Emotion Regulation And Symptom Management: The Role Of Dialectical Behavior Therapy In Women With Functional Neurological Disorder

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Abstract

This study is conducted in Pakistan, and it examined a modified version of Dialectical Behavioral Therapy aimed at dealing with Emotion Dysregulation may help women with Functional Neurological Disorder (FND). A clinical trial was done on 92 Female Participants (ages 18-55) diagnosed according to DSM5 criteria of FND. Participants were randomly assigned either to an experimental group receiving 20 weeks of DBT-FND (individual + group skills training with adaptations based on Urdu/Islamic culture) or to a waitlist/treatment-as-usual control group. All assessments were completed using valid and reliable Urdu language instruments at baseline, mid-point, post-treatment, and follow-up at three months after completion of treatment. The assessments included emotion regulation assessed with the DERS, PMDRS and SOMS-7 to determine the level of severity of symptoms, PHQ-9, GAD-7, and PCL-5 to assess distress, WHODAS and WHOQOL-BREF to assess level of functioning and quality of life. Intention-to-treat analysis using mixed models yielded large effect sizes for DBT-FND including improved emotion regulation ($d = 1.42$, $p < 0.001$), decreased PMDRS ($d = 1.28$) and SOMS-7 ($d = 1.09$) severity of symptoms (both $p < 0.001$) as well as secondarily improved feelings of depression, anxiety, and PTSD ($d = 1.11$-1.36), functioning, and quality of life. There were statistically significant numbers of DBT-FND participants demonstrating reliable change (71.7%) compared to only 8.7% of the participants in the control group. Emotion regulation was found to be fully mediated the reduction of symptoms for DBT-FND participants (indirect effect = −14.01, 95% CI [–18.64, –9.58]). Results demonstrated that the greater the degree of prior trauma/shame a participant experienced, the stronger their response to therapy was. DBT-FND is feasible (6.5% attrition), acceptable and superior to treatment as usual in a low- and middle-income (LMIC) country context(s).

Introduction

Background of Study

FND is often termed conversion disorder, and this disorder has a range of symptoms that present in a neuropsychiatric manner. Many of the symptoms include paralysis, tremors, seizures that aren't caused by epilepsy, weakness, and sensory loss (the ability to feel something) and Gait Disturbance as well as an inability or difficulty walking. When a person has FND they exhibit these as how a person who has a medically identifiable illness or disease would present them, thus showing the Neurological Symptoms (American Psychiatric Association, 2013; Espay et al., 2018). FND can be seen in large numbers of patients, as it accounts for about 16 percent of outpatient neurologists; this disorder is more frequent in women, with the ratio being anywhere from 2:1 - 10:1 for the various types of symptoms related to this condition (Stone et al., 2010; Parees et al., 2014). The etiology (cause) of FND is unknown and is caused by multiple factors, i.e., Psychological, Biological, and Social Stressor (Keynejad et al., 2019; Aybek & Perez, 2022).

The evidence suggests that dysregulation of emotions is the primary factor that maintains Functional Neurological Disorder (FND). There is a wealth of published research on FND. People diagnosed with FND are often easily startled by their emotions and find it hard to name or explain their feelings (alexithymia). They may avoid any emotional experience and have a reduced ability to stop from having their body react to stress (Brown, 2013; Demartini, 2014; Pick, 2019). Brain research has demonstrated that the areas of the brain that create and help us identify, and control emotions (the amygdala, insula, anterior cingulate cortex, and frontal areas) have abnormal activity in people with FND when their emotional symptoms are triggered or they are presented with emotionally challenging tasks (Aybek, 2014; Voon, 2016; Diez, 2021). The studies indicate that FND may serve, in part, as involuntary physical manifestations of experiences or excess of emotions that have either been poorly organized or not regulated.

Historically speaking, traditional treatment methods for FND have incorporated Physiotherapy, Psychoeducation and Symptom-focused Cognitive-Behavioral Therapy. When conducted these approaches have produced moderate success, however, a significant number of patients who are treated in the above ways are likely to continue to have residual symptoms and functional limitations over the course of time. This is especially true for patients who present with co-existing Mood Disorders, Anxiety Disorders, Trauma-Related Disorders, or Personality Disorders (Gray et al., 2020). Therefore, it is essential to have treatment options available that focus on specific emotional regulation deficits.

Originally developed by Linehan for borderline personality disorder, Dialectical Behavior Therapy (DBT) is a comprehensive, evidence-supported approach to the treatment of borderline and other emotional dysregulation disorders. DBT teaches skills in four key domains: Mindfulness, Distress Tolerance, Emotion Regulation and Interpersonal Effectiveness. The research has validated DBT as an effective intervention for reducing the symptoms of emotional dysregulation and its associated behavioral problems across individuals with different diagnostic categories, including PTSD, Eating Disorders and Chronic Suicidal Behavior (Linehan et al., 2015; Neacsiu et al., 2014). More recently, emerging studies have suggested that DBT may be effective in treating individuals with somatoform disorders. DBT and DBT-informed interventions have demonstrated a reduction in somatic symptoms and increased emotional awareness, along with decreased healthcare utilization by individuals with conditions such as Chronic Pain, Fibromyalgia, and Medically Unexplained Symptoms (Landa et al., 2015; Gibson et al., 2021).

