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DOCTOR OF PHILOSOPHY

The Effect of Mindfulness-Based Intervention on Cognitive Function and Wellbeing of People with Mild Traumatic Brain Injury and Refugees with PTSD

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Award date:
2023

Awarding institution:
Bangor University

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The Effect of Mindfulness-Based Intervention on Cognitive Function and Wellbeing of People with Mild Traumatic Brain Injury and Refugees with PTSD

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The School of Medical and Health Sciences

March 2023

Thesis submitted to Bangor University in partial fulfilment for the degree of Doctor of Philosophy

Abstract

An increasing body of research suggests that mindfulness-based interventions (MBIs) are effective in the clinical population and improve cognitive function and well-being. Mindfulness is defined as a technique for developing the ability to be nonjudgmentally aware of what is happening in the present moment, and it consists of five components: observing, describing, acting with awareness, non-judging, and non-reactivity. Few studies in Arab societies have examined the link between MBI, attention network function, cognitive performance, and well-being in mild traumatic brain injury (mTBI) patients and refugees with post-traumatic stress disorder (PTSD) to date. The aim of this research was to address these critical gaps in knowledge and to provide a link between theoretical attention studies, clinical neuropsychological evaluations, and neuropsychological rehabilitation courses. Therefore, this thesis focuses on the role of mindfulness in improving attention and psychological well-being in Kuwaiti mTBI outpatients and Syrian refugees with PTSD in Turkey. This thesis has four main goals: (i) to evaluate neuropsychological assessments for patients with attention deficits, (ii) to evaluate the Arabic version of the Five Facet Mindfulness Questionnaire (FFMQ) long version and its effectiveness, (iii) to compare the impact of MBIs and cognitive behavioural therapy (CBT) on improving well-being and the attention system.

The research reviews existing research on attention, the attention network theory, attention processes, and attention in clinical populations, such as attention impairment in people with mTBI and refugees with PTSD. It reviews how neuropsychological assessments are used in people suffering from attention impairment. The research reviews the existing mindfulness-based research, such as the three elements of mindfulness model and mindfulness in the clinical population. The research details the pilot study of the normative

data from a computerised Arabic language version of the Stroop task for healthy students from Kuwait university (*N* = 90) using the PsyToolkit application. The results suggest that the Stroop test is appropriate for Arabic translation. The research presents the outcomes of a comparison of the effects of a MBIs and standard CBT on the performance of Syrian refugees with PTSD (*N* = 20) and healthy control participants (*N* = 17) using the Stroop test. Following the intervention, both groups (PTSD refugees and healthy controls) performed better in the main test of interference effects of the Stroop task. The research compares the impact of an MBI and standard CBT on Stroop task performance in patients with mTBI (*N* = 19). The results of this study indicated that the patients with mTBI who received MBI and CBT performed significantly better after intervention in both the vocal and hand Stroop tasks. The effects of MBI and CBT on performance in standard neuropsychological assessments in patients with PTSD (*N* = 20) and healthy controls (*N* = 17) is presented in. The findings of this study indicate that both interventions improved performance in all assessments for both refugees with PTSD and healthy participants, with no significant differences. The research discusses psychological assessments using General Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire -9 (PHQ-9) before and after intervention in patients with mTBI (*N* = 19). Following intervention, the participants' scores on the anxiety (GAD-7) and depression (PHQ-9) scales improved in both groups. The FFMQ is used to assess the impact of these interventions on mindfulness in healthy individuals (*N* = 17), refugees with PTSD (*N* = 20), and mTBI patients (*N* = 19). The outcomes of this study indicate that there is no significant difference in the overall mean responses to the FFMQ among the participants (patients with mTBI, refugees with PTSD, and healthy controls) between the MBI and CBT groups in both the pre- and post-intervention phases. The findings and general discussion of the research are presented, including the limitations of the study, and suggestions are made for further research in this field.

The current thesis suggests that dispositional mindfulness may improve neurocognition and well-being in clinical populations, such as patients with mTBI in Kuwait and refugees with PTSD in Turkey. This is the first study to evaluate at the effectiveness of mindfulness interventions in the neuropsychological field in Kuwaiti hospitals, and it established a strong case for more research into this promising intervention.

Declaration and Consent

I hereby declare that this thesis is the results of my own investigations, except where otherwise stated. All other sources are acknowledged by bibliographic references. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless, as agreed by the University, for approved dual awards.

I confirm that I am submitting this work with the agreement of my Supervisor(s).'

Dr Martyn Bracewell

Yr wyf drwy hyn yn datgan mai canlyniad fy ymchwil fy hun yw'r thesis hwn, ac eithrio lle nodir yn wahanol. Caiff ffynonellau eraill eu cydnabod gan droednodiadau yn rhoi cyfeiriadau eglur. Nid yw sylwedd y gwaith hwn wedi cael ei dderbyn o'r blaen ar gyfer unrhyw radd, ac nid yw'n cael ei gyflwyno ar yr un pryd mewn ymgeisiaeth am unrhyw radd oni bai ei fod, fel y cytunwyd gan y Brifysgol, am gymwysterau deuol cymeradwy.

Rwy'n cadarnhau fy mod yn cyflwyno'r gwaith hwn gyda chytundeb fy Ngoruchwyliwr (Goruchwylwyr)

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Abbreviations

MBI	Mindfulness-Based Interventions
MAAS	Mindful Attention Awareness Scale
FMI	Freiburg Mindfulness Inventory
KIMS	Kentucky Inventory of Mindfulness Skills
FFMQ	Five Facet Mindfulness Questionnaire
FFMQ-SF	Five Facet Mindfulness Questionnaire Short - Form
GAD	Generalised Anxiety Disorder
PHQ	Patient Health Questionnaire
mTBI	Mild Traumatic Brian Injury
MBCT	Mindfulness-Based Cognitive Therapy
MBSR	Mindfulness-Based Stress Reduction
CBT	Cognitive Behavioural Therapy
ANT	Attention Network Theory
PTSD	Post Traumatic Stress Disorder
TMT	Trail Making Test
GCS	Glasgow Coma Scale
PTA	Posttraumatic amnesia
ACT	Acceptance and Commitment Therapy
DBT	Dialectical Behaviour Therapy
SMQ	Southampton Mindfulness Questionnaire
CAMS	Cognitive and Affective Mindfulness Scale

Dedication

I dedicate the findings of this research to the soul of my cousin Haya Al Saleh, who has always been a strong supporter of me, and whom I wish could see my achievements.

Acknowledgements

I would like to express my gratitude to my supervisors, Dr Martyn Bracewell, Dr Rudi Coetzer, and co-supervisor Dr Abdullah Al Ozairi. They have helped me through my PhD journey by sharing their knowledge and providing me with guidance, and have done this with kindness and patience. They have enriched my life experiences immensely - Thank you. I would like to thank Dr Dusana Dorjee for encouraging me to complete the scientific research process, as well as Prof. Rebecca Crane for her unwavering support. I would also like to express my gratitude to Prof Mark Williams for taking the time to go over the study design with me. In addition, I would like to show my thankfulness to my colleagues Eng. Abdullah Almahous, for his initial follow-up on the technical side and for helping to resolve difficulties, the therapist Ahmed Al-Mutairi for his participation in the research and his helped throughout the collection of data. I also appreciate the support and assistance provide by Dr Fadhel Khashawi, Dr Ben Pariss, Dr Mamdouh Alenazi, Dr Lamia Al-Sarraf, and the technical assistant Mr George Paul.

I would also like to thank Dr Rashid Al-Sahel, Mr Ahmed Al-Hafiz, the Mind Clinic Center and the Amiri Hospital in Kuwait as well as Ataa Humanitarian Relief Association in Turkey for allowing the use of their halls for training participants. I would also like to express my gratitude to the participants; this study would not have been feasible without their willingness to volunteer their time for the research, and big thanks goes to all the friends who accompanied me during the years of scientific research, starting from Kuwait, and to friends from various countries around the world. Your knowledge is a gift and I am honoured that you have been generous enough to share it with me. Finally, I would like to express my great gratitude to my family, to my mindful father who believed in me, and to my mother who eased my difficulties, to my husband for his support, and to my brothers, sisters, and their

children. Their presence in my life is a great blessing, through them, I have realised the value of family, and that love makes everything possible.

Chapter 1: Introduction

Impairment of Attention in Persons with Mild Traumatic Brain Injury and Refugees with Post-Traumatic Stress Disorder

Introduction

‘What holds attention determines action’.

(James, 1890)

This chapter summarises prior attention research and theories, such as the attention network theory (ANT), and the alerting, orienting, and executive control networks. This chapter covers attention mechanisms, attention in neuroscience, and clinical populations, including attention impairment in people with mild traumatic brain injury (mTBI) and refugees with post-traumatic stress disorder (PTSD) in Arab societies, namely Kuwait. It also briefly provides examples of treatment strategies for patients with attention deficits. In addition, this chapter identified gaps in the knowledge and compares findings from prior studies to better understand the problem and contribute to the growth of this scientific field as a framework for practical applications and to address the problem. At the end of this chapter, previous studies in the field of neuropsychological assessments and the role of rehabilitation programmes in helping patients overcome difficulties are highlighted.

1.1 Overview

Throughout history, defining attention has represented a significant challenge. In 370 BC, Aristotle described attention as a narrowing of the senses; centuries later, in 1890, William James contended that ‘everyone knows what attention is. Taking possession of the mind is a clear and vivid form of one out of what seem several simultaneous objects or trains of thought’. Even though James' understanding of attention was largely based on subjective perceptions and objected to trains of thinking, he noted that attention plays a significant explanatory role in the development of behaviour.

Donald Broadbent returned to his goal of discovering attentional mechanisms after the Second World War (Broadbent, 1958). Using the formal information theory, he likened attention to a filter; he suggested that attention was determined by the information between limited-capacity perceptual systems and parallel sensory systems (Broadbent, 1958). This view of the limitations of dealing with different signals during practical tasks has been criticised. When psychology progressed towards the study of cognitive processes, new objective methods enabled investigation of the selection process. For example, the premotor theory holds that attention is the preparation for a response or a selection of the objective intended by an activity (Craighero et al., 2002). The emphasis on a premotor response could be applied to both near space and space beyond reach. Consequently, intended activities are not exclusively sources of attentional selection and capacity limits. Even when there is no intent to act and watch scenes pass by (e.g., at movies), people will select the subset of information that reaches their senses. Other views interpret attention from a perspective of selection or limitation.

Attentional limits are often observed in unpractised activities; however, with practice, several attention-demanding activities can be performed independent of attention. One example is the search for specific letters within random letters. This activity necessitates attention, and the number of items in the display governs the time spent searching. However, after several weeks of practice, the slopes become flattened (Schneider & Shiffrin, 1977; Spelke et al., 1976). This is central to the investigation of the essence of selective visual attention when we search for a single object (target) in a crowded scene with several other objects (distractors). According to the classical theories of selective attention, visual searching requires two phases or modes of processing: a parallel, preattentive, and capacity-unlimited stage in which all visual items are processed to extract a search-guiding ‘master’ or ‘salience’ map, and a capacity-limited stage in which all visual items are processed to extract a search-guiding master or salience map. At a serial, capacity-limited level, focal attention is serially allocated to locations flagged on the salience map to classify selected items (Treisman, 1988; Treisman & Gelade, 1980; Wolfe, 1994). These examples of attentional limit theories can account for how these limits may be removed when the blockage is bypassed and the correct task is performed effortlessly.

1.2 Attention in Psychology Theories

Psychological attention theories are usually concerned with behavioural goals, like finding an object with specific features (Treisman & Gelade, 1980; Wolfe, 1994) or in a specific location (Eriksen & Hoofman, 1974; Posner, 1980) and responding to them in a suitable manner (Hommel, 2000). This type of selection is termed goal-driven and is endogenous to top-down or internal signals, which guide perception through dynamic interactions with bottom-up or sensory information. For example, the biased-competition framework of attention suggests that objects in visual scenes compete for access to short-term memory, and that this competition is biased by top-down signals that promote behavioural access in relevant objects (Desimone & Duncan, 1995). These top-down signals are characterised as working memories (e.g., Downing, 2000; Woodman & Luck, 2007), long-term memories (Moores et al., 2003), or action-related memories (Craighero et al., 2002; Rosenbaum, 2009).

1.2.1 Attention and Perception

Attention might not fully explain perceptual processes as there is a great deal that awareness cannot manage (Raz, 2004; Raz et al., 2004). For example, while moving to locations, attention may give high priority to a specific location (targets, which appear to be perceived rapidly and with lower thresholds). Nevertheless, attention may not be a substitute for acuity offered by the fovea. Because the fovea is essential for high-acuity vision, the time costs of reaction for unexpected foveal stimuli are important for an unexpected peripheral event. Therefore, visual attention affects procession, or priority preference, modulates top-down control and sensory processing (Minissi et al., 2022), and may influence accommodation. Compared with the unattended stimulus, the reaction time to attended stimuli is often used as a measure of attention and a way of speeding up attended stimuli.

Single neurons in extrastriate visual locations increased their firing rates to attended stimuli 90 ms after visual presentation (Minissi et al., 2022). Even though performance may be improved by increased attentional investments, there is no consensus regarding the effect that orienting attention has on a sensory stimulus.

The psychophysics literature offers reliable information on how visual thresholds relate to attentional investment. Several studies have shown that enhancement of visual acuity does not produce altered thresholds for better reaction times, detection, or performance. While acuity requires better detection thresholds, detail and reaction time may involve the summation of luminance that might conceal detail (Minissi et al., 2022). While investing in attention is often correlated with looking directly at a location of interest, covert attention is the capability of granting such information processing without eye movement. The following section describes the theories upon which this research is based, namely the theory of attentional networks. Posner and Petersen (1990) argued that there are three basic elements of the attention system—alerting, orienting, and executive control—and the attention process depends on these three elements.

1.2.2 Theory of Human Attentional Networks

Posner and Petersen (1990) suggested a conceptual model of human attention and its anatomical basis. The critical elements of the framework include alerting, orientation, and executive control. These elements have unique functions that are essential to at least three attentional networks that interact with each other in mind, each having unique neuroanatomy and neurochemistry. Raz (2004), Raz and Buhle (2006), Hopfinger et al. (2000), Fan et al. (2001, 2003, 2005), Tang et al. (2007), Corbetta and Shulman (2002), and Driver et al. (2005) performed imaging studies that confirmed the brain has three attentional networks. These studies confirmed long-held assumptions and provided supporting evidence for the functions of these anatomical systems. In general, most researchers agree that these three networks perform alerting, orientation, and executive control tasks. The following section elaborates on the functions of the three networks and their role in attention.

1.2.2.1 Alerting. To sustain human functioning, the brain naturally needs to be alert most of the time; however, there are instances when this is not the case, and the brain cannot achieve and maintain an optimally alert state. Researchers (e.g., Fan et al., 2003) have attempted to establish alertness by performing warning and performance tasks. These tasks aid in the study of the responsiveness of the brain to external stimuli. There are two types of warning signal tasks: exogenous, which can be triggered by auditory stimuli, and endogenous, which are tasks awaiting the processing of the expected target. Tasks involving continuous performance can either respond to an activity uninterruptedly or wait until they detect a weaker target (Raz, 2014), where the success depends on the ability of the participant to remain alert and to avoid distractions and interruptions that affect their concentration on target detection.

1.2.2.2 Orienting. The brain can filter items, select the most important ones, and disregard the others. Such capabilities result in selective visual attention that allows an individual to focus or gaze at an object of interest amidst the surrounding environment. Researchers have studied this phenomenon to understand the functioning of the brain and the factors contributing to such orientation towards items in the surroundings. Orienting is one of the most investigated attentional networks, and researchers have identified unique features that trigger the brain to focus on one item over another (Posner & Petersen, 1990; Posner et al., 1984). They identified three components that can inform such differences and are associated with distinct anatomical areas: disengagement, engagement, and movement (Posner & Petersen, 1990; Posner et al., 1984). The ability of the brain to shift attention from one item to another requires proper coordination of the three areas. Any impairments or difficulties in coordination affect the ability of an individual to shift their attention from one item to another.

1.2.2.3 Executive Control. An executive control network is part of a more comprehensive cognitive system of executive function (EF). EF is a concept that described cognitive processes in the brain that perform goal-directed behaviours (Botvinick et al., 2001; Miller & Cohen, 2001; Norman & Shallice, 1986; Shallice, 1982). Executive control is instrumental in conflict resolution, a process that requires suppressing automatic responses that interfere with the detection of the target (Ptak & Schnider, 2011). Brain networks function by coordinating different activities at the same time to achieve a desired outcome. Most of the control functions are closely connected to EFs, such as the control and coordination of activities for which the stimulus has not entirely determined the desired response (Norman & Shallice, 1986). Such actions include task switching, multitasking, resolving conflicts, detecting errors, and control of inhibitions (Shallice, 1982).

Brain functioning incorporates sub-functions that perform different activities, like working memory, planning, inhibition, and cognitive flexibility. Working memory is the ability of the brain to hold and manipulate information. Cognitive flexibility is the flexibility and efficiency of adapting to changing situations. Response inhibition focuses on the tendency to choose between different alternatives leading to an appropriate response to a desired behaviour and resisting an inappropriate one (Norman & Shallice, 1986). In the context of intense mental effort, neuroimaging data revealed activation of frontal regions associated with paying attention. The area of the anterior cingulate cortex (ACC) is constantly active during experimental tasks that require significant exertion, such as target identification or dispute resolution. As a result, the chosen network is a higher-level metacognitive attentional system concerned with the subjective perception of mental effort (Fernandez-Duque et al., 2000). The systems for monitoring and resolving conflict between thoughts, feelings, and responses comprise this type of supervisory or executive attention. These three network elements enable the brain to switch from one activity to another or perform different functions simultaneously. The events can occur simultaneously and depend extensively on the alertness of the brain and its ability to focus on selected tasks (Shallice, 1982).

1.3 Neuronal Processing

The human brain is made up of 86 billion neurons connected by 150 trillion synapses that allow neurons to communicate with one another via electrical or chemical signals (Azevedo et al., 2009; Pakkenberg et al., 2003). As neuroscientists seek to understand the information processing that underlies cognition, behaviour, and perception, studies on modelling the human brain as a complex system have increased (Bassett & Bullmore, 2006; Bullmore & Sporns, 2009; Craddock et al., 2013; Friston, 2011; He & Evans, 2010; Park & Friston, 2013; Reijneveld et al., 2007). Exploring the human brain from the perspective of connection patterns reveals crucial details about the brain's structural, functional, and causal organisation. Functional and effective connectivity have been the focus of computational studies in recent years (Friston, 1994, 2011; Farahani & Karwowski, 2018).

Neuromodulators affect the firing rates of excitatory and inhibitory neurons at the cellular level, leading to major changes in cognitive function, including awareness (Mitchell et al., 2007). Reduced firing rate variability decreases noise and enhances information, both of which are important for consciousness. Neuromodulators generated by brainstem neurons are required by important attention network areas of the brain (Bichot et al., 2015; Marder, 2012). Acetylcholine (ACh), dopamine (DA), noradrenaline (NA), and serotonin (5H-T) are all important neurotransmitters in higher cognitive processes (Thiele & Bellgrove, 2018). The newly activated attention network delivers feedback to the appropriate brainstem location, which causes the network to become more active (Munévar, 2020).

1.4 Neural Mechanisms and the Attentional Network System

The parts of the brain that deal with attention include distinct interconnected pathways that perform cognitive processes. Various methods have been used to assess the neural basis of these pathways, which have received substantial attention from researchers as they aim to elucidate the factors that affect attention. Researchers (e.g., Raz & Buhle, 2006) have employed techniques including positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). These two approaches revealed that there is no single brain area tasked with attention; instead, different areas combine to perform such operations (Corbetta & Shulman, 2002; Fan et al., 2003, 2005; Hopfinger et al., 2000; Posner & Rothbart, 2007; Raz, 2004; Raz & Buhle, 2006). The norepinephrine system in the locus coeruleus alerts the rest of the network.

Raz (2004) provided a detailed approach to understanding the functions of alerting, orientation, and executive control. Researchers have used different approaches to study executive control (Botvinick et al., 2001; Miller & Cohen, 2001). The findings of these studies are critical to understanding the functioning of the brain, including triggers of alertness and coordination of neural mechanisms. Three anatomical areas are thought to be responsible for orienting attention to a stimulus: the parietal lobes, which also perform the task of disengaging attentional focus from the current position or inhibition of return; the superior colliculus, which shifts the concentration to a different position; and the pulvinar, which reads information from the indexed position. The control complex is closely related to the ACC; it incorporates supplemental motor areas in the frontal lobes that are interconnected with the basal ganglia. The functions, structures, and chemical modular and neuroanatomical relations of the attentional networks involve proper coordination of activities (Posner et al., 2007).

1.5 Psychological Assessments

Psychological tasks are widely used to evaluate conflict detection, interference, and resolution. Some of the standard assessment methods for measuring these include the Stroop task (Stroop, 1935), which involves conflicts between word name and the colour of the ink, the Simon effect (Simon & Berbaum, 1990), which focuses on the location and direction of a response, and the flanker task (Eriksen & Hoofman, 1974) for identifying a stimulus. These three tasks can be either congruent, incongruent, or neutral. Studies show that latency and accuracy rates are higher in congruent than in incongruent trials due to the interference effects in the latter. The findings of such studies are instrumental to current and future research as they set a framework for future studies in which researchers can combine different tasks and targets to better understand congruence.

Some experiments combine more than two networks in a single task. Researchers investigating alerting and orienting combined the two using covert tests and varied conditions of alertness to determine change. Fernandez-Duque and Posner (1997) conducted such an experiment and found that orienting benefits from alerting. Similarly, Vivas and Fuentes

(2001) and Wei et al. (2006) explored the effects of cueing on conflict using a combination of the cueing paradigm and the Stroop task. They first presented the cue to attract attention and followed with a goal at a cued or un-cued target while asking the participants to react to the cued target. According to Klein (2000), reaction at the cued target was higher when the stimulus commencement asynchrony was 300 ms more than what was seen in the un-cued target. The outcome was attributed to an inhibition of return (IOR) effect, which can lead to reflexive prejudice in orienting and during visual searching of new locations.

Most studies focus on one or two elements of attention; however, two studies determined efficiency using three networks in a task. Robertson used the everyday test for attention (ETA) with ecological attentional measures, like map searching, listening to lottery numbers, and looking up phone directories (Robertson et al., 1996). Fan et al. (2002) formulated the attentional network task, which is one of the widely used activities for determining the efficiency of the three networks in a single experiment. Such studies present insight into the relationships between the three elements and their ability to network, affecting the attention of the participants. This study explored three network elements using different types of tasks; for example, it used the Stroop test to evaluate attentional control (Stroop, 1935), the coding and symbol search test from the Wechsler Scale (WAIS-IV) to evaluate attention shifting (Wechsler, 2008), and the trail making test (TMT) to evaluate orientation and concentration (Reitan, 1958). The researchers believe that using different forms of assessment is more reliable and prevents participants from being bored during testing, which might affect performance (Lezak & Thibodeau, 2016). The use of more than two tasks can be challenging; however, it allows researchers to unearth new knowledge and information to challenge long-held assumptions (Fan et al., 2002). Chapter two provides further information on neuropsychological assessments.

1.6 Classical Lesion Studies of Attention

Neurologists have long recognised the importance of the parietal cortex in spatially selective attention (Corbetta et al., 2008; Critchley, 1953; Mesulam, 1990; Riddoch et al., 2010). Separate regions of the parietal cortex, such as the intraparietal sulcus, have been implicated in healthy human subjects using more refined neuroanatomical techniques (Corbetta & Shulman, 2002; Hung et al., 2005; Molenberghs et al., 2007, 2008; Vandenberghe & Gillebert, 2009). In addition, other researchers stressed the role of the temporoparietal junction (Corbetta et al., 2000; Downar et al., 2000; Vossel et al., 2009) and the superior parietal lobule (Vandenberghe et al., 2001; Yantis et al., 2003) in attention processes, such as endogenous control (Corbetta & Shulman, 2002), spatial reorienting (Corbetta et al., 2008), and shifting attention (Vandenberghe et al., 2001; Yantis et al., 2003). In humans and nonhuman primates, the intraparietal sulcus is composed of functionally specialised regions (Gottlieb et al., 1998). The human intraparietal sulcus includes several visually responsive regions, including IPS0/V7, IPS1, and IPS2, with part of the visual field (Sheremata et al., 2010; Silver & Kastner, 2009). These areas are sensitive to the direction of attention (Bressler & Silver, 2010; Silver & Kastner, 2009; Vandenberghe & Gillebert, 2009).

1.7 Attention in the Clinical Population

There is debate surrounding the criteria for describing an ‘alteration throughout brain function’. Clinicians prefer hard diagnostic criteria, while surveillance studies aim to focus on a larger population to avoid missing possible new cases and to decrease the chance of underreporting. Self-reporting is often used to collect information on loss of consciousness (LOC), post-traumatic amnesia (PTA), and other alterations of consciousness (including confusion) in people with mTBI who present for care sometime after the injury (Zhu et al., 1999). Verification can be challenging; in the absence of LOC or PTA, the time of confusion or disorientation is considered part of an alteration of consciousness and may be used to formulate a diagnosis of mTBI. PTA or periods of confusion and disorientation have been associated with the majority of TBIs in sports and medical trauma settings (Zhu et al., 1999). In the absence of clinical or other witnesses, a comprehensive clinical interview is necessary for determining a TBI diagnosis. Furthermore, in the absence of some of the more objective criteria, such as LOC, PTA, or neurological deficits, the group felt strongly that a diagnosis of TBI should be considered when these symptoms are recorded (Zhu et al., 1999). Damage caused by a small, penetrating object, such as a dart or shotgun pellet, is the most obvious example; in these cases, there is brain damage, but there may be no accompanying complaints or health symptoms (Menon et al., 2010).

In contrast, mental symptoms may be triggered by several factors (e.g., pain, post-traumatic shock, medication, alcohol intoxication, and/or recreational substance use), and their appearance in isolation should not be regarded as conclusive evidence of TBI. The authors also discussed whether neuropsychiatric sequelae, such as depression, impulsivity, apathy, and anxiety, as a presenting symptom in later stages should be considered evidence for TBI (Menon et al., 2010).

1.7.1 Mild Traumatic Brain Injury

TBI often leads to behavioural impairments and persistent cognitive problems, such as executive dysfunction (Draper & Ponsford, 2008). mTBI is the most common type of TBI (Stuss & Alexander, 2007). People with mTBI usually have symptoms of dizziness, headache, fatigue, visual problems, sensitivity to light, inability to concentrate, and other impaired cognitive functions (Bryant & Harvey, 1998).

mTBI is any transient neurological dysfunction that results from biomechanical forces (Giza & Hovda, 2001) and is associated with subtle cognitive deficits in the first few weeks after the injury, which usually resolve between 3 to 6 months (Iverson, 2005; Bigler, 2008; Belanger et al., 2007). Although mTBI is not classically associated with visible lesions on scan or brain imaging, neuroimaging and neuropsychological studies can help predict short- and long-term cognitive impairment (Bigler, 2013; Chen et al., 2004; McCrea et al., 2013). Baseline and post-injury neurocognitive examination, ancillary evaluation (including balance testing), and symptom tracking procedures are currently being used to diagnose, monitor, and guide clinical treatment of sports concussions (McCrea et al., 2013; Pulsipher et al., 2011) and in people suffering from cognitive dysfunction following mTBI (Mayer et al., 2015).

1.7.1.1 Definition. Both the definition and diagnosis of TBI have evolved over time. One of the most used methods of stratifying TBI is the Glasgow Coma Scale (GCS). TBI is characterised as mild (13), moderate (9–12), or severe (3–8) using the GCS. Given that many pathologies with diverse clinical outcomes might result in a low GCS score on initial presentation, the GCS alone has limits in long-term prognostication (Jennett et al., 1976; Lobato et al., 1983). A patient with mTBI has a traumatically mediated physiological disturbance in their brain activity (Giza & Hovda, 2001), indicated by at least one of the following symptoms:

1. Any time of loss of consciousness
2. Some memory loss for incidents that occurred either before or after the accident
3. Any changes in emotional state at the time of the accident (e.g., feeling dazed, disoriented)

In addition, patients may have focal neurological deficits, which may or may not be transient but whose magnitude does not surpass the following:

- loss of consciousness for no more than 30 minutes
- a GCS score of 13–15 after 30 minutes

- PTA of less than 24 hours

1.7.1.2 Common Patient Complaints. There is growing global interest in mTBI and its short- and long-term sequelae. It has been suggested that some outcomes of mTBI may be linked to cumulative acute injuries, chronic sequelae, and adverse long-term effects, like early-onset dementia and cognitive impairment (Felmingham et al., 2004). According to Bohnen et al. (1992), within 2 weeks of injury, post-concussive cognitive complaints were higher in mTBI patients than in controls; in contrast, overall emotional and vegetative symptoms were not significantly different between the groups (Datta et al., 2009; Dischinger et al., 2009; Liu et al., 2021; Radoi et al., 2016). Psychological symptoms, such as exhaustion, headaches, sleep disturbances, and concentration problems, were frequently reported by people within 10 days of experiencing an mTBI (King et al., 1995); however, these levels were not compared to a control group.

There is a large body of work on the long-term complaints following mTBI; most mTBI survivors report virtually complete recovery, while others report complications (generally referred to as chronic symptoms) (Alexander, 1995; Gualtieri, 1995). According to some studies, age, education level, and gender have all been linked to long-term mTBI symptoms (Binder, 1997; Karzmark et al., 1995; Kibby & Long, 1996; Rutherford et al., 1979). According to Kay (1993), injury effects can outweigh demographic effects soon after an mTBI, with psychological and demographic factors becoming more important as time passes.

1.7.1.3 Mild Traumatic Brain Injury and Attention Impairment. Deficiency in attention is commonly seen in people who have recently suffered from mTBI. Research has shown that people with mTBI typically struggle to maintain or allocate their attentional resources when performing concurrent or single tasks (Cicerone, 1996; Chan, 2002; Chan et al., 2003; Felmigham et al., 2004; Ponsford & Kinsella, 1988; Spikman, 1996). While executive dysfunction is commonly associated with injury to the frontal lobe (Damasio et al., 1994; Stuss & Alexander, 2007), dysfunction may also be observed in the absence of focal injury after TBI (Anderson et al., 1995; Bigler, 2001) in addition to neurosensory impairments (Halterman et al., 2006; Hoffer, 2015; Fischer et al., 2014). This cognitive impairment is associated with a decrease in the structural integrity of cortical-subcortical connections; however, its association with functional interactions between the frontal lobes and subcortical structures, which are associated with behavioural control, is unclear (Little et al., 2010; Leunissen et al., 2013). Cognitive control processes, which underly executive functioning, rely on the cortical circuits that are usually abnormal in conditions that are attributed to executive dysfunction (Mennes et al., 2011; Unschuld et al., 2012). These circuits combine motivation and cognitive cortical information to enable motor control in goal-directed behaviours (Haber, 2016).

1.7.1.4 Overview of Mild Traumatic Brain Injury in the Middle East.

Epidemiological studies in the Middle East have analysed the high injury and casualty rate in conflict regions and their consequences. The burden of long-term disability among TBI survivors is poorly understood in Kuwait. Retrospective assessment of TBI figures between 2006 and 2007 in Palestine revealed that the main causes of TBI were assault with gunshots/firearms, accidents, falls, and other acts of violence (Younis et al., 2011). In addition, most of the studies, including those by Taha et al. (1991) and Fares et al. (2013), were conducted by the same teams during a single period and likely included the same patients. As a result, credible estimates of the incidence of head injuries and/or TBIs in Lebanon were difficult to obtain. A study from Qatar reported a TBI incidence rate of about 4.2–4.9 per 10,000 population (Kraus et al., 1984). TBI occurs in approximately 42 per

100,000 people in Al Ain, United Arab Emirates, and accounts for nearly two-thirds of trauma-related deaths. In addition, motor vehicle accidents are the leading causes of head injury in the United Arab Emirates followed by falls (Abdullah et al., 2011). Similarly, TBI affects 300–400 per 100,000 people in the neighbouring Arab country of Oman (Al-Naamani & Al-Adawi, 2007). The same picture was observed during the present research in the Kuwaiti hospitals, where many mTBI patients appeared to live with ongoing cognitive impairment.

Of the 206 consecutive head injuries, 28% were caused by falls from great heights and 58% were caused by traffic accidents, the majority of which were pedestrians (50%). Preventing head injuries in Kuwait necessitates focusing on road traffic accidents and falls from great heights (Adeloye et al., 1996). There is no available data to assess cognitive assessment or rehabilitation practices that are applied to people with neurological problems in Kuwait hospitals. According to Manee et al. (2017), it is necessary to establish suitable evidence-based rehabilitation guidelines in the country. Their work has encouraged me to work with mTBI patients in Kuwait and to compare our results regarding Syrian refugees with PTSD on the border between Turkey and Syria. Through my work with refugees since 2015, I found that most of them are suffering from anxiety and attention impairment. Furthermore, these refugees need urgent support and rehabilitation, which provided an opportunity for the present research to compare different clinical groups with attention impairment.

1.7.2 Post-Traumatic Stress Disorder and Attention Impairment

1.7.2.1 Definition of PTSD. According to the diagnostic criteria of the American Psychiatric Association (2013) Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-V), PTSD is a disorder that is associated with stress and trauma. This disorder may occur in individuals who have witnessed or experienced a traumatic event, like a serious accident, act of terrorism, natural disaster, violent personal assault, like rape, or war (Boland, 2015). PTSD is a type of disorder that results in short- or long-term involvement after an individual has witnessed or experienced an incident that has affected them emotionally (Bryant et al., 2011; Sard, 2011). Psychological distress after exposure to a stressful or traumatic incident varies from person to person. There may be a predisposition in some people that makes them highly susceptible to these disorders; therefore, there are arguments that PTSD represents a specific phenotype in addition to a failure to recover from the effects of trauma (Yehuda & LeDoux, 2007).

Regarding the incidence of PTSD, the trends in data vary according to the diagnostic criteria that are used to identify the disorder, the assessment procedures, the attributes of the sample, and the event after which they occurred. According to Doctor et al. (2011), these factors should be considered when analysing the data. In the United States, the lifetime risk for PTSD using the DSM-IV criteria at 75 years of age was 8.7% (APA, 1994, 2013), while the yearly incidence among American adults is almost 3.5% (Kessler & Wang, 2008). The estimates reported in Asia, Europe, Latin America, and Africa are lower by about 0.5%–1.0% (Kessler. et al., 2005).

However, different groups experience various levels of stress after traumatic events, and the probability of developing PTSD also varies between cultural groups with the same levels of exposure. The incidence of PTSD is much higher among ex-military personnel and individuals whose profession is associated with a high risk of traumatic events, such as police, medical personnel, emergency responders, and firefighters. The highest rates of exposure are among individuals who have survived rape, confinement, military combat, and ethnic or political genocide (Chapman & Diaz-Arrastia, 2014; McFarlane & Kaplan, 2012). Research has indicated that traumatic events that have a high probability of resulting in a disorder for both women and men are war, aggression, rape, murder, witnessing aggression, and physical abuse during childhood (Kessler et al., 2005; Ogle et al., 2013). PTSD affects both individuals and their communities (Salari et al., 2016). Physical and mental health comorbidities associated with PTSD include depression, substance abuse, interpersonal and parenting difficulties, and poor academic performance. Furthermore, because PTSD is significantly associated with suicidal behaviour, people with PTSD should be diagnosed and treated as soon as possible (Sareen et al., 2011).

1.7.2.2 Refugees with PTSD. In recent decades, the healthcare needs and safety of refugees have become a critical global humanitarian issue. The United Nations High Commissioner for Refugees (UNHCR) reported that the number of refugees in the world reached over 26 million people in 2020 (Skran, 2020). The United Nations (UN) has provided the most thorough description of refugees. The term ‘refugee’ is defined by the UN Convention Relating to the Status of Refugees as a person who flees their homeland due to a ‘well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, is outside the country of his nationality and is unable, or owing to such fear, is unwilling to return home’ (Cutts, 2000, p. 23). In most cases, refugees have experienced severe trauma, including physical, sexual, and emotional trauma or even the deaths of their family members (Fernando et al., 2021). Several studies have found that most refugees develop PTSD after enduring war trauma or specific circumstances that are associated with migration to a new country, including being jobless and the poor housing conditions in the new country. PTSD is described as disability and distress resulting from a traumatic event that occurred in the past (Fernando et al., 2021; Kessler et al., 2005).

Even in circumstances where healthcare resources are readily available, individual (stigma, mistrust), provider (inadequate interpretation and cultural sensitivity), and system (inadequate community) barriers to accessing healthcare persist (Asgary & Segar, 2011).

Torture can have both short- and long-term psychological consequences depending on a variety of interconnected risk factors related to the form of torture, the environment, and the individual. Torture can have many impacts on a person's psychological, physical, social, and spiritual well-being, and these effects can interact in a variety of ways (Patel & Granville-Chapman, 2010). Studies have shown that female sex, older age, and having unstable housing predicts a greater severity of anxiety, PTSD, and depression (Song et al., 2018).

1.7.3 Syrian Refugees with PTSD

Syria is the largest source of refugees in the world, with 6.3 million people fleeing the nation after nearly 8 years of conflict (Renner et al., 2020). The data show that Turkey not only took in the most refugees, but that the number of refugees increased dramatically from 585,601 in 2013 to 2,503,549 in 2015 (Ekmekci, 2017). In the United Kingdom, 55% of Syrian refugees who are protected under a government resettlement programme are torture survivors (Koca, 2016). From 84,197 in 2013 to 897,645 in 2015, the number of refugees arriving in EU countries has surged. Currently, over 897,000 refugees are seeking asylum in Europe, the majority of whom are settling in Serbia and Germany (Ekmekci, 2017). Syrians have been the most common asylum seekers in Germany since 2014, with the highest number of applications in 2016 (266,250 persons, 36.9% of all applicants) (Renner et al., 2020).

PTSD is very common among Syrian refugees in Turkey, Lebanon, and Germany (Alpak et al., 2015). Refugees face difficulties during and after their migration (Kirmayer et al., 2011). This movement has a high risk of resulting in serious and persistent mental disorders (Palic & Elklit, 2011). Sleijpen et al. (2016) found that refugee situations, from pre-migration through post-migration, could lead to symptoms of psychological and physical illness. Furthermore, the loss of a loved one may result in a lengthy period of grief (Prigerson et al., 2009). According to a recent study by Acarturk et al. who used the Impact of Event

Scale-Revised for PTSD and the Beck Depression Inventory for depression among Syrian refugees living in Turkey, the prevalence of PTSD and depression was 83.4% and 37.4%, respectively (Acarturk et al., 2018). Furthermore, in two other studies using an Arabic version of the Mini International Neuropsychiatric Interview among Syrian refugees living in camps in Lebanon, the prevalence of PTSD and depression was reported to be 27.2% and 43.9%, respectively (Kazour et al., 2017; Naja et al., 2016). Being female is frequently identified as one of the risk factors influencing the prevalence of mental disorders among refugees and displaced people. A recent meta-analysis of studies on war-affected populations found that studies with a higher percentage of women reported a higher prevalence of PTSD (Morina et al., 2018). Compared with the abundance of studies on psychological and health problems, there is limited research on the association between PTSD and attention deficit in Syrian refugees. The influence of trauma on cognitive function is discussed in the following section.

1.7.3.1 People with PTSD and Cognitive Impairment. Chronic PTSD has been associated with cognitive problems involving attention and memory. The association between early PTSD symptoms and cognitive impairment is under-investigated. However, such associations may result in reduced processing of traumatic memories and may consequently contribute to PTSD. Survivors with high levels of PTSD symptoms have lower IQ scores, impaired immediate recall, and impaired attention (Thase et al., 2014). According to Brands et al. (2002), reduced attention plays a role in shaping memories of a traumatic incident.

Vietnam veterans with PTSD also exhibit impairments in tracking abilities, visual attention, and word fluency (Berman et al., 2016; van Achterberg et al., 2001). These findings suggest that the diagnosis of chronic PTSD in ex-military personnel is linked with cognitive performance deficiency, especially when comparisons are made with other military personnel who are believed to be free of psychopathology related to stress. Results were found to be consistent with self-reported complaints of impairments in memory and concentration among PTSD-diagnosed individuals, highlighting the need for further investigation of the neuropsychological sequelae of extended exposure to stress (Uddo et al., 1993). The study proposed that intellectual resources could account for the vulnerability-protective factor for post-traumatic development and that PTSD was linked to cognitive impairment and intellectual functioning (Vasterling et al., 2002).

Certain studies have considered the relationship between attention deficit hyperactivity disorder (ADHD) and PTSD in adults. Adler et al. (2004) examined the prevalence of ADHD among 20 male veterans with PTSD and 22 male veterans with panic disorder. The frequency of comorbid ADHD was much higher in the PTSD group (n = 9; 36%) compared with the group of individuals with panic disorder (n = 2; 9%). In another study, the researchers investigated a sample of 222 female and male ex-military personnel who had been exposed to traumatic events and reported that 54.5% met the criteria for PTSD. Furthermore, 11.5% of the participants with PTSD disorder also met the diagnostic criteria for ADHD. The level of trauma exposure and ADHD prevalence was significantly higher compared with PTSD (Harrington et al., 2012; Kazour et al., 2017).

1.7.3.1.1 Frontal Lobe Dysfunction Causes Attention Deficits. Clinical observations inspired the need to understand more about frontal brain function in PTSD patients. This notion has been supported by cognitive tests, and functional imaging studies have recently identified frontal brain abnormalities in people with PTSD. The orbitofrontal cortex (Rauch et al., 1996; Shin et al., 1999), ACC (Bremner et al., 1999; Lanius et al., 2001; Liberzon et al., 1999; Rauch et al., 1996; Shin et al., 1997, 1999), dorsolateral prefrontal cortex (DLPC) (Osuch et al., 2001), and medial prefrontal cortex (Bremner et al., 1999; Lanius et al., 2001) have been linked to the attention network. All these functions can be viewed as executive system functions in patients with attention impairment (Mayes, 1988). Because frontal lobe dysfunction impairs the strategic organisation of cognitive processes, patients with frontal lobe impairment are expected to perform poorly on tasks that rely more heavily on these strategies (Mayes, 1988).

The California Verbal Learning Test (CVLT) was given to a group of Vietnam veterans and a group of normal control participants who were matched for age and IQ by Yehuda et al. (1995). Over five trials, the patients demonstrated normal acquisition of the first list; on the second list, they fared as expected. However, after both short and large delays, the patients had difficulty recalling the first list freely. According to the investigators, this impact indicated that the patients were unusually susceptible to retroactive interference. Jenkins et al. (2000) reported a similar pattern of results. They found that, while survivors of rape with PTSD did not have a substantial impairment in word learning over the five trials, they had a significant impairment in word recall after both short and long delays. This was in comparison with a healthy control group and a group of rape survivors who did not have PTSD. Surprisingly, neither the cued recall nor the recognition components of this task were impaired in the PTSD group. Furthermore, they had similar levels of serial order and semantic clustering, indicating that they were processing and encoding information normally.

1.7.3.1.2 PTSD and the Hippocampus. In a cohort of Vietnam veterans with PTSD, Gurvits et al. (1996) found selective bilateral hippocampal volume reduction compared with a cohort of combat veterans without PTSD. Adult survivors of childhood sexual abuse have a considerable reduction in the volume of the left hippocampus, according to Stein et al. (1997). However, Schuff et al. (1997) found no evidence of a significant decrease in hippocampal volume in war veterans. Furthermore, it is unclear whether the reported decreases in hippocampal volume can be linked to specific memory problems in PTSD. The role of the hippocampus in memory has long been a subject of study. Early research found that injury to the hippocampus caused global memory loss that affected all areas of memory. However, the precise role of this structure has recently become the subject of discussion. According to the findings of multiple studies, patients with isolated hippocampal injury function adequately on item identification tests (Aggleton & Brown, 1999; Aggleton & Shaw, 1996; Carhart-Harris et al., 2015; Mayes et al., 2001; Vargha-Khadem et al., 1997) suffered from a primary deficit.

1.7.1.3.3 PTSD and the Amygdala. The amygdala has long been believed to have a role in emotion, and it is necessary for the acquisition of a conditioned response to fear-inducing stimuli (LeDoux, 1998). The role of the amygdala' in emotional memory has been investigated (Babinsky et al., 1993; Cahill & McGaugh, 1998; McGaugh et al., 1996). Patients with such damage perform poorly on memory tasks involving emotionally-arousing stimuli and perform normally on tasks involving emotionally neutral stimuli (e.g., Adolphs et al., 1997; Babinsky et al., 1993; Cahill et al., 1995; Esber et al., 2012; Markowitsch et al., 1994; Merlo et al., 2015). Both the left amygdala and the right parahippocampus have been linked to PTSD in previous studies. The left amygdala is hypothesised to play a role in face stimuli processing. In a group of PTSD patients who were 5 years post-trauma, decreased activity of this region when viewing facial stimuli was linked to emotional numbing (Felmingham et al., 2014). Limbic areas responsible for emotional memory processing were previously demonstrated to exhibit impaired coupling in subjects with PTSD (Sripada et al., 2012). Prior affective psychotherapy course reconsolidation research revealed that feelings of safety are required for traumatic memories to be altered with less fear (Hogberg et al., 2011).

1.7.2 Summary

This chapter discussed the meaning of attention and its role in our daily lives in addition to theories explaining attention from various scientific domains. Alerting, orientation, and executive control networks are all part of the ANT. This chapter also covered attention mechanisms, neuroscience attention, and attention in the psychology field.

In this chapter, I discussed mTBI and PTSD. Specifically, I reviewed mechanisms underlying the cognitive deficits in mTBI and the epidemiology of the two conditions and have focused on the factors that affect attention.

Following this in-depth examination of the issue of attention and how it may influence people with brain injury and PTSD, I believe it necessary to increase awareness and to conduct future research. A deeper understanding of the difficulties and coordination of neuropsychological examinations is essential to understand the effects of clinical disorders that influence cognition and well-being, such as PTSD and mTBI, which will be explored in the next chapter. In Chapter 3, potential therapies for reducing the impact of trauma on attention and well-being are discussed.

Chapter 2: Neuropsychological Assessments for People with Attention Impairment

Overview

This chapter addresses neuropsychological testing and the critical cognitive tests for diagnosing attention deficit in cases where a neurologist or neurosurgeon is unable to predict the functional effects of localised brain damage. I first explain the importance of using neuropsychological assessments in general and then describe the Stroop task in depth. Then, I review the studies on the TMT and WAIS-IV. Furthermore, I discuss the connection between these tests, the elements of the attention system, and the role of these tests in the clinical field. These measures were chosen because of their effectiveness in the neuropsychology domain, especially in individuals who suffer from impaired attention.

2.1 Neuropsychological Assessments

According to the literature, neuropsychological evaluations are rarely regarded as neutral events, with the technique frequently described as ‘helpful’, ‘interesting’, and ‘facilitating awareness of cognitive strengths and limitations’ (Bennett-Levy et al., 1994; Westervelt et al., 2007). Appropriate assessment preparation and verbal and written feedback of results are critical aspects in reducing anxiety and improving client outcomes (Foran et al., 2021; Rosado et al., 2018). The assessment atmosphere, service availability, assessment length, exhaustion, frustration, and the clinician's interpersonal communication all have an influence on outcomes.

Sundberg and Tyler (1962) define neuropsychological assessment as ‘the systematic collecting, organisation, and interpretation of information about a person and his or her situations, as well as the prediction of his or her behaviour in new situations’. It can also be defined as ‘normatively informed use of performance-based assessments of various cognitive skills’ (Harvey, 2012, p. 91). Neuropsychological assessment is a fundamental part of care following a TBI to detect impairments (Sherer et al., 2002). TBI can have a variety of repercussions due to physical, cognitive, behavioural, and emotional issues depending on the type, location, and severity of the injury. Likewise, people with PTSD suffer from varying degrees of impaired attention and emotional issues that are associated with the severity of the trauma.

Tests are provided in a battery format that usually take around 2 hours to examine a range of cognitive domains, such as attention, processing speed, memory and learning, problem solving, visuospatial, language, and executive skills (Lezak et al., 2012). Neuropsychological assessments are widely used to detect, measure, and diagnose cognitive deficits caused by neurological illness or injury and to aid in the formulation of treatment plans, clinical decision-making, and make changes to disease monitoring (Lezak et al., 2012). The tests are usually selected according to the referrer's requests, the clinician's interest, and the client's problem. Neuropsychological testing is an important part of a clinical neuropsychologist's work, and it is frequently performed in conjunction with observations of behaviour and self-reporting. Questionnaires, comprehensive clinical interviews, medical history, and behavioural and emotional well-being are used to assess pre-morbid functioning.

The Division of Neuropsychology of the British Psychological Society published guidance to aid neuropsychologists in maintaining professional standards. Clinical practice, the use of neuropsychological tests, medico-legal practice, research, professional description, and insurance are all addressed in these guidelines (McCarter et al., 2009). Only professionals with the requisite training and experience should practice and provide clinical neuropsychology services. Furthermore, when providing services to clients, all clinical neuropsychologists should assess their skills and experience, taking into account the client's age and ethnicity, the diagnosis, and the clinical condition (Lezak, 2000). Although physical impairments are the most obvious deficit after TBI, cognitive, behavioural, and emotional impairments have a major impact on functioning and predict long-term outcomes due to their high incidence and persistence (Paulsen, 2011). Given the link between cognitive disability and outcomes, the incidence and durability of neuropsychological impairments following TBI and PTSD emphasise the necessity of neuropsychological assessments (Giza et al., 2013). Many clinicians advocate for a flexible battery, claiming that it is reasonable and cost-effective to only perform tests that are related to the patient's specific complaints, while others contend that this only verifies the presence of obvious symptoms (Reitan & Wolfson, 2001). Choosing several tests may be an optimal option that ensures the flexibility, efficiency, and accuracy of the diagnosis.

2.1.1 Neuropsychological Assessments for Attention

Neuropsychological tasks are some of the preferred strategies for understanding conflict detection, interference, and resolution. Some of the standard assessment methods for measuring these parameters include the Stroop task (Stroop, 1935), which involves conflicts between word name and the colour of the ink, the Simon effect (Simon & Berbaum, 1990), which focuses on the location and direction of a response, and the flanker task (Eriksen & Hoofman, 1974), which involves identifying stimuli. These three tasks can either be congruent, incongruent, or neutral. Studies report that latency and accuracy rates are higher in congruent than incongruent trials due to interference effects (Eriksen & Hoofman, 1974; Simon & Berbaum, 1990; Stroop, 1935). The findings of such studies are instrumental to current and future research as they set a framework for future studies in which researchers can combine different tasks and targets to understand congruence.

2.1.1.1 Stroop Task. Different versions of the Stroop task are frequently used to assess performance inhibition and to measure attention (Stroop, 1935). For example, when the examiner asks a patient to name the colour of a displayed letter string, the task is significantly more difficult if the letter string is the name of a conflicting colour (e.g., ‘green’ displayed in red) than if the letter string is a control (e.g., ‘green’ displayed in green) (Stroop, 1935). This Stroop interference effect is commonly recognised as a gold standard in cognitive neuroscience as it is one of the most robust and well-studied cognitive phenomena. In addition to the mismatched font colour sheet, there were two tests: one with little rectangles of coloured ink and another with the names of colours. The Stroop Colour and Word Test (SCWT) is a neuropsychological tool that is frequently used in clinical and experimental settings (Scarpina & Tagini, 2017).

The traditional view of the Stroop task has four major stages: an input process, a decision process, a response selection process, and a response output/execution process (e.g., Lupker & Katz, 1981), with the consensus that the Stroop interference occurs late, either in the response output process or in the response selection and response output processes (e.g., Lupker & Katz, 1981). Exhibiting the automaticity of reading may improve flow (see review by MacLeod, 1991). Therefore, the Stroop task would be an optimal tool for investigating the processes that underpin successful reading; however, the visual word recognition process is surprisingly poorly understood.

Previous research has reported that the Stroop interference effect can be manipulated by presenting the word distractor in a different spatial location from the to-be-named colour patch (Spieler et al., 2000). In addition, other studies claimed that presenting just one letter within a word distractor in colour (Augustinova & Ferrand, 2014; Stolz et al., 2005) reduced or even eliminated the effect, indicating that the effect is spatially dependent (Lien et al., 2010). Monsell et al. (2001) evaluated colour naming response latencies for each item independently, mixing the different types of distractor situations randomly, as is now customary in Stroop research. This reflects the widespread belief that the Stroop interference occurs late, either in the response output process or in the response selection and output process. Within this framework, the method of the colour response—whether verbal or manual—should only affect the final stage or the final two stages (MacLeod, 1991).

2.1.1.1.1 The Stroop Colour and Word Test. Subjects are asked to read three separate tables as quickly as possible in the most common version of the SCWT, which was first published by Stroop in 1935. Two of the tables reflect the 'congruous condition', in which participants are expected to read colour names in black ink (henceforth referred to as 'colour-words') and to label various colour patches (Stroop, 1935). Evidence from methodological approaches (e.g., Lachter et al., 2004; Lien et al., 2010) suggests that spatial attention to the word is required for lexical access. According to Neely and Kahan (2001), the standard Stroop interference effect observed with word distractors that are colour names within the response set (e.g., 'red' presented in green when red is a response colour) may not reflect the word's semantic representations but instead 'non-semantic, task-relevant response competition' (p. 71). In the third table, colour-words are printed in an inconsistent colour of ink (for example, the word 'red' is printed in green ink), known as the colour-word condition. Participants must name the colour of the ink instead of reading the word in this incongruent condition.

The Stroop effect refers to the difficulty of inhibiting the automatic process (Stroop, 1935). While the SCWT is most often used to assess the subject's capacity to prevent cognitive interference, it has also been used to assess other cognitive processes, such as attention, processing speed, cognitive flexibility, and working memory (Jensen & Rohwer, 1966). As a result, the SCWT can be used to assess cognitive functions (Kane & Engle, 2003) and as a measure of attentional improvement after an intervention.

2.1.1.1.2 Manual Versus Vocal Response. The method of response used to identify the colour of the written word (e.g., responding manually via a keypress vs. responding vocally by speaking the colour name aloud) determines the amount and type of facilitation and interference that results from Stroop trials (Fennell & Ratcliff, 2019; Glaser & Glaser, 1989; Kinoshita et al., 2017; Zahedi et al., 2019). Several studies have investigated the effect of vocal responses versus manual keyboard responses, and the overall conclusion is that manual responses cause less interference than vocal responses; this is referred to as the modality effect (Neill, 1977; Redding & Gerjets, 1977; Sharma & McKenna, 1998; White, 1969). For example, Sharma and McKenna (1998) and Brown and Besner (2001) reported that the manual response Stroop test had no semantic Stroop effects. Differential access to the systems (phonological, lexico-semantic, or response-level processing) that are believed to cause interference is proposed in accounts of distinctions between these two response modes (Glaser & Glaser, 1989; Fennell & Ratcliff, 2019; Kinoshita et al., 2017; Sharma & McKenna, 1998; Zahedi et al., 2019).

Furthermore, in some cases, the facilitation impact for manual responses is greater than for vocal ones (Redding & Gerjets, 1977). This suggests that there is a difference in reaction patterns that is dependent on response modality, although it is unclear what difference in processing causes this variation in response patterns. It has recently been proposed that vocal and manual responses require different tasks (naming vs. classification, respectively); as a result, the type of evidence accumulated during the Stroop task is different, resulting in qualitatively different Stroop effects (Kinoshita et al., 2017). In contrast with the differential access position, Roelofs (2003) argued that manual and vocal response modes have similar effects based on his WEAVER++ model of Stroop task performance, which posits mandatory verbal mediation of manual responses. In this case, participants subvocally produce the colour name when responding manually, and any effect found with vocal responses can thus be observed.

2.1.1.1.3 PsyToolkit Online Stroop Task. The advent of the internet provided us with new avenues of investigation. Internet-based experimental instruments enable us to conduct experiments with demographically and culturally diverse samples, recruit large subject pools in less time, avoid organisational issues, such as scheduling conflicts, save money on laboratory space, equipment, personnel hours, and administration, and expand our ability to conduct international experiments (Reips, 2000, 2002). PsyToolkit is a free and open-source psychological instrument designed to help researchers, including student researchers, easily program and run experimental psychological experiments and surveys in both laboratory and internet settings (Stoet, 2016). PsyToolkit is available in two versions: a laboratory-based version that runs on Linux and a JavaScript-based internet version that can run on modern browsers without the need for participants to download any programmes. Because it is a free software designed specifically for hosting online questionnaires, simple response time (SRT) tasks, and choice response time tasks (CRT), the internet-based version of the instrument is specifically aimed at addressing the financial and technical limitations commonly encountered by students (Stoet, 2016). According to Stoet (2016), PsyToolkit is intended for use in a teaching environment, with minimal technical barriers and free web-based hosting of their studies. Students can examine and adapt a library of existing psychological scales and experiments, and extensive online documentation and tutorials are available to help if they encounter any problems.

PsyToolkit is designed to allow students to randomise the item order in both questionnaires and cognitive experiments, to provide a convenient method of scoring, and to provide feedback to participants about their test scores, options that are not available in all internet-based instruments. To create experiments using the internet-based version of PsyToolkit, all users must create an account, which is free (Stoet, 2016). Stoet (2018) claims that both the internet and Linux versions of PsyToolkit can measure small effects of less than 50 ms reliably, with the Linux version being more precise.

SRT is an experimental test in which participants are tasked with responding to every presentation of the stimulus in the exact same manner and as quickly as possible (Zajdel & Nowak, 2007). For example, participants may be instructed to watch a colour name, such as ‘red’, and to press a certain button as quickly as possible whenever the word ‘red’ lights up. A CRT is an experimental task in which multiple stimuli are displayed and/or presented on different areas of the screen, and the participant is tasked with responding in various ways depending on the nature of each presentation. Participants may be instructed to look at a screen that displays letters with the task of pressing the corresponding letter on a keyboard. The complexity of CRTs can vary; simple CRTs, such as the one described above, require participants to recognise the stimuli and respond appropriately. Participants in more complex CRTs must also make judgements about the nature of the stimuli (Zajdel & Nowak, 2007).

2.1.1.2 Stroop Task in Clinical Populations

2.1.1.2.1 Traumatic Brain Injury, Stroop, and Brain Imaging. An analysis of the colour-word Stroop (1935) test, the most popular tool used to measure selective attention in TBI patients in both clinical and experimental settings, prompted a debate on selective attention. The TBI Clinical Trial Network recently reiterated the essential significance of the Stroop test in neuropsychological examinations of TBI patients (Bagiella et al., 2010).

Other researchers have sought to identify differences in Stroop performance at the level of brain processes using different imaging techniques to address these anomalies in behavioural data. In healthy people, fMRI studies revealed that activation of the DLPC and the ACC was associated with Stroop performance (e.g., MacDonald et al., 2000). Active cognitive control over behaviour (DLPC; Petrides, 2005), interference detection, and selective attention are all activities that both regions are involved in when performing the Stroop task (ACC; Bush et al., 2000). In contrast, Mani et al. (2007) discovered activations both inside and outside the DLPC and ACC in TBI patients during a Stroop task; the investigators concluded that ‘recruitment of outside regions was important for successful task fulfilment’ (p. 235).

Other imaging investigations of the Stroop task in TBI patients found that, while the ACC was less activated, regions outside the ACC were more activated when compared with the controls (Goethals et al., 2004; Soeda et al., 2005). Diffuse axonal injury (DAI), a possible outcome of TBI (primarily in moderate-to-severe TBI; Gennarelli et al., 1998), may be linked to differential brain activation in the Stroop task. TBI causes white matter pathways to be sheared, primarily in subcortical white matter tracts, some of which are association fibres connecting distinct cortical regions (Stuss & Gow, 1992). As a result, the interconnectedness between anatomical regions and their accompanying networks is diminished. Extra brain areas may be recruited as a compensatory mechanism in response to the impact of lesions and/or inadequate connectivity in and between the regions of interest.

A comparison of healthy controls and TBI participants' event-related potentials (ERPs) during Stroop task performance revealed changes. Waves related to colour-incongruent trials in healthy subjects (e.g., N450; West, 2003) were not found in TBI patients (Perlstein et al., 2006). During the Stroop task, Spikman et al. (2004) reported delays in N2 and P3 wave latencies in TBI patients, indicating a delayed evaluation process of the stimuli (Clark et al., 1992; Keyser-Marcus et al., 2002).

In conclusion, neuroimaging studies suggest that TBI patients may process stimuli during Stroop tasks differently than controls. Stroop effects may vary depending on behavioural groups due to these brain variations. However, because TBI comprises a wide range of idiosyncratic brain injuries, it is unclear whether these changes in brain activation are due to variances in selective attention or other processes.

2.1.1.2.2 Stroop Task for People with Post-Traumatic Stress Disorder. Adults in the general community are susceptible to traumatic events, with prevalence rates of around 50%. (Kessler, 2000; Resnick et al., 1993). Despite widespread exposure to stressful situations, PTSD is believed to affect roughly 8% of the population (Kessler et al., 1995, 2005; Kilpatrick et al., 2003). Even though various types of trauma in specific demographics have been related to the greater prevalence of PTSD, more research is needed (e.g., approximately 20% of women who have been sexually abused meet the criteria for PTSD; Kessler et al., 1995; Resnick et al., 1993). Even the highest estimates of PTSD prevalence constitute a small percentage of those who have been exposed to traumatic experiences. As a result, simply being exposed to a traumatic incident is insufficient to account for the development of PTSD (Rosen & Lilienfeld, 2008; Yehuda & LeDoux, 2007), highlighting the need for better knowledge of the mechanisms underlying PTSD to facilitate improved understanding of why PTSD develops and persists. A deeper understanding of the processes that mediate PTSD could lead to the development of novel treatment strategies that map more directly onto the psychopathology of PTSD, improving treatment efficacy.

The knowledge of how PTSD develops and persists, the identification of people who are likely to develop PTSD, and the treatment of those who have developed PTSD requires an explanation of critical mechanisms of PTSD. Examining cognitive processes and information processing biases is one method of explaining core PTSD problems (Brewin et al., 2007; Buckley et al., 1990). The EST is a type of Stroop task that is commonly used in neuropsychological research; it aids in the understanding of the core dysfunctional mechanisms that mediate PTSD. The EST is similar to the original task, but the semantic content of the word is manipulated; the word is neutral in valence (e.g., ‘pencil’) in some trials and threatening in valence (e.g., ‘attack’) in other trials. By changing the emotional content of the to-be-ignored word and assessing for changes in performance, the EST can detect the influence of emotional processes on a typically cognitively based activity. Numerous studies have shown that anxious people have a higher risk of developing PTSD (Buckley et al., 2000; Foa et al., 1991a, 1991b; McNally et al., 1990). When compared with neutral words, emotional words have longer colour-naming times (Bar-Haim et al., 2007; Williams et al., 1996). Many cognitive theories of psychopathology suggest attention biases for emotion-congruent information (Beck, 1979; Bower, 1981; Power & Dalgleish, 1999; Williams et al., 1997). The theory is that having an emotional disorder causes basic cognitive processing to be biased in favour of stimuli that are consistent with the individual's prevalent emotions. Such biases lead to greater emotional information processing, which exacerbates the disease and thereby increases the level of prejudice in a vicious cycle (Power & Dalgleish, 1999). The modified Stroop task has recently become the most popular method of investigating such biases.

The impact of trauma on psychological outcomes, memory impairments, attention difficulties, and learning deficiencies has been described in neuropsychological studies as part of the cognitive dysfunction associated with PTSD (Brandes et al., 2002; Koenen et al., 2001; Vasterling et al., 2002; Roca et al., 2006). Recent neuroimaging research employing PET or fMRI in PTSD patients has focused on symptom provocation or reactions to trauma-related or emotional stimuli (Francati et al., 2007; Shin & Liberzon, 2009). Activation of the lateral prefrontal cortex (LPFC) regions and the ACC was consistently observed in a number of functional neuroimaging studies using PET and fMRI to investigate neural correlates of Stroop interference (Derrfuss et al., 2005; Laird et al., 2005). To apply efficient treatment for

PTSD patients, a review of neuropsychological and neuroimaging studies in PTSD patients emphasised the significance of understanding PTSD-related attentional and inhibitory dysfunctions (Aupperle et al., 2012). Research in this field is still limited and should be expanded, especially in the Middle East.

2.1.1.3 The Stroop Effect and Learning. The differing effects of interference on colour and word naming suggest that the amount of practice people have with tasks can modulate the Stroop effect. Evidence suggests that practising the Stroop task alters the degree of interference. People improve their attentional control with practice, as demonstrated in a classic Stroop experiment (1935). Interference for conflicting terms was minimised after 8 days of practice (200 trials each day). Similarly, Ellis et al. (1989) allowed their subjects three or four daily sessions to perform the Stroop colour-naming task; following the practice trials, there was a considerable reduction in interference.

2.1.2 Trail Making

The TMT (e.g., Reitan and Wolfson, 1985), was developed by U.S. Army psychologists as a general intelligence test. It is now widely used to assess set switching in brain-injured patients. The standardised version of the TMT has two task components: TMT-A and TMT-B. The TMT-A requires the subject to draw lines and connect circled numbers in a numerical sequence (for example, 1–2–3...). The subject is required to draw lines to connect circled numbers and letters in an alternating numeric and alphabetic pattern in the TMT-B (e.g., 1-A-2-B...). Without lifting the pen from the worksheet, the participant must finish both task components as quickly and as accurately as possible. The TMT is normally administered without an explicit time constraint; however, a test discontinuation cut-off of 300 seconds is commonly used (Bowie & Harvey, 2006). The experimenter keeps track of task performance;

if a mistake occurs, they conduct error correction. The total time to completion is commonly used to measure TMT performance (Bowie & Harvey, 2006). Corrected TMT-B scores are obtained by computing a difference (TMT-B-TMT-A), a ratio (TMT-B/TMT-A), or a proportional score ([TMT-B - TMT-A]/TMT-A) to isolate the latter component (e.g., Stuss et al., 2001; Muir et al., 2015). Studies revealing substantial correlations between TMT-A and TMT-B outcome measures in both healthy (e.g., Arbuthnott & Frank, 2000) and brain-injured persons (Kortte et al., 2002; Muir et al., 2015) have provided empirical support for the shared low-level processes underpinning TMT-A and TMT-B.

However, the true nature of the cognitive component that makes the TMT-B more challenging, as measured by a completion time cost compared with the TMT-A, has been a source of controversy. There is evidence that the TMT-B causes an increase in low-level visual search needs (Gaudino et al., 1995). For example, compared with the TMT-A, the TMT-B requires longer distances between individual visual array parts, which may place greater demands on the low-level visuospatial search and motor components (Gaudino et al., 1995). Alternatively, a research series that validated the TMT-B outcome measures against commonly used EF tests, including assessments of set-switching ability, suggested that performance on the TMT-B reflects higher-order processes (Arbuthnott & Frank, 2000; Kortte et al., 2002). In a group of young, healthy adults, ratio scores were associated with task-switch response times but not with a difference in scores (Arbuthnott & Frank, 2000). In a group of neuropsychological patients, raw TMT-B completion durations were associated with the set-switching but not the defined component of the Wisconsin Card Sorting Task (WCST) (Kortte et al., 2002). Performance accuracy can be calculated, and different types of errors can be defined, even though this does not directly contribute to the conventional scoring process (Bowie & Harvey, 2006). TMT-B sequencing errors (failure to connect letters or numbers following a set shift in the right order (e.g., connecting A-2-C… or 1-A-

3...) are distinguished from TMT-B shifting errors (i.e., failure to alternate between letters and numbers, e.g., connecting A-B... or 1-2...) (Klusman et al., 1989). Error analysis has been shown in several studies to improve the specificity of detecting cognitive impairment in clinical situations (e.g., Amieva et al., 1998; Stuss et al., 2001; Mahurin et al., 2006; Christidi et al., 2013; Kopp et al., 2015).

In contrast, other researchers have cast doubt on the clinical value of TMT error analysis (Ruffolo et al., 2000; Klusman et al., 1989). When performing the TMT, many cognitive processes are likely to be engaged (for a review, see Sanchez-Cubillo et al., 2009), implying that distinct brain regions may be relevant for task completion. This makes identifying the neurological correlates of the TMT more challenging. The errors were evaluated in this study to determine attention impairment in clinical conditions (Christidi et al., 2013; Kopp et al., 2015). By calculating the answer time before and after the intervention, the researcher was able to observe how the concentration of attention improves for patients with impaired attention (mTBI or PTSD) (for further information, see Chapters 7 and 8).

2.1.3 Wechsler Adult Intelligence Scale

The fourth edition of the WAIS-IV is a comprehensive clinical tool for evaluating the intellectual ability of older adolescents and adults. It continues a long legacy of mental ability testing development, testing, and improvement (Hartman, 2009). The following sections review the historical context that led to the modern intelligence assessment movement, the development and features of the WAIS-IV, and its clinical applications. In addition, coding and symbol search are specifically addressed in this study.

2.1.3.1 An Historical Perspective. In the late 19th century, a movement led by English statistician Sir Francis Galton called for the examination of mental capacities (1869, 1883). Galton felt that intelligence could be measured by quantifying individual sensory and motor skills, like visual acuity, reaction speed, and manual grip strength. The work of Alfred Binet and Theodore Simon, who were commissioned by the French government in 1894 to devise an objective method of discriminating between normal and cognitively challenged children, gave rise to modern intelligence testing. Their 1905 Binet–Simon Intelligence Scale was widely used (Binet & Simon, 1916; Binet, 1908), and Stanford professor Lewis Terman adapted it for use in the United States soon after its publication (Terman & Childs, 1912; Terman, 1916). The Stanford–Binet scale he developed was based on a normative sample of 1,000 children and adolescents under 14 years of age. Based on a frequency distribution of 30 businesses and 32 high school students, Terman expanded the mental age groups first used in the Binet–Simon scale to include adults (Terman, 1916).

Adult IQ testing became an important instrument in the assessment of draftees when the United States entered the First World War in 1917. The Army Alpha and Army Beta group-based examinations were developed by American psychologist Robert Yerkes, who was tasked with designing psychometric measures to assign recruits to different levels of military service (Yerkes, 1917). Binet, Simon, Terman, and Yerkes' combined efforts eventually became the foundation for American psychologist David Wechsler's current IQ test series. Wechsler developed a series of IQ tests based on his clinical talents and statistical background as a mentee of statistician Charles Spearman and as a World War I psychological examiner (Wechsler, 1939, 1981). The Wechsler–Bellevue Intelligence Scale represented Wechsler's conception of intelligence (Wechsler, 1939). The Wechsler–Bellevue scale was a global composite intellectual score created by the Psychological Corporation. It offered verbal and nonverbal intelligence scores based on individual performance on 11 subtests developed from the Stanford–Binet and Army tests (i.e., Information, Comprehension, Arithmetic, Similarities, Digit Span, Vocabulary, Digit Symbol, Picture Completion, Block Design, Picture Arrangement, and Object Assembly).

Importantly, Wechsler realised that the verbal/non-verbal distinction was only one of many possible ways to organise intellectual areas. Nonetheless, the Wechsler–Bellevue Scale was innovative as it used computed standard scores based on deviation quotients obtained from the subject's performance compared to a population-based average. The first WAIS, which was released in 1955, was a significant revision of the original Wechsler–Bellevue Scale. The WAIS currently includes indexes for Full-Scale IQ, Verbal IQ, and Performance IQ. Most crucially, the WAIS used a nationally stratified sample based on U.S. Census Bureau data to establish norms, which was an improvement over its predecessor's small and geographically constrained standardisation sample. The Wechsler Adult Intelligence Scale-Revised Edition (WAIS-R) and the WAIS-III were released in 1981 and 1997, respectively, and included changes to the test instructions, scoring procedures, and subtests (Hartman, 2009). The stratification of normative data was also improved. New index scores for flow domains of working memory and processing speed were introduced. However, the most ambitious reform of the WAIS was yet to come (Hartman, 2009).

2.1.3.2 Wechsler Adult Intelligence Scale – Fourth Edition. The WAIS-IV was published in 2008 (Wechsler, 2008). The WAIS-IV Full Scale is made up of the 10 core subtests from the four index scales. The Full-Scale IQ, a composite number that measures general cognitive capacity, can be used to describe Full-Scale performance (Wechsler, 2008). The Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), and Processing Speed Index (PSI) are all based on a series of core and supplemental subtests (scaled scores: mean = 15, *SD* = 3) that provide significant clinical information and flexibility in application. This WAIS revision offered multiple benefits over its predecessors, including revised instructions and improved floor/ceiling scores for reduced testing time, redesigned record forms for ease of use, subtest changes to reduce the burden on motor demands, enlarged visual stimuli, and increased portability (Wechsler, 2008).

2.1.3.3 Primary and Supplementary Indexes. The WAIS-IV VCI includes subtests that assess lexical and semantic knowledge expression, concept formulation, abstract reasoning, and problem-solving ability (Wechsler, 2008). Similarities (i.e., concept formation and abstract reasoning for pairs of related words), Vocabulary (i.e., lexical knowledge and expressive vocabulary), and Information (i.e., general semantic knowledge) are the three basic subtests of the WAIS-IV VCI. Comprehension (i.e., practical knowledge and judgement utilising knowledge of abstract social conventions and rules) is an optional subtest in the WAIS-IV VCI (Wechsler, 2008). Subtests measuring nonverbal perception, organisation, manipulation, and reasoning are included in the PRI (Wechsler, 2008). The three primary subtests of the WAIS-IV PRI are Block Design (i.e., three-dimensional praxis, problem solving), Matrix Reasoning (i.e., pattern recognition, nonverbal abstract problem solving, inductive spatial reasoning), and Visual Puzzles (i.e., spatial rotation, reasoning, and nonverbal abstract problem, solving). Figure Weights (i.e., quantitative and analogical reasoning) and Picture Completion are two extra subtests (i.e., visual perception, recognition, organisation).

Subtests of the WMI examine simultaneous and sequential processing, attention, and concentration (Wechsler, 2008). Digit Span (i.e., auditory processing, attention/concentration, mental manipulation) and Arithmetic (i.e., attention/concentration, mental calculation, numerical reasoning) are the two core subtests in the WAIS-IV WMI. Letter-Number Sequencing (sequential processing, mental manipulation, and attention/concentration) is one of the supplemental subtests. The PSI consists of subtests that assess mental and graph motor processing speed (Wechsler, 2008). Symbol Search (i.e., visual-perceptual speed, visual-motor coordination, visual scanning, visual working memory, and decision-making) and Coding are two core subtests of the WAIS-IV PSI (i.e., visual-perceptual speed, visual-motor coordination, visual working memory). Cancellation (i.e., visual-perceptual speed) is a supplemental subtest. In this study, only the Coding and Symbol Search tests were applied due to the researcher's interest in measuring the attention system.

2.1.3.6 Clinical Considerations and Indications. In clinical practice, the WAIS-IV is extremely useful; it applies to anyone aged 16–90 years, and there is extensive literature demonstrating patterns of cognitive performance across demographic, developmental, and injury- and disease-related variables. Many clinical populations, including those with intellectual disabilities, learning problems, acquired brain injury, mental health issues, and neurodegenerative illness, can produce normative data (Mallin et al., 2008). In the characterisation of test performance and the clarification of clinical diagnoses, both normative and item-response data can be used. While the WAIS-IV provides a wealth of information on its own, the results should always be interpreted considering important contextual factors, like medical history, psychiatric history, psychosocial history, education, behavioural observations, previous testing performance, and the purpose of the evaluation. Because of the complexity of the data obtained, neuropsychologists, clinical psychologists, and school psychologists must undergo extensive training to interpret it. The amount of work engagement and effort is an essential aspect to consider when interpreting WAIS-IV data (Boone, 2008). Furthermore, clinicians must ethically manage the WAIS-IV test and the data obtained. Clinicians should not make decisions, interpret data, or make recommendations based on data that are obsolete or contradictory to the measure's objective (Miranda et al., 2006).

2.2 Summary

This chapter provided an overview of some of the cognitive scales that are utilised in clinical settings for patients with attention deficit disorders. It covered the basics of cognitive testing before describing the tests that are the subject of this research. The chapter was introduced with a spotlight on the Stroop task, which included a review of variants of the Stroop challenge, Stroop colour and word, oral and manual response, online Stroop task and Stroop task for the clinical setting. Then, it discussed the TMT, followed by Symbol Search and Coding from the WAIS-IV. It explained the role of each test in measuring attention and its link to the elements of the attention theory. In addition, the chapter considered how these tools could assist the psychologist in the clinical setting, that is, in patients with mTBI and refugees with PTSD.

While the growing body of literature is beginning to shed light on the subject, it also leaves us with many unanswered questions and knowledge gaps. For example, some studies reported that participants found the procedure to be beneficial but did not specify what they learned, how it applied to their daily lives, or how it enhanced their attention system. In addition to these technologies and frameworks, I attempted to investigate a range of phenomena that are encompassed by attention. Research is needed to measure attention and cognitive performance in the neuropsychological field, especially in the Middle East, and select the appropriate treatment. A multimodal strategy concentrating on neurorehabilitation is used to treat cognitive problems. Occupational therapy, physiotherapy, speech therapy, vocational training, cognitive rehabilitation, and pharmaceutical therapies can aid in the management of specific cognitive deficiencies (Arciniegas et al., 2010). I focused on these psychological measures due to their frequent use in the clinical field, and I sought to translate them and compare the results to previous research. The following chapter focused on cognitive rehabilitation, namely mindfulness and cognitive behavioural therapy (CBT), for people with attention impairment. Then, I discuss the results of existing studies to answer the persisting questions and address the gaps in previous research to establish the basis of neuropsychological services that should be initiated in Kuwaiti hospitals.

Chapter 3: Mindfulness-Based Interventions

for the Neuropsychological Rehabilitation of Patients with Attention

Impairment

Overview

'The best way to capture moment is to pay attention'.

(Kabat-Zinn, 1985)

Many researchers in clinical and experimental psychology have focused their attention on the concept of mindfulness, which is emerging as an area of interest to understand the function and performance of the brain. The techniques and methodologies used include the interaction of brain networks to better understand attention. Kabat-Zinn (2003) described the ontological concept as an approach for cultivating non-judgemental awareness from paying attention when needed and at the right time. With a basis in ancient Eastern Buddhism and philosophy, mindfulness-based interventions (MBIs) are frequently used within modern healthcare (Carlson & Garland, 2005), and a growing number of works indicate its potential as a beneficial intervention programme (Mars & Abbey, 2010).

This chapter includes a literature review of the mindfulness theory and approaches, mindfulness in neuroscience, ANT, psychology, and the clinical population, and how mindfulness can improve attention in people with attention deficits, such as people with mTBI and post stress disorder. I then briefly describe some comparisons between mindfulness and other treatments, namely CBT. CBT may be beneficial in these populations as well (Schwarzbold et al., 2008).

3.1 The History of Mindfulness

Over the past few decades, people have adopted practices of meditation from Eastern traditions, like Yoga and Zen Buddhism, as therapeutic methods of regulating oneself, without their original cultural, ideological, and religious forms (Shapiro & Giber, 1978;

Shapiro, 1985). According to Khoury et al. (2013), Kabat-Zinn (2003), and Kabat-Zinn et al. (1984), authorities have suggested that mindfulness is an efficient tool that can be used in supporting individuals suffering from physical and psychological distress. The mindfulness strategy is to inform people on how to control their emotions without being judgemental (Chaskalson, 2014). Chaskalson claims that people can use strategies for developing awareness of themselves and others surrounding them, improving their knowledge on how to act when they are faced with various emotions. According to De Silva (2016), conscious awareness motivates individuals to aim to be present during tasks, without prejudice. William & Penman (2011) highlighted that people's self-awareness and their focus on the present does not mean that mindfulness entails planning and thinking. McCown et al. (2010) suggested that mindfulness involves individuals practising how to respect their bodies, use their minds, meditate on ideas without being judgemental, and enjoy the present world.

By the end of the 20th century, Kabat-Zinn had expanded on the idea of mindfulness utilising theoretical approaches to solve people's psychological and physical issues (Shapiro, 1983; Kabat-Zinn, 1982; Williams, 2010). Recently, there has been an expansion of MBIs used to deal with physical and psychological health. Mindfulness meditation is an important tool as it involves purposely paying close attention to the present moment, without being judgemental (Kabat-Zinn, 2013).

3.2 Definition of Mindfulness

According to Chaskalson (2014), mindfulness meditation is not about setting achievements and establishing positive thinking. In one approach to mindfulness, individuals focus on three steps: the first is a body-scan, which involves paying close attention to the body and working to identify sensations that arise within the body; the second step of mindfulness is paying close attention to breathing during meditation; and the last step is sitting meditation, which involves paying close attention to breath, sounds, emotions, and body sensations (Kabat-Zinn et al., 2003).

According to Shapiro (2009), individuals can be instructed to centre their attention on any target, which in turn enables them to follow the principles of mindfulness meditation. When sensations, thoughts, or emotions arise, an individual who is trained in mindfulness can engage them without judgement. Moreover, when people notice that their minds have been distracted by memories or thoughts, the mind’s activities are briefly acknowledged before attention is returned to the present (Kabat-Zinn et al., 1984). Individuals are aided in observing their thoughts and feelings without any risk of harm, and they are required to remain committed in their efforts (Chaskalson, 2014).

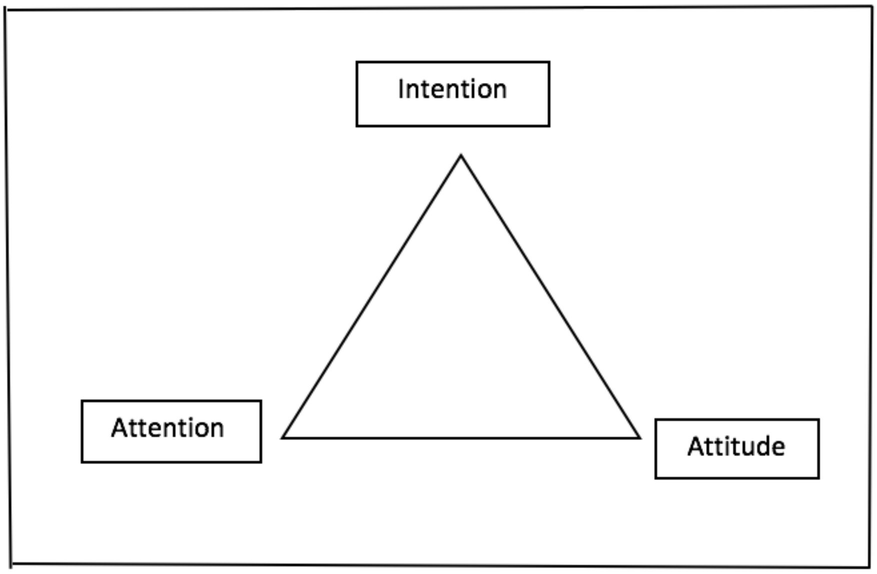
A study by Williams (2010) investigated how people stay focused by comparing, analysing, judging, and planning most of their time without an interest in the present moment. Williams claims that mindfulness coaching may aid individuals in shifting their focus of attention and establishing a more flexible response. Furthermore, Williams claims that the tiredness of the mind might lead to individuals forgetting the pleasure of the present, and he notes that practising mindfulness is not only about clearing one's mind, but also regulating oneself (Williams, 2010). People experience the opposition between living by using the mode of ‘how things are’ and the model of the mind ‘how we want them to be’; however, ‘being the mode of mind is the experience of interconnection with and consent of self and the world’ (Kabat-Zinn et al., 1984). The model and various types of therapeutic methods are described in the following chapters.

3.2.1 Three Elements of the Mindfulness Model

The mechanism list of actions reported by Shapiro et al. (2006) facilitated the creation of a model of mindfulness that focuses on intention, attention, and attitude with non-judgement and openness.

Figure 3. 1:

Three elements of the mindfulness model (Shapiro et al., 2006)



These three elements of the mindfulness model always contact to gather, as a single periodic process that occurs simultaneously (Shapiro et al., 2006). This inter-related process has an essential role in altering the way people view their surroundings. Kabat-Zinn (1982) explained that intention was meant to 'set the stage for what is possible'; he notes, 'they remind you from moment to moment of why you are practising in the first place'. People tend to change their attention along with the linked series from one's self-exploration to self-regulation while they remain mindful. Mindfulness enhances people's capability to perceive what may be beneficial to their lives. Therefore, an individual can learn how to transfer from self-regulation to self-exploration during the period of intention (Shapiro et al., 2006). Furthermore, a person's objective in the present day may be improved if they practise mindfulness. Studies have suggested that this condition can be achieved by enabling negative experiences to pass by, expanding the attentional levels in the present (Shapiro & Schwartz, 2000).

Shapiro et al. (2006) claimed that re-perceiving enhances exposure, self-regulation, and emotional, cognitive, and behavioural flexibility. The authors also posited that human minds could change in different ways, given the transformational impact of the three elements of mindfulness framework (Shapiro et al., 2006). A metacognitive mechanism of actions, which entails becoming aware of one's own thought processes and comprehending the patterns that underpin them (Baron-Cohen et al., 1995, 1999, 2001; Happé, 1994; Hill, 2004; Losh et al., 2012; Perner et al., 1989), is improved after practising mindfulness; therefore, mindfulness is positively associated with a more significant meta mechanism of actions (Safran & Segal, 1990; Dorjee, 2017).

3.3 Mindfulness Approaches

MBIs are usually associated with psychological well-being and health (Keng et al., 2011). Mindfulness may also be considered a process and a result through the regular mindful process whereby an individual seeks to cultivate their conscious awareness (Shapiro & Carlson, 2009). The last-mentioned has been defined as intentional, open, and non-judgemental awareness of the constant unfolding experience in the present (Kabat-Zinn, 2013). Researchers use models to understand the concept of mindfulness. Such frameworks present a straightforward approach to replicate the information or use the same framework for future studies. Four therapy models have gained widespread acceptance by scholars and researchers of mindfulness.

Kabat-Zinn (2003) formulated the mindfulness-based stress reduction (MBSR) model, which is an 8-week course that teaches an individual the use of mindfulness in their normal activities by alleviating stressors. The programme helps individuals with mental issues or mental disorders and difficulties in their life. Segal et al. (2002) developed the mindfulness-based cognitive therapy (MBCT) model that combines mindfulness approaches and behavioural techniques to help a person understand their thoughts and emotions to alleviate feelings of distress. MBCT has gained widespread use in the treatment of mental disorders and depression. Another model is the dialectical behaviour therapy (DBT) model by Linehan (1987), which aims to identify and alter negative thinking patterns by introducing positive behaviour. The models appreciate the role of self-destructive behaviour in an individual and aim to adjust the mindset by adding appropriate skills and facilitating change. The fourth model is acceptance and commitment therapy (ACT), which was formulated by Hayes et al. (1999). ACT encourages an individual to embrace their feelings and thoughts rather than feeling guilty and fighting one's thoughts. The model allows a patient to understand their current situation and strive to address the issue by dealing with the problem.

Despite varying approaches, these four models all involve mindfulness. For example, MBSR and MBCT both deal with meditation while MBCT integrates cognitive therapy. In contrast, DBT and ACT do not teach meditation but rather use other mindfulness exercises to focus attention and promote awareness. Below is a detailed explanation of each approach and the reason for choosing an intense MBCT course over others mentioned in our study.

3.3.1 Mindfulness-Based Stress Reduction

In 1979, Jon Kabat-Zinn established the MBSR model at the Massachusetts Medical School. In this model, individuals receive intense mindfulness meditation training to help them relate to their physical and psychological issues in a more accepting and non-judgemental manner. The programme is an 8–10-week course in which a group of up to 30 people meet twice a week for 2–2.5 hours of mindfulness meditation instruction and training (Kabat-Zinn, 2003). Kabat-Zinn focused on helping students deal with their chronic pain, which had not responded to the alternative treatments previously provided. Offering mindfulness meditation coaching for 90 chronic pain patients for 10 weeks, the use of pain-related drugs was decreased while self-respect increased (Kabat-Zinn et al., 1984).

Jha et al. (2007) proposed that mindfulness could enhance attention-related responses in behaviour by improving the functioning of a certain subsystem of attention. These researchers tested a subsystem that overlapped in three neural and functional systems: orienting, cautioning, and struggle. In addition, an attention network test indexed the workings of these subsystems. Jha et al. (2007) divided the sample into two categories and used the MBSR approach to measure the differences between the two groups. The outcome of this experiment indicated that mindfulness training had a positive impact on monitoring performance. In addition, Davidson et al. (2003) reported that individuals who participated in the MBSR course enhanced their orienting attention. Increases in left frontal activation were discovered, which were indicative of dispositional and state positive affect (Davidson et al., 2003). In addition, MBSR participants exhibited increased activation in brain regions associated with experiential, present-focused thought (Farb et al., 2007) and brain regions associated with adaptive self-representation and emotion regulation processes (Farb et al., 2010; Ochsner & Gross, 2008).

Regarding the impact of mindfulness exercises on personal and mental health, a study conducted by Carmody and Baer (2008) found that using mindfulness exercises at home enhanced the health of participants and decreased their psychological symptoms. Moreover, while the use of mindfulness programmes increased in the health groups, it reduced psychological and medical symptoms. They came to this conclusion after assessing the relationship between the practice of mindfulness and improvements in the MBSR programme across the four groups: medical, well-being, mindfulness, and psychological symptoms.

3.3.2 Acceptance and Commitment Therapy

ACT was developed on the premise that psychological distress is frequently associated with attempts to control or avoid negative thoughts and emotions, which paradoxically increases the frequency, intensity, or salience of these internal events, resulting in additional distress and the inability to engage in behaviours that would lead to valued long-term goals (Hayes et al., 1999). As a result, the basic goal of ACT is to teach skills that strengthen an individual's desire to come into deeper contact with their experiences, realise their values, and commit to behaviours that are consistent with those values. Acceptance, diffusion, being in touch with the present moment, self as context, values, and committed action are the six fundamental therapy processes underlined in the ACT model (Hayes et al., 2006). Mindfulness is taught in the framework of the first four processes, in which a range of exercises are utilised to increase awareness of an observing self and promote deliteralisation of negative thoughts and beliefs.

Although ACT does not include mindfulness meditation activities, it is like other mindfulness-based methods in that it focuses on helping patients establish present-centred awareness and acceptance (Baer, 2003). ACT has been used in both individual and group settings, with durations ranging from 1 day (Gregg et al., 2007) to 16 weeks (Gregg et al., 2007; Hayes et al., 2004). ACT has been studied for its usefulness in treating depression, anxiety, impulse control disorders, schizophrenia, substance abuse, addiction, and workplace stress (Hayes et al., 2006; Powers et al., 2009).

3.3.3 Dialectical Behaviour Therapy

DBT was first developed to treat chronic suicidal and other self-destructive behaviours, which are common in people with severe borderline personality disorder (Linehan, 1993). It views the dysfunctional behaviours of individuals with borderline personality disorder as the result of an underlying dysfunction of the emotion regulation system, which includes excessive emotional reactivity and an inability to control emotions. DBT combines components of classic CBT with Zen philosophy and practice, focusing simultaneously on acceptance and behaviour change tactics to help patients improve their emotional regulation abilities (Robins, 2002; Linehan, 1993). Individual therapy, group skills training, telephone consultation between the therapist and patient, and therapist consultation team meetings are the four treatment modes of DBT. Mindfulness skills are taught as part of a skills-training group to help patients enhance self-acceptance and as an approach to decrease avoidance of uncomfortable emotional and terror reactions (Linehan, 1993). A set of mindfulness ‘what’ skills (observe, describe, and participate) and a set of mindfulness ‘how’ skills (nonjudgmentally, one-mindfully, and effectively) make up these abilities.

Mindfulness exercises include imagining thoughts, feelings, and sensations as clouds floating across the sky, counting or coordinating breaths with footsteps, and incorporating mindful awareness of daily activities. The other three skill modules, which focus on distress tolerance, emotion regulation, and interpersonal effectiveness, also include mindfulness skills (Lynch et al., 2007; Robins & Chapman, 2004). Binge eating disorder (Telch et al., 2001), bulimia (Safer et al., 2001), and chronic depression in the elderly have all been reported to benefit from DBT (Lynch et al., 2003).

3.3.4 Mindfulness-Based Cognitive Therapy

The development of mindfulness training increased in 1992 when Mark Williams, John Teasdale, and Zindel Segal were asked by the director of a clinical psychology research network to enhance a group-based therapy that could be used for the treatment of relapsed depression. In response, they developed MBCT, which was intended to aid people who were more susceptible to depression by recognising their mental behaviours, like rumination

(Chaskalson, 2014). MBCT is a practical, 8-week group intervention programme based on the MBSR model (Segal et al., 2002). MBCT combines mindfulness training and aspects of cognitive therapy with the goal of targeting vulnerability mechanisms that have been implicated in the maintenance of depressive episodes. It was developed to prevent relapse in remitted depression. MBCT, like cognitive therapy, aims to help participants perceive ideas as mental events rather than facts, understand the significance of negative automatic thoughts in maintaining depressive symptoms, and separate the appearance of negative thoughts from their negative psychological consequences (Barnhofer & Crane, 2009).

MBCT teaches individuals mindfulness skills that provide methods for relating their experiences to stop the consolidation of negative thinking patterns and feelings. The findings suggest that MBCT is at least as useful as antidepressant medications (ADMs) for individuals with three or more depressive episodes. The authors also claimed that mindfulness can change the normal function of the human brain (Kuyken et al., 2008). MBCT aims to change the individual's awareness and their relationship with their emotions and thoughts. Semple & Lee (2007) noted that MBCT could be used to treat children with anxiety. Moreover, they highlighted that anxious children who learned MBCT had improved their abilities to a greater extent than children who had not participated in the therapy. This corroborated Davidson (2016), who stated that MBCT is helpful in patients with specific characteristics, such as anxiety and depression. Furthermore, MBCT might aid people with a bad childhood history (Segal et al., 2018). The programme is designed to give a patient adequate time to adjust to the interventions. The 8-week period has proven to be sufficient in addressing most of the conditions affecting patients. The programme has seven 2-hour group sessions that ensures that the patient receives adequate attention while limiting such exposure to reduce resentment. In addition, patients are offered a half-day retreat once they complete 5 weeks of the programme. The instructor engages the participants in various methods in each session.

Some of the most common methods include breathing, open awareness meditation, body scan, walking, and compassion meditation (Williams, 2010).

The instructor includes different awareness exercises in each session. Other therapeutic strategies include stories and discussion to increase the comprehension of mindfulness principles and to create an opportunity for the participants to share their experiences. Another effective fundamental approach is the use of daily home meditation practices lasting 20 minutes. Instructors can also send email notifications each day reminding patients or participants of their tasks, including completing an online diary and reporting their daily home practices. The instructor designs the programme to enable participants to practise various forms of meditation in the half-day retreat. Such activities are usually in silence with no group discussion or exercises (Segal et al., 2018).

3.4 Mindfulness Questionnaires

Mindfulness has traditionally been characterised as a consistent awareness of what is occurring within the phenomenal field. The concept has acquired additional meanings through its translation into the empirical domain. A proper assessment of mindfulness is required to gain insight into the mechanisms that produce these beneficial effects, such as the mediating effects of different mindfulness facets. The Freiburg Mindfulness Inventory (Buchheld et al., 2001), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004), the Mindful Attention Awareness Scale (MAAS) (Brown & Ryan, 2003), the Toronto Mindfulness Scale (TMS) (Davis et al., 2009), the Cognitive and Affective Mindfulness Scale (CAMS) (Feldman et al., 2007), and the Southampton Mindfulness Questionnaire (SMQ) (Chadwick et al., 2008) are all self-report mindfulness measures. Although these measures have demonstrated adequate psychometric features, they vary in their generalisability, substance, and structure, indicating a lack of agreement among researchers on how to operationalise the concept of mindfulness. Recent studies indicated that the Five Facet Mindfulness Questionnaire (FFMQ) is more realistic and comprehensive than others (Baer et al., 2006).

3.4.1 The Five-Facet Mindfulness Questionnaire

A quality of non-judgemental acceptance, curiosity, or openness is usually included in questionnaires. While psychometric considerations may justify this inclusion, these initiatives indicate an attempt to transfer comparable but separate Buddhist ideas into the non-religious domain of mindfulness (Gilpin, 2008; Rapgay & Bystrisky, 2009). In this regard, awareness has come to imply more than it did in its previous meaning. However, to isolate the signal of mindfulness, scientific conceptualisations have emphasised practices that are taught in conjunction with mindfulness. Mindfulness has been compared to cognitive reappraisal procedures (Gross, 2002), which are an important component of CBT. All this research and the preceding methods are critical in determining the validity and reliability of the measurement. The use of scales allows researchers to determine the extent of a treatment programme's impact on patients, and this study focuses on the FFMQ for several reasons, which are listed in detail in the Methods chapter.

The FFMQ is a self-help and self-score assessment of the five facets of mindfulness: observation, description, aware acts, non-judgemental inner experience, and non-reactivity. The FFMQ is a 39-item self-reported tool for determining mindfulness. It was developed by Baer et al. (2006) and has gained widespread usage in psychological studies involving MBCT and MBSR. The scale and its facets emerged from exploratory factor analysis combining 112 items from the FMI, MAAS, CAMS, KIMS, and SMQ, resulting in five elements replicable in confirmatory factor analysis. The researchers scored the items on a Likert scale spanning from 1 as the lowest value to 5 as the highest value. The next step involved computing the scores that range from 8 to 40 and summing the individual items. