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Comparison of the Effectiveness of Pharmacotherapy With and Without Psycho-Educational Intervention on Executive Functions in Hospitalized Bipolar Patients

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A B S T R A C T

Purpose: This study aimed to compare the effectiveness of pharmacotherapy alone versus pharmacotherapy combined with a structured psycho-educational intervention in improving executive functions among hospitalized patients with Bipolar I Disorder.

Methods and Materials: A randomized controlled trial was conducted involving 30 patients diagnosed with Bipolar I Disorder who were hospitalized in psychiatric facilities in Tehran. Participants were randomly assigned to two groups: an experimental group (n = 15) that received both pharmacotherapy and a 15-session psycho-educational intervention, and a control group (n = 15) that received pharmacotherapy alone. Executive functions were measured using three standardized tools: the Wisconsin Card Sorting Test (WCST), Stroop Color and Word Test (SCWT), and Trail Making Test (TMT). Assessments were conducted at pre-test, post-test, and a two-month follow-up. Data were analyzed using repeated-measures ANOVA and Bonferroni post-hoc tests via SPSS version 27.

Findings: Results indicated statistically significant improvements in executive function scores over time in both groups; however, the experimental group showed significantly greater gains across all three measures. Repeated-measures ANOVA revealed significant time × group interaction effects for WCST ($F(2, 56) = 25.23$, $p < .001$, $\eta^2 = .47$), SCWT ($F(2, 56) = 21.72$, $p < .001$, $\eta^2 = .44$), and TMT ($F(2, 56) = 18.91$, $p < .001$, $\eta^2 = .41$). Bonferroni post-hoc tests confirmed that improvements in the experimental group from pre-test to post-test and follow-up were significantly greater than those observed in the control group.

Conclusion: The findings support the superiority of combining psycho-educational interventions with pharmacotherapy in enhancing executive functions in bipolar patients.

Keywords: *Bipolar disorder, executive function, psycho-educational intervention, pharmacotherapy, randomized controlled trial, cognitive rehabilitation.*

1. Introduction

Bipolar disorder is a chronic and often disabling psychiatric condition characterized by episodes of mania, hypomania, and depression, with substantial functional impairments and cognitive disruptions. Among the most debilitating features of this disorder are executive dysfunctions, which persist even during euthymic states and significantly hinder social and occupational functioning (Karbasi et al., 2024). Executive functions, including planning, problem-solving, cognitive flexibility, and inhibitory control, are crucial to adaptive functioning, yet they are commonly compromised in individuals with bipolar disorder across its phases (Dong, 2024; Dorozhenok & Strukova, 2024). This has led researchers and clinicians alike to prioritize interventions that not only target mood stabilization but also aim to restore or enhance cognitive capacities.

Pharmacological treatments, particularly mood stabilizers and atypical antipsychotics, are the cornerstone of bipolar disorder management. Lithium remains one of the most extensively used agents, demonstrating efficacy in mood stabilization and relapse prevention (Airainer & Seifert, 2024). However, despite its longstanding status as the "gold standard" treatment, concerns regarding side effects, adherence, and variable patient response have prompted debates over its continued preeminence (Kessing, 2024). Case studies further suggest that pharmacodynamic factors and individual physiological variability—such as in the case of altered serum lithium levels during plasmapheresis—can complicate treatment outcomes (Lien et al., 2024). Adjunctive medications like atypical antipsychotics (e.g., aripiprazole and brexpiprazole) are increasingly being utilized to address residual symptoms, cognitive deficits, and comorbid conditions (Dorozhenok & Strukova, 2024; Hirose et al., 2023).

Nevertheless, pharmacotherapy alone often fails to fully address the broader cognitive and psychosocial impairments seen in bipolar patients. This realization has led to the integration of psychosocial and educational interventions aimed at improving insight, medication adherence, emotion regulation, and daily functioning (Banifatemeh et al., 2024; Isasi et al., 2014). Psycho-educational programs, in particular, have garnered strong empirical support as effective adjunctive strategies. Such interventions focus on equipping patients with knowledge about their illness, teaching coping and cognitive restructuring techniques, and encouraging behavioral regulation. Evidence shows that psychoeducation not only enhances patients' understanding of the disorder but also improves their capacity for self-management and reduces relapse rates (Bernhard et al., 2006; Rahmani et al., 2016).

