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# UNMASKING THE MIND: NEUROPSYCHOLOGICAL PROFILES AND EMOTIONAL REGULATION IN FUNCTIONAL NEUROLOGICAL DISORDER AND EPILEPSY

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**Article Info**



**Abstract**

**Purpose:**The current study aimed to investigate the neuropsychological profiles and emotional regulation strategies employed by individuals with functional neurological disorder (FND) and epilepsy.

**Method:** Using correlational research design, purposive sampling strategy was used and the sample comprised of (N=220). A neuropsychological battery Pakistani named Neuropsychological Test Assessment Battery (PANTAB: Fatima & Zubair, in process) and Emotional Regulation Questionnaire (ERQ: Gross & John, 2003) was used.

**Findings:** T test analysis revealed individuals with FND scored higher on PANTAB subscales as compared to those with epilepsy, suggest higher neuropsychological functioning. Findings revealed significant correlations between PANTAB subscales and emotional regulation subscales. Overall, orientation, executive functioning, memory and attention & concentration showed a positive correlation with cognitive reappraisal, while language and visuo-spatial & perceptual abilities showed nonsignificant relationship with cognitive reappraisal. Furthermore, analysis revealed that individuals with epilepsy scored more on cognitive reappraisal meanwhile, individuals with FND exhibited greater tendency towards emotional suppression.

**Research Limitations/Implications:** Due to time constraints, a cross-sectional study was conducted, neglecting the importance of a longitudinal study, which could have provided a more in-depth understanding of the phenomenon. Future prospective studies could offer a more enriched comparison between the studied populations, especially if an experimental study with therapeutic interventions were to be conducted. Despite the shortcoming the current research fill the gap in the Pakistani literature regarding the neuropsychological profiling of individuals with FND and epilepsy.

**Originality/Value:** This article adds to the expanding body of research into the topic of neuropsychological profiling and emotional regulation in individuals with epilepsy and functional neurological disorder.

**Keywords:**
*functional neurological disorder, emotional regulation, neuropsychological functioning, seizures, cognitive reappraisal, suppression, epilepsy.*

## Introduction

Neuropsychology is the branch of psychology that deals with the brain functioning and its connection with the observable behavior (Beamount, 2008). It emphases on the ways in which brain areas and its functions affect emotions, cognitive ability and behavior (Bradshaw & Mattingley, 2013). Neuropsychological evaluation focused on evaluating executive functioning of the brain including language and communication abilities, memory, learning, attention and concentration (Reichenberg, 2010). Moreover, neuropsychological profiling provides a structured approach to measure the intricate patterns of psychological symptoms and cognitive discrepancies connected with epilepsy, and similar problems.

Functional Neurological Symptom Disorder was conceptualized as a conversion disorder (American Psychiatric Association, 2022), a term popularized by Freud in which underlying traumatic stress and other mental health symptoms are transformed (or converted) into physical/neurological manifestations (Zepf, 2015). Functional Neurological Symptom Disorder (DSM 5-TR) is described as a psychasthenia in which symptoms and signs involving voluntary motor or sensory function cannot be accounted by a primary neurological or medical condition (Ballmaier & Schmidt 2005). Psychiatric illness in which signs and symptoms affect voluntary, sensory and motor functions cannot be explained by a general medical condition or neurological condition (Ballmaier & Schmidt 2005). FND is linked to more mental comorbidities but are just as incapacitating as those caused by diseases involving structural or physiological abnormalities (Grey et al., 2020). Motor symptoms include weakness or paralysis, abnormal gait or posture, tremors, and abnormal movements e.g. jerking (Carson et al., 2016). Motor symptoms can mimic strokes but do not reveal underlying damage. Sensory symptoms include numbness or tingling, blurred vision, double vision, or sudden blindness in one or both eyes, despite a lack of organic eye pathology. Visual symptoms include blurred vision, double vision, or sudden blindness in one or both eyes, despite a lack of organic eye pathology. Pain is chronic, unexplained pain in areas such as the head, back, or limbs, without a clear physical origin (Stone et al., 2020).

FND patients frequently exhibit overlapping neurological, psychological manifestations. clinicians assess emotional control, cognitive function and neurological symptoms using an integrated strategy. Attentional biases towards symptoms associated with illness or increased vigilance of the body's signals are characteristic of FND individuals. These cognitive biases may in fact lead to heightened awareness of symptoms and their maintenance (Pick et al., 2007). Several authors have pointed out that neuropsychological testing of FND patients provides evidence of mild cognitive dysfunction especially learning (Demir et al., 2013), auditory and verbal memory (Brown et al., 2014) attention (Brown et al. 2014; Kozlowska et al., 2015; Taycan & Etikan, 2013). These deficits might be due to primary psychological pathology or neurobiological abnormalities (Voon et al., 2010). There are often dissociative symptoms like depersonalization or derealization due to which there is disturbance in consciousness and self-awareness in FND. Such processes may be involved in the experience of conversion symptoms (Carson et al., 2000).

Epilepsy is the most common serious neurological disease that causes recurring, unprovoked seizures. The incidence is about 50/100,000 per cases a year in developed societies and 100-190/100,000 in developing countries (MacDonald et al., 2000; Sander & Shorvon, 1996). The condition can come with physical, psychological and social impacts to the affected patient or impose threats of injuries, reduced brain function and even death (Christian Vollmar, 2015). The symptom-based prevalence of epilepsy in Pakistan is estimated as 9.99/1000 population. It is most common with patients aged 30 years and below. Most cases of epilepsy recorded in rural areas due to delayed diagnosis, limited access to treatment, and the persistence of avoidable risk factors such as trauma, infections, and prenatal problems. Health disparities may be made worse by socioeconomic constraints, which also lead to underreporting and poor 16 management in these areas (Shan et al., 2024).

A seizure is considered as a paroxysmal change in electrical cerebral function due to the phenomenon of hypersynchronous neuronal discharge. Whereas "epileptic seizure" refers to the convulsion arising from

a pathological phenomenon in neurons, the term psychogenic seizure refers to a non-epileptic event that imitates a seizure. Epilepsy is a disease of recurrent seizures which manifest impaired cerebral function (Shorvon et al., 2011). Epilepsy affects all the aspects of cognitive abilities including memory, attention, language, and the ability to plan and solve problems (Kwan & Brodie, 2001). It is therefore clear that these cognitive impairments can be different based on the type of seizures, frequency, and age of onset (Helmstaedter & Witt, 2017). Patients with epilepsy, many have memory problems especially in the aspects of short-term memory or memory of episodes (episodic memory) or in the ability to learn new material either verbally or in pictures (verbal and visual memory). These memory disturbances can affect the day-to-day functionality as well as life satisfaction (Baxendale & Thompson, 2012). Literature has shown that epilepsy causes behavioral changes and deficits in emotional regulation. These are symptoms such as rapid mood swings, irritation or outburst of aggression, anxiety, depression and so on (Brodie, 2016). These problems can be related to epilepsy or develop because of the psychosocial consequences of having a chronic neurological disorder (Reilly et al., 2015).

Executive functions such as planning, executing actions, making decisions, and adapting to new situations may be affected by epilepsy. In this case, executive dysfunction may present with problems on planning, solving problems, arranging tasks and even controlling the response (Helmstaedter & Witt, 2017). Epilepsy is associated with executive dysfunction, but the results are conflicting. It is also important to establish at this point that epilepsy can also impact on the language aspects such as fluency, understanding, and oral expression. Deficits may be observed in spoken and written expression, thus affecting academic and work-related endeavors (Baxendale & Thompson, 2010).

Researches suggests that neuropsychological changes in epilepsy patients are more limited to memory and/or language or are more general in nature (Hermann et al., 2007; Reyes et al., 2020). In epilepsy, neuropsychological evaluation helps in understanding the effects of antiepileptic medications, recurrent seizures and potential structural brain irregularities on cognitive domains such as attention, memory and executive functioning (Hermann et al., 2006).

Emotion regulation is the ability to control reactions to specific emotional outcomes in a way that avoids psychological impairment (Campbell-Sills & Barlow, 2007). The severity of alexithymia in FND patients without other psychiatric disease is higher than that of healthy individuals (Gulpek et al., 2014). FND patients are likely to have emotional dysregulation could be useful when evaluating their psychological well-being in order to choose the most effective type of therapy for them. Furthermore, in FND, attachment patterns and maladaptive childhood experiences in family-related environments that yield somatization tendencies are responsible for emotional dysregulation (Ludwig et al., 2018). In other words, individuals who have not learnt how to deal with their particular mood states and disadvantaged as individuals when it comes to modulating these moods in case of tension or stress. This is why attachment patterns have been thought to be relevant in individuals with psychogenic nonepileptic seizures (Jungilligen et al., 2022). With reference to epilepsy, Arani et al. (2021) revealed in his research that epileptic patients are more likely to experience emotion dysregulation and employed more negative cognitive emotional regulation strategies than healthy subjects. Similar findings were reported by other researchers that that people with epilepsy showed more inclination towards sadness, anxiousness and angry mood (Bazarnik, 2018, Wolf et al., 2015).

Previous researches have revealed scarcity of researches comparing and contrasting the neuropsychological profiling and emotional regulation patterns between individuals with FND and those with epilepsy (Reuber & Elger 2003). So, this study aimed to address the gap by comparing neuropsychological profiling and emotional regulation patterns among individuals with functional neurological disorders and epilepsy. By offering a thorough knowledge this study will help clinicians to develop better diagnostic tools and treatment protocols that account for shared and unique characteristics of FND and epilepsy. The current study hypothesized that there was likely a difference in neuropsychological profile of individuals with FND and epilepsy. Secondly, It was hypothesized that was

likely a significant positive correlation between neuropsychological functioning and emotional regulation in patients with FND and epilepsy.

**Method**

Individuals with epilepsy and functional neurological disorder were taken. Purposive sampling was used and total sample was N=220 (110 epilepsy and 110 FND diagnosed individuals) from different hospitals in Lahore. Cross-sectional design was used to explore the relationship between neuropsychological functioning and emotional regulation in individuals with epilepsy and FND. The key variables were measured with standardized scales named as Emotional Regulation Questionnaire (Gross & John, 2003) and Pakistani Neuropsychological Test Assessment Battery (PANTAB: Fatima & Zubair, in process).

**Results**

**Table 1 Descriptive and Reliability Analysis of Emotional Regulation (N = 220)**

| Variables | K | (α) | M (SD) | Range | |
|---|---|---|---|---|---|
| | | | | Actual | Observed |
| Cognitive Reappraisal | 6 | .70 | 22.25 (6.24) | 6-42 | 7-38 |
| Suppression | 4 | .73 | 16.51 (4.55) | 4-28 | 6-27 |

*Note: k= total number of items, a= Cronbach alpha, M= Mean, SD=Standard Deviation*

Findings revealed that internal consistency of both scales is supported by their reasonable reliability, which indicates that the items consistently assess the desired constructs. the results indicate that participants employ both cognitive reappraisal and suppression to control their emotions.

**Table 2 Descriptive Statistics of the Demographic Characteristics of the Sample (N=220)**

| Variables | *M* | *SD* | *F* | *%* |
|---|---|---|---|---|
| Age | 26.11 | 5.124 | | |
| Gender | | | | |
| Male | | | 110 | 50 |
| Female | | | 110 | 50 |
| Education | | | | |
| Matric | | | 17 | 8 |
| Intermediate | | | 86 | 39 |
| Bachelors | | | 79 | 36 |
| Masters | | | 38 | 17 |

| | | |
|---|---|---|
| Socioeconomic status | | |
| Lower class | 105 | 48 |
| Middle class | 90 | 41 |
| Upper class | 25 | 11 |
| Marital status | | |
| Married | 95 | 43 |
| Unmarried | 97 | 44 |
| Divorced | 28 | 13 |

*Note: M= mean, S. D=standard deviation, f=frequency; %=percentage*

**Table 3 Correlations among PANTAB (Orientation, Attention and Concentration, Language, Visuo-Spatial & Perceptual Abilities, Memory, Executive Functioning) and Emotional Regulation (Cognitive reappraisal, Suppression) (N = 220)**

| | Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ORI | 3.94 | .87 | | .57*** | .22** | .27*** | .42*** | .50** | .18** | -.13 | .67*** |
| 2 | A&C | 10.06 | 2.17 | | | .02 | .21** | .36*** | .30*** | .32*** | -.23** | .59*** |
| 3 | Language | 12.95 | 1.71 | | | | .36*** | .33*** | .29*** | .02 | .01 | .54*** |
| 4 | VS | 20.09 | 2.86 | | | | | .39*** | .27*** | .13 | -.19** | .69*** |
| 5 | Memory | 8.54 | 1.64 | | | | | | .37*** | .22** | -.12 | .69*** |
| 6 | EF | 17.23 | 3.03 | | | | | | | .22*** | -.10 | .73*** |
| 7 | CR | 22.25 | 6.24 | | | | | | | | .28*** | .20** |
| 8 | SUP | 16.51 | 4.56 | | | | | | | | | -.33*** |
| 9 | PANTAB | 72.80 | 8.13 | | | | | | | | | |

*Note: ORI= orientation, A&C= Attention and Concentration, VS=Visuo-Spatial & Perceptual Abilities, EF=Executive Functioning, CR=Cognitive Reappraisal, SUP=Suppression. *p <.05, **p<.01, ***p <.00*

Table 3 showed significant correlations between PANTAB subscales and emotional regulation subscales. PANTAB subscales including orientation, executive functioning, memory, attention & concentration showed a positive correlation with cognitive reappraisal. Moreover, PANTAB subscales including orientation, executive functioning, memory, attention & concentration and visuo-spatial & perceptual abilities revealed negative correlation with emotional suppression.

**Table 4 T-test analysis to find out the difference between Neuropsychological Profile and Emotional Regulation in Individuals with FND and Epilepsy (N = 220)**

| | FND ($n$ = 110) | | epilepsy ($n$ = 110) | | | Cohen's $d$ |
|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *T (218)* | |
| Orientation | 4.0 | .94 | 3.08 | .79 | .93 | 0.13 |
| A & C | 9.96 | 2.32 | 10.2 | 2.02 | .67 | 0.11 |
| Language | 13.55 | 1.63 | 12.35 | 1.57 | 5.55 | 0.74 |
| Visuo-spatial | 20.64 | 3.40 | 19.54 | 2.07 | 2.89 | 0.39 |
| Memory | 8.69 | 1.77 | 8.39 | 1.50 | 1.36 | 0.18 |
| E. F | 17.52 | 3.08 | 16.94 | 2.96 | 1.43 | 0.19 |
| PANTAB | 75.0 | 8.99 | 71.20 | 6.86 | 2.87 | 0.38 |
| C.R | 20.44 | 6.42 | 24.06 | 5.52 | -4.49*** | 0.60 |
| SUP | 17.46 | 4.91 | 15.55 | 3.96 | 3.17** | 0.42 |

*Note: A&C= Attention and Concentration, Visuo-Spatial= Visuo-Spatial & Perceptual Abilities, EF=Executive Functioning, CR=Cognitive Reappraisal, SUP=Suppression. *p <.05, **p<.01, ***p <.00*

Table 4 revealed that scores on PANTAB were higher in individuals with FND as compared to those with epilepsy which suggested better neuropsychological functioning in individuals with FND. Moreover, individuals with epilepsy practiced cognitive reappraisal strategy for emotional regulation. Meanwhile, emotional suppression was more common in individuals with FND.

**Discussion**

The aim of the study was to compare the neuropsychological profiles and emotional regulation in individuals with FND and epilepsy. It was also hypothesized that there was likely a difference in neuropsychological profile between individuals with FND and epilepsy. Results of the study showed that there was significant difference in neuropsychological functioning of individuals with FND and epilepsy. The findings are aligned with previous findings comparing neuropsychological functioning between epileptic patients and psychogenic non-epileptic seizures, while FND showed better neuropsychological functioning (Al-Omari et al., 2023; Karaaslan & Hamamcı, 2020). The findings can also be justified by the fact that both conditions have different causes. As in FND revealed no structural damage whereas, in epilepsy abnormal neuronal fieriness and synchronization occurs due to genetic or structural damages. In order words, epileptic seizure activities cause neuronal damage over time, leading to progressive cognitive impairment.

Another reason of having difference in neuropsychological profile can also attribute to emotional and psychological factors. FND is strongly linked to trauma, psychological stressors and unconsciousness motives (Blitzstein, 2008; Strachey & Freud, 1962). epilepsy is clearly linked to genetic factors,

developmental brain abnormalities, infection, traumatic brain injury (TBI), stroke, brain tumors, or other identifiable problems (Chauvette et al., 2015). Moreover, in epilepsy psychiatric comorbidities (e.g., depression, anxiety) are often result from disease burden rather than being a primary driver of symptoms (Mula et al., 2021)

The findings also revealed that cognitive reappraisal strategy positively and suppression strategy negatively related to the neuropsychological functioning. Furthermore, the individuals with epilepsy were practicing more cognitive reappraisal strategy whereas, individuals with FND practice suppression strategy to regulate their emotions. Similar findings were reported by literature (Kienle et al., 2018; Scorza et al., 2014). The major reason behind this is that the FND is a condition in which the brain circuits that are majorly responsible for emotion regulation get impaired. As a result, FND patients opts maladaptive strategies to regulate their emotions.

**Conclusion**

The study concluded that the individuals with FND and epilepsy had significant difference in neuropsychological functioning. Individuals with FND revealed better neuropsychological functioning as compared to individuals with epilepsy. Furthermore, analysis revealed that individuals with epilepsy practice cognitive reappraisal strategy to regulate their emotions meanwhile, individuals with FND exhibited greater tendency towards emotional suppression strategies.

**Implications and Recommendations**

This study has given the insight in understanding the neuropsychological profiling and emotion regulation in individuals with functional neurological symptom disorder and epilepsy however, the current researcher recommends to replicate this study with longitudinal research so that more enriched information can be extracted. The study may facilitate psychologists and mental health stakeholders to design interventions specific to the studied sample to improve their emotional regulation strategies.

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