Faculty of Psychology and Education of University of Tehran (Ethics code: IR.UT.PSYEDU.REC.1404.104).

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Declaration of Competing Interest

All authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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