A growing body of research emphasizes the importance of integrating cognitive-focused modules within psycho-educational frameworks to better address executive dysfunction in bipolar patients. For instance, programs incorporating elements of mindfulness, cognitive-behavioral techniques, and emotion regulation have been shown to significantly improve attention, working memory, and inhibitory control in both adolescent and adult populations (Karbasdehi & Ghasemzadeh, 2024; Shayegh Borojeni et al., 2019). These interventions often result in better emotional stability and reduced hospitalization, which is particularly vital for populations with recurrent episodes or treatment resistance (Isasi et al., 2014; Kurdal et al., 2013).

Importantly, the sustainability of treatment outcomes is a major concern in bipolar disorder management. Longitudinal studies suggest that structured psychoeducational programs can yield improvements that extend well beyond the immediate treatment phase, provided there is adequate follow-up and reinforcement (Eisner et al., 2017). Moreover, combining pharmacotherapy with psychosocial interventions is increasingly viewed not as an optional enhancement but as a necessary clinical standard for optimizing recovery (Miller et al., 2004). Psychoeducation also has a positive impact on family systems, improving caregivers' understanding of the illness and decreasing stigma, which in turn supports the patient's long-term functional recovery (Rahmani et al., 2016).

In Iran, as in many other countries, bipolar disorder remains a significant public health concern, with challenges including stigma, medication nonadherence, and limited access to structured psychosocial services (Banifatemeh et al., 2024). Studies conducted within the Iranian clinical context have demonstrated that culturally adapted interventions focusing on mindfulness and cognitive restructuring are not only feasible but effective in improving quality of life and executive function in patients with bipolar disorder (Karbasi et al., 2024). These findings align with global research advocating for multi-component treatment plans tailored to the individual's cognitive and emotional profile (Dong, 2024; Lyu, 2023).

Given the importance of executive functions in adaptive functioning and their susceptibility to disruption in bipolar disorder, the present study aims to evaluate the comparative effectiveness of pharmacotherapy alone versus

E-ISSN: 2980-9681

pharmacotherapy combined with a psycho-educational program specifically designed to enhance executive functioning.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a randomized controlled trial (RCT) design to compare the effectiveness of pharmacotherapy alone versus pharmacotherapy combined with a structured psycho-educational intervention on executive functions in hospitalized patients diagnosed with bipolar disorder. The research was conducted in Tehran across several psychiatric wards under the supervision of licensed clinical psychologists. A total of 30 participants who met the DSM-5 criteria for Bipolar I Disorder during a stable mood phase (i.e., not in acute mania or major depressive episode) were selected through purposive sampling and then randomly assigned to one of two groups: an experimental group (n = 15) that received both pharmacotherapy and the psycho-educational intervention, and a control group (n = 15) that received only pharmacotherapy. Participants were matched based on age, gender, duration of illness, and educational level to ensure group homogeneity.

Inclusion criteria included being between the ages of 18 and 50, having a minimum educational level of high school diploma, being clinically stable at the time of admission (as confirmed by a psychiatrist), and providing informed consent. Exclusion criteria included comorbid psychotic disorders, intellectual disabilities, or severe physical illnesses that could interfere with participation. The intervention was administered over fifteen 45-minute sessions across five weeks, with both groups followed up for a duration of two months after the intervention to assess the sustainability of effects.

2.2. Measures

2.2.1. Wisconsin Card Sorting Test (WCST)

The Wisconsin Card Sorting Test (WCST), developed by David A. Grant and Esta A. Berg in 1948, is a widely used neuropsychological assessment tool designed to evaluate executive functions, specifically cognitive flexibility, problem-solving ability, and the capacity for abstract reasoning. The test includes a series of 128 response cards and four stimulus cards, where participants are asked to match the cards according to color, shape, or number, with the sorting rule changing intermittently without warning. The WCST measures several key indices, including the number of categories completed, perseverative errors, and non-perseverative errors. Scoring is based on correct responses, errors, and the number of successfully identified sorting rules. The WCST has demonstrated strong psychometric properties, with numerous studies confirming its reliability and validity in clinical populations, including individuals with bipolar disorder, schizophrenia, and frontal lobe damage.

2.2.2. Stroop Color and Word Test (SCWT)

The Stroop Color and Word Test, originally introduced by John Ridley Stroop in 1935, is a standard tool used to assess selective attention, cognitive inhibition, and processing speed, all of which are core components of executive functioning. The test comprises three parts: the Word Page (reading color names printed in black ink), the Color Page (naming color patches), and the Color-Word Page (naming the ink color of incongruent color names). The SCWT includes 100 items per section and measures the interference score, which reflects the individual's ability to inhibit cognitive interference. The scoring involves the time taken and errors made in each condition. The SCWT has been extensively validated and is known for its high test-retest reliability and construct validity in both healthy individuals and clinical populations, particularly those with affective and attentional disorders.

2.2.3. Trail Making Test (TMT)

The Trail Making Test (TMT), part of the Halstead-Reitan Neuropsychological Battery, was first introduced by Ralph Reitan in the 1950s. It is a reliable measure of visual attention, task switching, and cognitive processing speed—key domains of executive functioning. The TMT consists of two parts: Part A requires connecting numbered circles in sequence, while Part B requires alternating between numbers and letters (e.g., 1-A-2-B). The primary score is the time (in seconds) taken to complete each part, with errors also noted. The TMT is brief, easy to administer, and has been validated in numerous studies, showing good sensitivity to frontal lobe dysfunction and executive impairment. It is particularly effective in detecting cognitive deficits in psychiatric populations, including those with bipolar disorder.

E-ISSN: 2980-9681

2.3. Interventions

All participants in both the control and experimental groups received standardized pharmacotherapy as prescribed by their attending psychiatrists, based on current clinical guidelines for the management of Bipolar I Disorder. The primary medications included mood stabilizers such as lithium carbonate (900–1200 mg/day) or sodium valproate (1000–1500 mg/day), adjusted according to serum levels and patient tolerance. In some cases, atypical antipsychotics such as olanzapine (5–10 mg/day) or quetiapine (200–400 mg/day) were co-administered based on symptom severity and individual treatment needs. Dosages were titrated gradually and monitored weekly through clinical evaluations to assess therapeutic response and manage side effects. No changes were made to the medication regimen during the intervention period unless medically necessary. All pharmacological treatments were administered under close supervision within the hospital setting to ensure adherence and safety.

The intervention is a structured psycho-educational program designed to complement pharmacotherapy in the treatment of bipolar disorder. The program aims to enhance executive functioning through cognitive-behavioral strategies, emotional regulation training, and illness management education. It is delivered over fifteen 45-minute sessions, held individually or in small groups, conducted by a trained clinical psychologist. The protocol is based on principles from evidence-based psychoeducation models for mood disorders, incorporating cognitive rehabilitation elements that target executive dysfunction commonly observed in bipolar patients. The structure gradually progresses from awareness-building to skill application, ensuring continuity and integration with pharmacological treatment.

Session 1: Introduction and Rapport Building

This session focuses on establishing a therapeutic alliance, introducing the structure and objectives of the program, and discussing the importance of psychoeducation in managing bipolar disorder. Patients are encouraged to share their understanding of the disorder and expectations from the sessions.

Session 2: Understanding Bipolar Disorder

Participants receive psychoeducation about the nature, types, and phases of bipolar disorder. Emphasis is placed on recognizing mood episodes (mania, hypomania, depression), the course of the illness, and factors influencing relapse.

Session 3: Biological and Psychological Basis of the Illness

This session explores the neurobiological underpinnings of bipolar disorder, including brain structures involved in executive function. Patients also learn about genetic predispositions, neurotransmitter imbalances, and stress-related factors.

Session 4: Medication Adherence and Side Effects

An overview of mood stabilizers, antipsychotics, and antidepressants is presented. The session addresses the importance of medication adherence, management of side effects, and the risks of discontinuation without consultation.

Session 5: Recognizing Early Warning Signs and Relapse Prevention

Participants identify their own early signs of manic or depressive episodes. Strategies for self-monitoring and developing personal relapse prevention plans are discussed.

Session 6: Cognitive Functioning and Executive Deficits in Bipolar Disorder

The focus shifts to understanding how bipolar disorder affects executive functions such as planning, impulse control, working memory, and decision-making. Patients complete self-assessments to identify areas of difficulty.

Session 7: Attention and Concentration Skills Training

Cognitive exercises are introduced to improve attention span and concentration. Patients practice focused attention tasks and learn methods to manage distractions.

Session 8: Enhancing Working Memory

Activities target working memory through repetition, visualization, and chunking strategies. Patients are taught how to apply these techniques in daily activities.

Session 9: Planning and Organizational Skills

This session includes training in goal-setting, prioritization, time management, and breaking complex tasks into manageable steps. Real-life examples are used for practice.

Session 10: Inhibitory Control and Impulse Management

Patients explore strategies to delay gratification, pause before action, and manage impulsive behaviors, especially during mood fluctuations. Role-play is used to reinforce skills.

Session 11: Emotional Regulation Techniques

Participants learn cognitive-behavioral and mindfulness techniques for regulating intense emotions. Techniques such as cognitive restructuring, deep breathing, and emotion labeling are practiced.

Session 12: Stress Management and Coping Strategies

E-ISSN: 2980-9681

The session focuses on identifying personal stressors and learning adaptive coping strategies. Relaxation exercises, activity scheduling, and problem-solving methods are introduced.

Session 13: Communication and Social Skills

Patients engage in activities to improve assertiveness, active listening, and conflict resolution. Emphasis is placed on managing interpersonal difficulties that may exacerbate symptoms.

Session 14: Lifestyle Factors and Routine Stabilization

The importance of sleep hygiene, regular daily routines, healthy eating, and physical activity is emphasized. Patients create individualized lifestyle stabilization plans.

Session 15: Review, Consolidation, and Relapse Prevention Plan

The final session reviews the skills learned throughout the program. Patients refine their personal relapse prevention plans and set long-term self-management goals. Feedback is collected to assess the program's perceived usefulness.

2.4. Data Analysis

To analyze the effectiveness of the intervention, a repeated-measures analysis of variance (ANOVA) was conducted with time (pre-test, post-test, and follow-up) as the within-subjects factor and group (experimental vs. control) as the between-subjects factor. The assumptions of normality, homogeneity of variance, and sphericity were checked prior to analysis. Where significant interaction effects were found, the Bonferroni post-hoc test was applied to identify the source of differences between time points within and between groups. Statistical analyses were performed using SPSS version 27, and the level of statistical significance was set at $p < .05$. This approach allowed the evaluation of both immediate and sustained changes in executive functioning as a result of the intervention.

3. Findings and Results

The study sample consisted of 30 hospitalized patients diagnosed with Bipolar I Disorder, with 15 participants in each group. In terms of gender distribution, 18 participants (60.00%) were male and 12 (40.00%) were female. The participants' ages ranged from 21 to 49 years, with a mean age of 34.27 years (SD = 7.83). Regarding educational level, 11 participants (36.67%) held a high school diploma, 13 (43.33%) had a bachelor's degree, and 6 (20.00%) had a postgraduate degree. The majority of participants were single (n = 17, 56.67%), while 13 (43.33%) were married. The average duration of illness across the sample was 6.45 years (SD = 3.91), indicating a moderately chronic course of bipolar disorder among participants.

Table 1

Descriptive Statistics for Executive Function Scores Across Time Points

Test	Group	Pre-test (M ± SD)	Post-test (M ± SD)	Follow-up (M ± SD)
WCST	Experimental	61.42 ± 5.87	75.68 ± 4.31	74.93 ± 4.52
	Control	62.11 ± 5.76	67.04 ± 5.08	66.28 ± 4.89
SCWT	Experimental	42.36 ± 4.55	55.74 ± 3.72	54.81 ± 3.98
	Control	41.97 ± 4.61	46.20 ± 4.05	45.68 ± 4.22
TMT	Experimental	85.31 ± 6.72	70.48 ± 5.93	71.15 ± 6.12
	Control	84.67 ± 7.11	78.26 ± 6.78	77.84 ± 6.52

Table 1 presents the mean and standard deviation scores for each executive function test across three time points. For the WCST, the experimental group improved markedly from pre-test (M = 61.42) to post-test (M = 75.68), while the control group improved more modestly (M = 62.11 to M = 67.04). For the SCWT, the experimental group improved from M = 42.36 to M = 55.74, while the control group increased from M = 41.97 to M = 46.20. For the TMT (where lower scores indicate better performance), the experimental group improved from M = 85.31 to M = 70.48, while the control group showed a smaller reduction from M = 84.67 to M = 78.26. Improvements were largely sustained at follow-up.

Prior to conducting the repeated-measures ANOVA, the assumptions of normality, homogeneity of variances, and sphericity were tested and met. The Shapiro–Wilk test showed no significant deviation from normality for any of the three time points (pre-test: $p = .263$, post-test: $p = .187$, follow-up: $p = .224$). Levene's test for equality of variances indicated homogeneity between groups at each time point (pre-test: $F(1,28) = 1.37$, $p = .252$; post-test: $F(1,28) = 0.93$, $p = .343$; follow-up: $F(1,28) = 1.02$, $p = .321$). Mauchly's Test of Sphericity was not significant ($W = 0.914$, $\chi^2(2) =$

E-ISSN: 2980-9681

2.14, p = .343), confirming that the assumption of sphericity was met. These results support the appropriateness of applying repeated-measures ANOVA to examine group and time effects on executive functioning.

Table 2

Repeated-Measures ANOVA Summary for Executive Function Scores

Test	Source	SS	df	MS	F	p	η^2
WCST	Time	1582.43	2	791.22	42.61	<.001	.61
	Group	1245.76	1	1245.76	28.74	<.001	.51
	Time × Group	936.89	2	468.45	25.23	<.001	.47
SCWT	Time	1094.18	2	547.09	39.14	<.001	.58
	Group	831.62	1	831.62	26.38	<.001	.49
	Time × Group	604.74	2	302.37	21.72	<.001	.44
TMT	Time	1983.65	2	991.83	36.22	<.001	.56
	Group	1172.54	1	1172.54	22.57	<.001	.45
	Time × Group	816.43	2	408.21	18.91	<.001	.41

The repeated-measures ANOVA revealed significant main effects of time, group, and time × group interaction for all three measures. For the WCST, the interaction effect was significant, F(2, 56) = 25.23, p < .001, indicating that the experimental group improved more over time than the control group. Similar significant interaction effects were observed for the SCWT (F(2, 56) = 21.72, p < .001) and the TMT (F(2, 56) = 18.91, p < .001). These findings confirm that the psycho-educational intervention had a superior effect compared to pharmacotherapy alone across all cognitive domains assessed (Table 2).

Table 3

Bonferroni Post-Hoc Comparisons for Executive Function Scores

Test	Comparison	Mean Diff	SE	p
WCST	Exp: Pre vs Post	-14.26	1.38	<.001
	Exp: Pre vs Follow-up	-13.51	1.45	<.001
	Exp: Post vs Follow-up	0.75	0.94	.421
	Ctrl: Pre vs Post	-4.93	1.07	<.001
	Ctrl: Pre vs Follow-up	-4.17	1.15	<.001
	Ctrl: Post vs Follow-up	0.76	0.91	.402
SCWT	Exp: Pre vs Post	-13.38	1.26	<.001
	Exp: Pre vs Follow-up	-12.45	1.33	<.001
	Exp: Post vs Follow-up	0.93	0.89	.301
	Ctrl: Pre vs Post	-4.23	1.12	<.001
	Ctrl: Pre vs Follow-up	-3.71	1.20	<.001
	Ctrl: Post vs Follow-up	0.52	0.95	.586
TMT	Exp: Pre vs Post	14.83	1.62	<.001
	Exp: Pre vs Follow-up	14.16	1.74	<.001
	Exp: Post vs Follow-up	-0.67	1.01	.518
	Ctrl: Pre vs Post	6.41	1.44	<.001
	Ctrl: Pre vs Follow-up	6.83	1.51	<.001
	Ctrl: Post vs Follow-up	-0.42	0.87	.632

Bonferroni-adjusted post-hoc comparisons showed that the experimental group exhibited significant improvements from pre-test to post-test and from pre-test to follow-up in all three tests: WCST (p < .001), SCWT (p < .001), and TMT (p < .001). There were no significant declines between post-test and follow-up, indicating sustained improvement. The control group also showed statistically significant improvements from pre-test to post-test and follow-up (p < .001), but with smaller mean differences. No significant changes were observed between post-test and follow-up in either group. These results underscore the enhanced and stable effect of the psycho-educational intervention on executive functioning (Table 3).

E-ISSN: 2980-9681

Table 4

Bonferroni Post-Hoc Comparison Between Experimental and Control Groups at Each Time Point

Test	Time Point	Mean Difference (Exp − Ctrl)	SE	p
WCST	Pre-test	-0.69	1.25	.587
	Post-test	8.64	1.17	<.001
	Follow-up	8.65	1.23	<.001
SCWT	Pre-test	0.39	0.96	.681
	Post-test	9.54	1.04	<.001
	Follow-up	9.13	1.07	<.001
TMT	Pre-test	0.64	1.38	.647
	Post-test	-7.78	1.26	<.001
	Follow-up	-6.69	1.32	<.001

Table 4 displays the between-group differences at each time point using Bonferroni-adjusted comparisons. At the pre-test stage, no statistically significant differences were found between the experimental and control groups for WCST ($p = .587$), SCWT ($p = .681$), or TMT ($p = .647$), indicating baseline equivalence. However, at post-test, the experimental group performed significantly better than the control group across all three measures: WCST ($p < .001$), SCWT ($p < .001$), and TMT ($p < .001$). These differences remained significant at follow-up, confirming the superior and sustained effectiveness of the psycho-educational intervention in improving executive functioning compared to pharmacotherapy alone. The negative values for TMT post-test and follow-up scores (where lower scores indicate improvement) further emphasize better performance in the experimental group.

4. Discussion and Conclusion

The present study investigated the comparative effectiveness of pharmacotherapy alone versus pharmacotherapy combined with a structured psycho-educational intervention in improving executive functions among hospitalized patients with Bipolar I Disorder. The findings of the repeated-measures ANOVA demonstrated that both groups—those receiving only pharmacotherapy and those receiving pharmacotherapy plus psycho-educational intervention—showed statistically significant improvements in executive functioning from pre-test to post-test and follow-up. However, the experimental group that participated in the psycho-educational sessions exhibited significantly greater improvement across all executive function domains, including cognitive flexibility, inhibitory control, attention regulation, and planning ability. This result supports the primary hypothesis of the study and highlights the added value of incorporating psychological interventions into the pharmacological treatment framework for bipolar disorder.

The statistically significant interaction effect between time and group, confirmed by the Bonferroni post-hoc test, further suggests that the observed improvements in the experimental group cannot be attributed to natural recovery or pharmacotherapy alone. Instead, these gains reflect the targeted influence of the psycho-educational sessions in addressing core cognitive deficits. These findings are consistent with earlier studies that have emphasized the limited scope of pharmacological treatments in addressing cognitive symptoms in bipolar disorder and the necessity of complementary psychosocial interventions (Airainer & Seifert, 2024; Kessing, 2024). While lithium and atypical antipsychotics are effective in stabilizing mood symptoms, they are less potent in remediating executive dysfunction, a domain closely tied to daily functioning and relapse risk (Dorozhenok & Strukova, 2024; Lien et al., 2024).

The results align well with previous research showing that cognitive-psychoeducational interventions can substantially enhance executive functions in bipolar patients. For instance, Bernhard et al. (2006) demonstrated that psychoeducation for both patients and their families significantly improved cognitive adaptation and reduced recurrence rates (Bernhard et al., 2006). Similarly, Isasi et al. (2014), in a five-year controlled clinical trial, found that psychoeducation combined with cognitive-behavioral therapy significantly enhanced patients' self-regulation, decision-making, and impulse control compared to medication alone (Isasi et al., 2014). These improvements, sustained over time, were attributed to better illness insight, enhanced emotional regulation, and strengthened executive control mechanisms—factors echoed in the outcomes of the current study.

E-ISSN: 2980-9681

Moreover, the results are in line with local evidence that has validated the effectiveness of culturally tailored psycho-educational programs for Iranian patients with bipolar disorder. For example, Karbasi et al. (2024) found that positive mindfulness therapy significantly improved mental well-being and cognitive adaptability in women diagnosed with bipolar disorder, while also reducing stress responses (Karbasi et al., 2024). Similarly, Banifatemeh et al. (2024) emphasized the importance of personal knowledge management and illness awareness in empowering patients and their families to manage the course of the illness more effectively (Banifatemeh et al., 2024). These findings collectively suggest that executive deficits, long considered resistant to pharmacological interventions, can in fact be mitigated through structured educational and cognitive training approaches.

Further support for the results of this study is provided by Karbasdehi and Ghasemzadeh (2024), who conducted a systematic review on adolescents with bipolar spectrum disorders and found that evidence-based psychosocial interventions were effective in preventing symptom recurrence and enhancing executive and emotional functioning (Karbasdehi & Ghasemzadeh, 2024). The benefits observed in the current study's experimental group—most notably in planning, response inhibition, and task switching—mirror the improvements identified in that review. Additionally, Dong (2024) highlighted the value of neuroregulatory techniques in improving attention and impulse control, reinforcing the notion that executive deficits in bipolar disorder can be therapeutically targeted through non-pharmacological means (Dong, 2024).

The significance of addressing executive dysfunction is further underscored by studies linking cognitive impairments with functional disability and poorer prognosis in bipolar patients. Lyu (2023) notes that impaired executive functioning is a predictor of occupational and interpersonal challenges, thus making its remediation a critical aspect of comprehensive treatment planning (Lyu, 2023). Hirose et al. (2023) also demonstrated that even targeted pharmacological treatments, such as brexpiprazole, are more effective when paired with psychosocial support strategies that enhance cognitive and emotional processing (Hirose et al., 2023). These complementary effects suggest a synergistic relationship between pharmacotherapy and cognitive interventions, validating the integrative approach used in the current study.

Interestingly, the improvement in the control group, while statistically significant, was modest in comparison. This suggests that while mood stabilization alone may have some indirect effects on cognitive performance, these are limited and insufficient for restoring full executive functioning. This observation resonates with findings by Kessing (2024), who questioned the sole reliance on lithium, arguing that the traditional emphasis on pharmacology often overlooks cognitive and functional recovery in bipolar patients (Kessing, 2024). Likewise, Kurdal et al. (2013) found that psychoeducation significantly enhanced patients' daily functioning levels, a result that supports the broader efficacy of integrating cognitive strategies into conventional treatment protocols (Kurdal et al., 2013).

The results of this study also lend support to Rahmani et al. (2016), who reported that psychoeducational programs had a transformative effect on both patients and their caregivers, improving not just attitudes toward illness but also practical capabilities such as cognitive and emotional management (Rahmani et al., 2016). This aligns with the multi-dimensional benefits observed in the current study's experimental group, where participants showed enhanced performance in domains such as selective attention and working memory—skills critical for autonomy and community reintegration.

In summary, the findings of this study confirm that while pharmacotherapy remains foundational to bipolar disorder treatment, it is not sufficient on its own to address the pervasive executive dysfunctions experienced by patients. The addition of a structured psycho-educational program targeting cognitive domains produces significantly superior outcomes, both immediately post-intervention and during follow-up. These results underscore the need for a paradigm shift toward integrated, multi-modal treatment approaches that address both symptom control and functional recovery.

Despite its contributions, the study has several limitations that should be acknowledged. First, the relatively small sample size (n = 30) limits the generalizability of the findings to the broader population of bipolar patients. While the randomized controlled design strengthens internal validity, the small cohort may have restricted the statistical power needed to detect more nuanced differences between subdomains of executive functioning. Second, the study relied solely on performance-based cognitive tests, which, although standardized, may not fully capture real-world executive functioning in daily settings. Third, the follow-up period of two months, while sufficient for short-term efficacy assessment, is not long enough to evaluate the long-term sustainability of cognitive improvements or relapse rates. Furthermore, all participants were recruited from

E-ISSN: 2980-9681

psychiatric hospitals in Tehran, which may introduce regional or institutional biases and limit applicability to outpatient or community-based settings.

Future studies should consider larger and more diverse samples, including outpatient populations and patients across various phases of the disorder, to enhance the external validity of findings. Longitudinal research with extended follow-up periods is also essential to determine the durability of treatment gains and their potential impact on relapse prevention and long-term functioning. Additionally, the inclusion of qualitative methods such as patient self-reports and caregiver interviews could provide a more holistic understanding of cognitive recovery and its subjective relevance. Comparative studies exploring different types of psychosocial interventions—such as cognitive remediation, mindfulness-based therapy, or family-focused therapy—would also offer valuable insights into the most effective strategies for enhancing executive functioning in this population.

Clinicians treating individuals with bipolar disorder should consider integrating structured psycho-educational programs into standard pharmacological care, especially during hospitalization or in the early stages of stabilization. These programs should include modules that specifically target executive functions such as attention, planning, impulse control, and working memory. Mental health professionals should also receive training in delivering cognitive-based psychoeducation to ensure fidelity and therapeutic effectiveness. Additionally, treatment plans should be personalized to the cognitive profile of each patient, incorporating family education and lifestyle management to support holistic recovery. Ultimately, bridging the gap between pharmacology and psychosocial care will enhance both the clinical and functional outcomes for individuals living with bipolar disorder.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the study and participated in the research with informed consent.

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