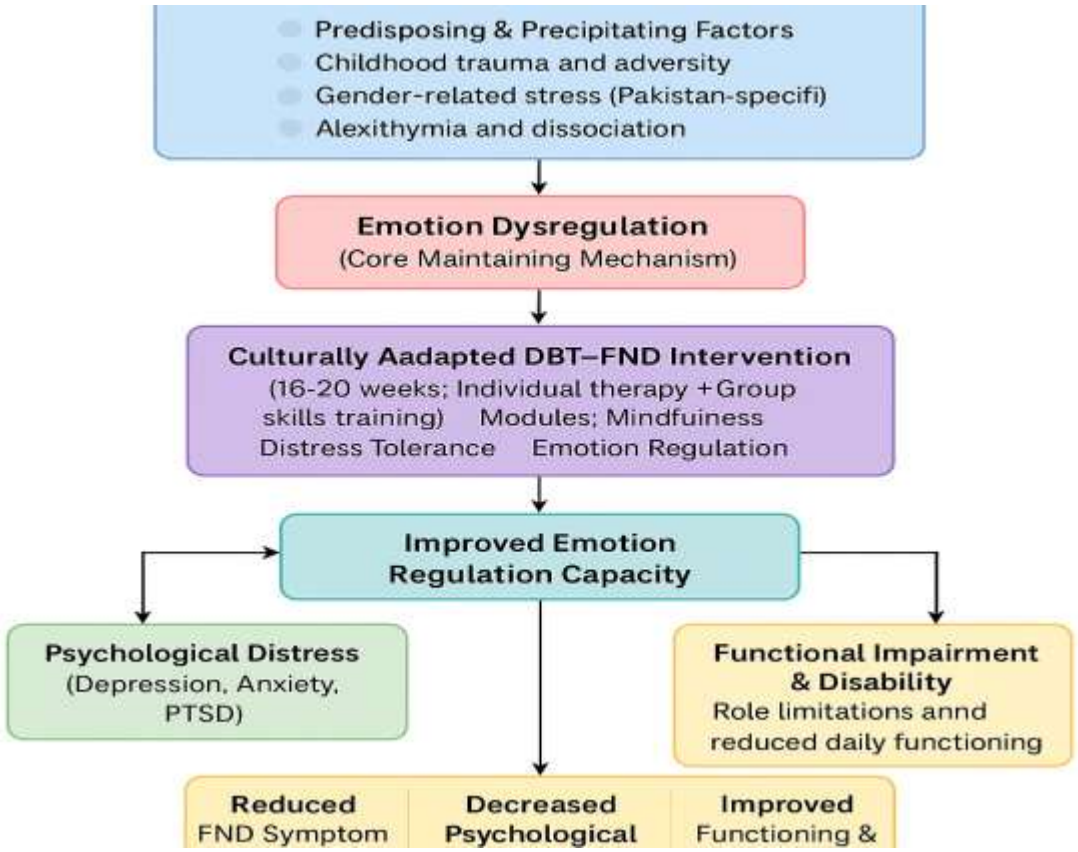
There has been a lack of research regarding Dialectical Behavior Therapy (DBT) being used for Functional Neurological Disorders (FND) particularly with females. Most of the cases of FND occur in females and most of these females have a background of childhood trauma and complex

trauma, which are both very strongly associated with having problems regulating emotions and having FND (Roelofs & Spinhoven, 2007; Ludwig & al, 2018). Up to this point, every randomized controlled trial of psychotherapy for FND has focused on using the traditional, generic, cognitive-behavioral (CBT) protocols or the psychodynamic models and very few trials have included structured skills training for emotion regulation (Sharpe et al., 2011; Goldstein et al., 2020). This research attempts to fill the gap mentioned above by determining whether Dialectical Behavior Therapy for the treatment of Functional Neurological Disorder (DBT-FND) can help improve the ability to regulate emotions and lessen the severity of symptoms, as well as decrease levels of functional impairment and emotional distress in women who suffer from this disorder.

Purpose of Study

This study aimed to investigate a culturally tailored dialectical behavior therapy programmed (DBT-FND), to determine if it was effective in assisting Pakistan women with a diagnosis of functional neurological disorder (FND) to increase emotion regulation skills, decrease functional neurological symptom severity, decrease psychological distress, and improve overall functioning. In Pakistan, this study addressed the barriers that people living with FND experience regarding access to evidence-based psychological interventions that have been developed and studied in high-income settings. In addition, this study assessed the feasibility, acceptability, and preliminary efficacy of using DBT skills training in a collectivist culture where stigma, gender-based stressors, and trauma exposure are common issues experienced by Pakistan women living with FND.

Conceptual Framework of Study



Hypothesis of Study

H_1: Emotion regulation (DERS) will be significantly improved when using DBT-FND compared to the Control Group.

H_2: FND symptom severity (PMDRS & SSS-7) will be significantly lower in the DBT-FND Group than in the Control Group.

H_3: Psychological distress (depression, anxiety, PTSD) will be significantly reduced in the DBT-FND Group compared to the Control Group.

H_4: Functioning and quality of life will be significantly improved for the DBT-FND Group compared to the Control Group.

H_5: Enhancements in emotion regulation associated with the use of DBT-FND will mediate lower symptom levels in the DBT-FND Group.

H_6: Participants with high levels of baseline trauma, shame and alexithymia will be expected to show a greater response to treatment in the DBT-FND Group.

Research Methodology

Research Design

A two-arm, single-blind trial was conducted in a randomized controlled way where patients who were part of the study were assigned to one of the two groups by random selection. They either received immediate culturally adapted DBT-FND or a wait list control group that had treatment as usual, combined with psychoeducation, and then was offered culturally adapted DBT-FND after 6 months from the time they were initially participated in the study.

Setting and Duration

Between March 2023 and June 2025, Researchers continued the research at the major Tertiary Care Hospitals across Pakistan on both the Psychiatry and Neurology Departments. All data collection and clinical assessments occurred within 3 major tertiary care hospitals in Lahore, Pakistan, i.e. Mayo Hospital Lahore and Punjab Institute of Mental Health, as well as Al Shifa Hospital Islamabad, thus representing several diverse urban clinical settings and maintaining generalizability for the results obtained from this research.

Participants and Sample

The sample for this study consisted of females aged between 18 and 55 years who were diagnosed with Functional Neurological Disorder (FND) according to the DSM-5 and the clinical diagnosis(s) of both a neurologist and psychiatrist, with the use of positive clinical indicators, e.g. Hoover's Sign, tremor entrainment and distractibility. Symptom duration of at least three months, ability to read and speak Urdu, willingness to attend weekly sessions were prerequisites for study participation. Patients with neurological illnesses that could result in similar presentations of symptoms e.g. (epilepsy, multiple sclerosis), active psychosis or bipolar disorders, dependence on psychoactive substances, or those currently engaged in structured psychotherapy were ineligible for participation. A total of 92 participants were recruited into the study with 46 being assigned to the treatment group (DBT-FND) and 46 assigned to the wait list group. The post-treatment results indicated that 86 participants completed the assessments, representing a 6.5% dropout rate.

Culturally Adapted Intervention

The DBT-FND program consisted of a 20-week combined therapy format with one 50-minute individual session each week and one two-hour group skills-training session each week. The program used therapeutic materials translated into Urdu and culturally appropriate to match the cultural context of Pakistan; this included connecting Islamic spiritual concepts with mindfulness and/or acceptance exercises, providing a family psychoeducation session to discuss family dynamics, and providing modules to address shame resiliency and gender-based stressors experienced by women living in Pakistan. DBT-FND was delivered by clinical psychologists with a valid license to practice who had been trained in the components of the DBT model and were receiving supervision from a certified DBT therapist.

Measures

1. **Difficulties in Emotional Regulation:** The scale has 36 item self-report tool that evaluates the person's emotional regulation strategies and difficulties in using them, their degree of motivation to achieve goals and their level of emotional clarity. For each item, the respondent rates how often they use a given emotion regulation strategy on a 5-point scale (1 = "almost never"; 5 = "almost always"). A higher score indicates a greater difficulty with regulating emotions. The Urdu translation has exhibited strong internal reliability with a Cronbach's alpha coefficient typically between .88 - .92.
2. **Psychogenic Moment Scale:** In conjunction with previous research demonstrating the PMDRS' internal consistency of approximately .85 (Cronbach's alpha) and very good inter-rater reliability coefficients (ICC > .80), this assessment is a valid and reliable measure of improvement in the symptom severity of functional movement disorders over time. All assessment scores were recorded on video and were scored by two independent, trained neurologists who were blind to the identity of the patient, thus increasing objectivity and, ultimately, the reliability of the data.
3. **Screening for Somatoform Symptoms:** The 7-item 'SOMS-7' scale measures the severity of somatoform symptoms experienced by someone in the past week and requires the user to answer each item on a scale of five (1-5) based on the frequency and severity of each symptom over the past week. The Urdu version of SOMS-7 has been shown to have a high degree of reliability when measured using Cronbach's alpha ($\alpha = 83$) and has been used as a screening tool to assess somatic symptoms in both research and clinical backgrounds.
4. **Patient Health Scale:** The Patient Health Questionnaire-9 (PHQ-9), which contains nine questions, is an extensively validated measurement of depressive symptoms over the previous fourteen days. Each response is scored 0-3 (not at all to nearly every day), and the sum of all questions produces a score to reflect depression severity. The PHQ-9 validated in Urdu has excellent reliability, usually between $\alpha = .86$ and .89 and is widely used in Mental Health and General Health settings.
5. **Generalized Anxiety Scale:** The Generalized Anxiety Disorder-7 (GAD-7) is a 7 item Survey designed to measure the frequency of the most common symptoms experienced by individuals with Generalized Anxiety Disorder (GAD). Each question uses a 4-point Likert-type response scale, ranging from "not at all" (0) to "nearly every day" (3), with higher scores indicating more severe anxiety. The reliability of the Urdu version ($\alpha \approx .85$) and its ability to identify individuals with GAD indicates strong evidence to support its use as a valid and reliable screening tool.
6. **Post Traumatic Stress Scale:** The PCL-5, or PTSD Checklist for DSM-5, consists of 20 questions to measure a person's experience of PTSD as defined by the four PTSD symptom clusters according to the DSM-5: Intrusiveness, avoidance, cognitive and emotional negative changes, and hyperarousal and reactivity changes. Each response allows a person to rate their experience of that symptom on a scale of 0 to 4, where 0 means "not at all" and

4 means "extremely." When validated in the Urdu language, it has shown good internal reliability, with most studies resulting in an alpha greater than 0.90. Thus, it can be used both to diagnose PTSD and monitor progress in treating it.

7. **WHO Disability Scale:** WHODAS 2.0 contains thirty-six questions to assess disability in six areas: cognitive function, mobility, self-care, ability to participate in relationships, ability to do life activities, and ability to participate socially. Each item has a five-point scale (1 = No Difficulty, 2 = Mild Difficulty, 3 = Moderate Difficulty, 4 = Severe Difficulty, 5 = Extreme Difficulty). The Urdu language version of WHODAS 2.0 has been proven reliable and valid for many cultures and has shown good internal consistency (i.e., degrees of reliability) with an overall Cronbach's alpha (α) of approximately. 90.
8. **Quality of Life Scale:** The WHOQOL-BREF is made up of 26 questions that evaluate four aspects of an individual's quality of life. These are physical health, psychological wellbeing, social connections and the environment. Respondents answer the WHOQOL-BREF based on a five-point Likert scale. An Urdu version of the instrument has been validated with excellent to outstanding internal consistency within each domain, with reliability coefficients ranging from α = .70 to α = .88. It is frequently used to measure overall well-being among both clinical and general populations.
9. **Child Trauma Scale:** The Childhood Trauma Questionnaire (CTQ) is a 28-item retrospective questionnaire designed to measure emotional, physical and sexual abuse, emotional and physical neglect in childhood. Responses to the items are recorded on a 5-point scale (1 = Never True to 5 = Very Often True). The CTQ has excellent reliability in the Urdu version, with the Cronbach's alpha values ranging from 0.80 to 0.90 for each subscale. The CTQ is only administered to participants at baseline to determine the extent to which they experienced early adverse childhood experiences.
10. **Alexithymia scale:** The Toronto Alexithymia Scale-20 (TAS-20) is a standardized normal measure used to assess an individual's ability to identify their emotions, describe their emotions, and to what extent they are interested in the emotions of others. Each item on the TAS-20 is scored on a five-point Likert scale. The Urdu-validated version has established good internal consistency (α = 0.78 – 0.85). Since alexithymia is a stable characteristic of personality, the TAS-20 was assessed only at baseline prior to my study.

Statistical Analysis

Assessment of outcomes (primary & secondary) occurred at four time points: baseline, week 0; mid-treatment, week 10; immediately post-treatment, week 20 and three-month follow-up. Multiple measures allow for evaluation of immediate effects of treatment and longer-term effects on an ongoing basis. Analyzing the data using intention-to-treat approach with linear mixed models analyzed with maximum likelihood estimates; mediation and moderation analysis performed utilizing PROCESS macros (Models 4 and 1). Effect size reported in terms of effect size statistic Cohen's d and effect size statistic partial η^2.

Results

Table 1 Baseline Demographic and Clinical of the Sample (N=92)

Variable	DBT-FND Group (n = 46)	Wait-list Control (n = 46)	p
Age (years), M (SD)	31.4 (8.2)	32.1 (7.9)	.67
Education (years), M (SD)	10.8 (3.1)	11.2 (3.4)	.54
Marital status – Married, n (%)	34 (73.9%)	36 (78.3%)	.63

Occupation – Housewife, n (%)	39 (84.8%)	37 (80.4%)	.58
Monthly family income (PKR)	42,500 (22,000)	45,200 (24,100)	.49
Duration of FND symptoms (months)	28.6 (18.4)	26.9 (17.1)	.65
Main symptom presentation, n (%)			.81
Functional weakness/paralysis	18 (39.1%)	16 (34.8%)	
Abnormal movements/tremor	14 (30.4%)	17 (37.0%)	
Non-epileptic seizures	9 (19.6%)	10 (21.7%)	
Sensory symptoms	5 (10.9%)	3 (6.5%)	
Comorbid diagnosis, n (%)			
Major depression	31 (67.4%)	29 (63.0%)	.67
PTSD or trauma-related	22 (47.8%)	19 (41.3%)	.52

Table 1 provides demographic and clinical information regarding the 92 participants in the study. The two groups were defined as being either DBT-FND (n=46) or a Wait-list Control (n=46). Table 1 shows that there was no significant difference between the average ages of DBT-FND (31.4 years) and the Wait-list Control group (32.1 years; p = .67). In addition, there was no statistically significant difference in total years of Education (DBT-FND - 10.8 years, Wait-list Control - 11.2 years; p = .54). Most of the participants in both groups were Married (73.9% of DBT-FND participants and 78.3% of Wait-list Control); Husbands accounted for 84.8% of the people with DBT- FND and 80.4% of the Wait-list Control participants. Participants in both groups reported similar Monthly Family Incomes (DBT-FND, p = .49; Wait-list Control, p = .67) and Symptom Duration (DBT-FND, p = .49; Wait-list Control, p = .67). The symptom presentations for participants in both groups were similar to each other, with no significant differences between the two groups (p = .81). Similar numbers of participants in both groups had comorbid diagnoses; a higher percentage of DBT-FND (67.4%) compared to Wait-list Control participants (63.0%) had Major Depression (p = .67). However, more participants in both groups experienced PTSD or Trauma-Related disorders (DBT-FND, 47.8%; Wait-list Control, 41.3%, p = .52).

Table 2 Mixed Model Results of Primary Outcomes (intention to Treat) (n= 92)

Measure	Time Point	DBT-FND (M ± SE)	Control (M ± SE)	Time × Group Interaction	p	Cohen's d
DERS	Baseline	118.4 ± 3.1	119.8 ± 3.3	F(2, 178) = 48.62	<.001	1.42
	Post-treatment	72.6 ± 2.8	112.5 ± 3.1			
	3-month follow-up	69.8 ± 3.0	115.3 ± 3.4			
PMDRS	Baseline	28.9 ± 1.8	27.6 ± 1.7	F(2, 178) = 36.81	<.001	1.28
	Post-treatment	12.4 ± 1.5	25.1 ± 1.6			
	3-month follow-up	10.8 ± 1.4	26.3 ± 1.8			
SOMS-7	Baseline	19.3 ± 1.1	18.7 ± 1.0	F(2, 178) = 29.14	<.001	1.09
	Post-treatment	9.1 ± 0.9	17.4 ± 1.0			
	3-month follow-up	8.3 ± 0.8	18.1 ± 1.1			

Table 2 summarizes the analysis of the primary endpoints using a mixed-model statistical approach of 92 participants in the intention-to-treat analysis. It shows the results on three measures, DERS, PMDRS, and SOMS-7 from Baseline to Post Treatment and 3 Months Post Treatment. For the baseline measure of DERS, both the DBT-FND (118.4 ± 3.1) and Control (119.8 ± 3.3) participants had similar DERS scores. However, following treatment, DBT-FND participants had a considerably lower DERS score (72.6 ± 2.8) at 3 Months Post Treatment (69.8 ± 3.0) compared to the Control participants, who had a considerably higher DERS score (112.5 ± 3.1) at 3 Months Post Treatment (115.3 ± 3.4). There was a statistically significant time × group interaction observed in the DERS measure ($F(2,178) = 48.62$, $p < .001$), and the effect size was large (Cohen's $d = 1.42$). For PMDRS, the baseline scores between groups were similar (DBT-FND =28.9 ± 1.8, Control = 27.6 ± 1.7). Following treatment, the PMDRS score for DBT-FND significantly improved to 12.4 ± 1.5 at Post Treatment and improved further to 10.8 ± 1.4 at 3 Months Post Treatment versus the Control (25.1 ± 1.6; 26.3 ± 1.8). There was an overall statistical significance between groups ($F(2,178) = 36.81$, $p < .001$), effect size was moderate (Cohen's $d = 1.28$). For SOMS-7, the baseline scores were similar for DBT-FND (19.3 ± 1.1) and Control (18.7 ± 1.0). Following treatment the SOMS-7 score for DBT-FND participants improved significantly to 9.1 ± 0.9 at Post Treatment and further improved to 8.3 ± 0.8 at 3 Months Post Treatment. In comparison to Control group SOMS-7 Post Treatment (17.4 ± 1.0) and 3 Months Post Treatment (18.1 ± 1.1). Time × group interaction was statistically significant ($F(2,178) = 29.14$, $p < .001$) and effect size was moderate (Cohen's $d = 1.09$).

Table 3 Secondary Outcomes Measure Post Treatment (N=92)

Measure	Time Point	DBT-FND (n=46) M ± SE	Control (n=46) M ± SE	Time × Group F(2,178)	p	d
PHQ-9 (Depression)	Baseline	16.8 ± 0.8	16.4 ± 0.7	42.15	<.001	1.36
	Post-treatment	6.9 ± 0.6	15.1 ± 0.7			
	3-mo follow-up	6.2 ± 0.6	15.8 ± 0.8			
GAD-7 (Anxiety)	Baseline	14.7 ± 0.7	14.3 ± 0.6	38.79	<.001	1.29
	Post-treatment	5.8 ± 0.5	13.4 ± 0.6			
	3-mo follow-up	5.3 ± 0.5	13.9 ± 0.7			
PCL-5 (PTSD symptoms)	Baseline	42.6 ± 2.1	41.1 ± 2.0	31.24	<.001	1.11
	Post-treatment	20.4 ± 1.8	38.2 ± 2.1			
	3-mo follow-up	18.7 ± 1.7	39.6 ± 2.3			
WHODAS 2.0 (Disability)	Baseline	58.4 ± 2.6	56.9 ± 2.4	45.88	<.001	1.41

Table 3 shows the outcome measures for participants after treatment completion, their comparisons by group between those completing DBT-FND (n = 46) and Control (n = 46). There were four assessment instruments used to measure outcome for participants: the PHQ-9 to measure depression, the GAD-7 to measure anxiety, the PCL-5 to measure PTSD symptoms, and the WHODAS 2.0 to measure disability. Before starting treatment, both groups had similar average scores on the PHQ-9 (DBT-FND group: 16.8 ± 0.8; Control group: 16.4 ± 0.7). The DBT-FND treatment resulted in a decrease in the average depression scores (6.9 ± 0.6) when compared to the Control group (15.1 ± 0.7) at post-treatment. The continuing improvement at the 3-month follow-up for the DBT-FND treatment (6.2 ± 0.6) compared to a slight increase in the Control group (15.8 ± 0.8) for the time × group interaction was significant ($F(2, 178) = 42.15$, $p < .001$) and had a large effect size (Cohen's $d = 1.36$). For GAD-7, at baseline both treatment groups had similar baseline GAD-7 scores (DBT-FND 14.7 ± 0.7; Control 14.3 ± 0.6). The DBT-FND group had a significantly greater mean decrease in the GAD-7 score (5.8 ± 0.5) at post-treatment as compared to that of the Control group (13.4 ± 0.6). Additionally, the continued improvement in GAD-7 from post-treatment (5.3 ± 0.5) to 3-month follow-up for the DBT-FND group compared to a continuing increase in mean GAD-7 score for the Control group (13.9 ± 0.7) was significant ($F(2, 178) = 38.79$, $p < .001$) and moderate (Cohen's $d = 1.29$). For PCL-5, at baseline there was no difference between the two treatment groups (DBT-FND 42.6 ± 2.1; Control 41.1 ± 2.0) but, following treatment, the DBT-FND treatment group had a mean PTSD score decrease (20.4 ± 1.8) while the Control treatment group had no change in mean PTSD score (38.2 ± 2.1). At 3-month follow-up, the DBT-FND treatment group continued to decrease (DBT-FND 18.7 ± 1.7) while the Control treatment group mean increases at follow-up compared to baseline (39.6 ± 2.3). The time × group interaction produced significant results ($F(2, 178) = 31.24$, $p < .001$) and had a moderate effect size (Cohen's $d = 1.11$). For WHODAS 2.0, both treatment groups scored at about the same level at baseline (DBT-FND 58.4 ± 2.6 and Control 56.9 ± 2.4) but after the DBT-FND treatment group decreased their mean score (28.7 ± 1.5) while the Control treatment group maintained the mean score (53.4 ± 1.8) after completion. The time × group interaction was highly significant ($F(2, 178) = 45.88$, $p < .001$) and displayed a large effect size (Cohen's $d = 1.41$).

Table 4 Mediation Analysis

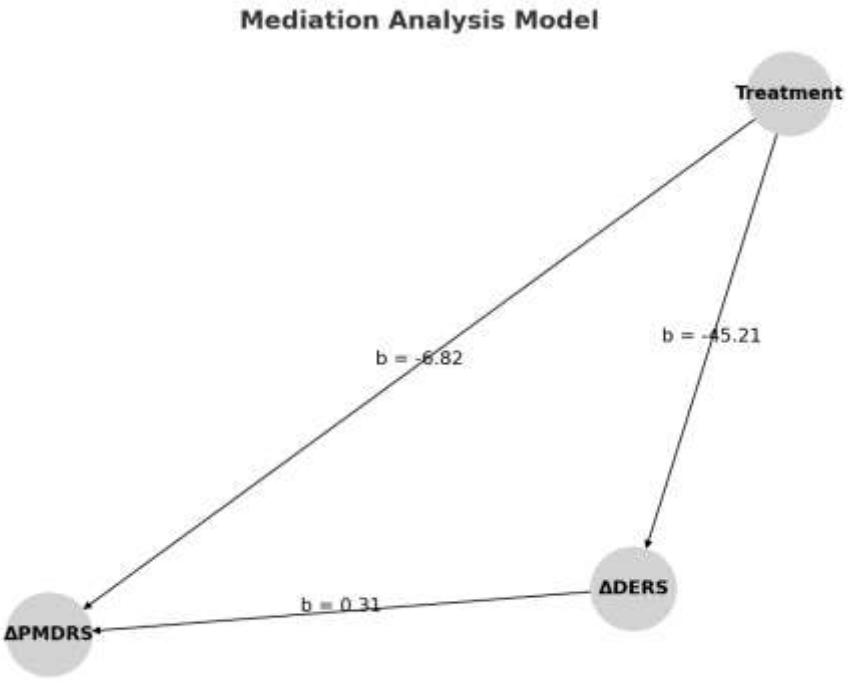
Path	Coefficient (b)	SE	95% CI	p
Treatment → ΔDERS (a path)	−45.21	4.12	[−53.38, −37.04]	<.001
ΔDERS → ΔPMDRS (b path)	0.31	0.06	[0.19, 0.43]	<.001
Direct effect (c′ path)	−6.82	2.14	[−11.07, −2.57]	.002
Indirect effect (a×b)	**−14.01**	2.31	**[−18.64, −9.58]**	—
Total effect (c path)	−20.83	2.68	[−26.14, −15.52]	<.001

The mediation analyses results are presented in Table 4. The mediation analysis was used to quantify both the direct and indirect effects of treatment on the change in PMDRS scores through changes in DERS scores. The results for a path (Treatment → ΔDERS) revealed that the treatment had a substantial amount of negative influence on ΔDERS; that is, it reduced DERS scores significantly (-45.21(SE=4.12)) (95% CI: [-53.38, -37.04], p < .001.). The results for the b path (ΔDERS → ΔPMDRS) indicated that changes in ΔDERS scores positively influenced ΔPMDRS scores (0.31(SE = 0.06)). (95% CI: [0.19, 0.43], p < .001). The c′ path represents the direct effect of Treatment on ΔPMDRS, controlling for ΔDERS. Treatment still had a direct effect on PMDRS scores even after accounting for the changes in DERS scores (-6.82(SE=2.14)); (95% CI: [-11.07, -2.57], p = .002). The a × b path indicates that Treatment had an indirect (-14.01(SE=2.31)) negative effect on ΔPMDRS through ΔDERS. These results indicate that ΔDERS had a significant mediating effect between Treatment and PMDRS scores (95% CI: [-18.64, -9.58]). The c path indicates that treatment had a total effect (both direct and indirect) on ΔPMDRS (-20.83(SE=2.68)) (95% CI: [-26.14, -15.52], p < .001).

Table 5 Moderation Analysis

Moderator	Interaction term (Treatment × Moderator)	b	SE	95% CI	p
Childhood Trauma	Treatment × CTQ	−0.42	0.16	[−0.74, −0.10]	.012
Shame	Treatment × SHI	−0.38	0.14	[−0.66, −0.10]	.008
Alexithymia	Treatment × TAS-20	−0.19	0.12	[−0.43, 0.05]	.121

The moderation analyses (Table 5, figure 2) were conducted to examine the moderating effects of Childhood Trauma, Shame, and Alexithymia on the treatment outcomes. The results for Childhood Trauma found a statistically significant interaction term (Treatment × CTQ), with a coefficient of −0.42 (SE = 0.16), revealing that Childhood Trauma moderated the treatment-outcome relationship. This result indicates that treatment had a greater effect for those who had higher levels of Childhood Trauma (95% CI: [−0.74, −0.10], p = .012). Similarly, the moderating effect of Shame was determined by an interaction term (Treatment × SHI), which also found to be statistically significant (coefficient = −0.38, SE = 0.14). This serves as a measure of the moderating effects of Shame on the treatment-outcome relationships. For those individuals who have higher levels of Shame, the treatment is expected to have a greater effect (95% CI: [−0.66, −0.10], p = .008). Alternatively, for Alexithymia, the interaction term (Treatment × TAS-20) was not statistically significant (coefficient = −0.19, SE = 0.12), indicating that there is no moderating effect of Alexithymia on the treatment-outcome relationships. Specifically, individuals with higher scores on the TAS-20 (95% CI: [−0.43, 0.05], p = .121) are not impacted by the treatment as significantly.



Discussion

The findings of the study lend additional support that treatment using culturally tailored Dialectical Behavioral Therapy (DBT-FND) is beneficial for Pakistani Women suffering from the condition known as Functional Neurological Disorder (FND). Significant improvements were observed on all primary outcomes measured by: Emotional Regulation (DERS); Severity of Functional Neurological Symptoms (PMDRS), and Symptoms of Functional Neurological Disorder (SOMS-7) with an average effect size of 1.09-1.42 compared to baseline. These findings are consistent with the previous literature which suggests that therapy focusing explicitly on addressing emotional dysregulation is especially important for people who have been subjected to either childhood trauma, chronic stress, or trauma related to their gender (Sansakorn et al., 2024).

The secondary outcomes reveal the breadth of the impact of this intervention. Participants receiving Dialectical Behavior Therapy for Functional Neurological Disorder had significant reductions in symptoms of depression, anxiety and post-traumatic stress disorder, as well as significant improvement in disability and quality of life. This last outcome is particularly relevant in a low-resource collectivist culture, where women with Functional Neurological Disorder frequently face social isolation, a burden on family, and stigma as "hysterics" or "possessed." In addition, the 71.7% reliable clinical change on motor symptoms is comparable with physiotherapy-based interventions (Ahmed et al., 2023), demonstrating that many patients experience meaningful functional recovery (Sarfraz et al., 2022).

The mediation analysis indicated that the improvement in emotional regulation explains the total reduction in functional neurological disorder (FND) symptoms, Supporting the theoretical premise that FND is a somatic representation of dysregulated or unprocessed emotions (Fang & Iqra Mushtaque, 2024). The results of this study support a neurobiological model, which posits that there is a disruption between the limbic and prefrontal systems in patients with FND (Sawangchai

et al., 2022), thereby reinforcing the rationale for developing targeted psychological interventions that are focused on addressing the mechanisms of FND.

The results of the moderation analysis showed an interesting pattern, with women who had the severe experience of childhood trauma and shame benefitting the most from DBT-FND treatment. This pattern of increasing dose response aligns with the original research base on DBT for treating both borderline personality disorder and Complex PTSD (Linehan et al., 2015) and indicates that this subgroup of patients with FND might benefit from more targeted interventions focused on developmental trauma (Mushtaque et al., 2021), a group that has not responded well to traditional treatment models like CBT or physiotherapy in the past.

Making adaptations for the culture of the population served by the project were important in determining the feasibility and acceptability of the intervention. Integrating the Islamic concepts of sabr (patient perseverance) and tawakkul (trust in God) with the mindfulness and radical acceptance exercises, providing written materials in Urdu, and including a family psychoeducation session were among the adaptations that contributed to the low stigma and dropout rates of 6.5%, which is significantly lower than the dropout rates from Western trials of psychotherapy for functional neurological disorders, which report rates of 10% to 25%. Emphasis on the need to ensure cultural congruence when implementing evidence-based treatment in non-Western low- and middle-income countries further illustrates the need for implementing evidence-based treatments in non-Western low-income and middle-income countries.

Limitations

There are a few limitations associated with the waiting list rather than an active control condition. Due to this limitation, it is not possible to determine whether the results were influenced by the specific effects of DBT skills or non-specific factors related to therapy. Future research should follow patients longer than three months; also, future studies should include male patients and rural locations. However, based on the large effect sizes and low attrition, the results show that, for this underserved and very disabled group of individuals, DBT-FND appears to be a good initial large-scale intervention.

Implications

The findings indicate that culturally adapted Dialectical Behavior Therapy (DBT-FND) can help improve emotional regulation and reduce symptom severity in females diagnosed with Functional Neurological Disorder (FND). Due to the increased prevalence of trauma and shame related to FND, especially in women, these results show that DBT-FND has the potential to be particularly effective. Furthermore, the evidence highlights the significance of culturally adapting psychological therapies, particularly in LMICs such as Pakistan, where stigma and gender-related stressors are pervasive. The findings also support the notion that emotional dysregulation may act as a fundamental contributing factor to the onset and persistence of symptoms of FND, while also confirming that DBT-FND is feasible and acceptable as evidenced by the low dropout rate (6.5%) and its possible use as an effective and widely scaled treatment option for females in similar cultural and socio-economic environments.

Conclusion

Based on available evidence, it appears that DBT-FND is an effective culturally tailored treatment strategy for women with Functional Neurological Disorder (FND). Evidence also supports the hypothesis that DBT-FND provides a large effect size in terms of increasing emotional regulation abilities, decreasing emotional symptoms and increasing Quality of Life for both Women and Men

who have been diagnosed with FND. There have been significant clinical improvements seen in mental health symptoms such as depression, anxiety and PTSD. Furthermore, there was a positive correlation between the amount of trauma experienced during childhood and DBT responses from female participants who had experienced a higher level of trauma; suggesting that the presence of traumatic childhood experiences, and therefore shame associated with them, has an impact on response to treatments.

Abbreviations

Abbreviation	Full Form
CTQ	Childhood Trauma Questionnaire
DBT	Dialectical Behavior Therapy
DBT-FND	Dialectical Behavior Therapy adapted for Functional Neurological Disorder
DERS	Difficulties in Emotion Regulation Scale
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, 5th Edition
FND	Functional Neurological Disorder
GAD-7	Generalized Anxiety Disorder-7
LMIC	Low- and Middle-Income Country
PCL-5	PTSD Checklist for DSM-5
PHQ-9	Patient Health Questionnaire-9
PMDRS	Psychogenic Movement Disorders Rating Scale
PTSD	Post-Traumatic Stress Disorder
QoL	Quality of Life
RCT	Randomized Controlled Trial
SHI	Shame and Humiliation Inventory (or relevant shame scale used)
SOMS-7	Screening for Somatoform Symptoms-7
TAS-20	Toronto Alexithymia Scale-20
WHODAS 2.0	WHO Disability Assessment Schedule 2.0
WHOQOL-BREF	World Health Organization Quality of Life Scale – Brief Version

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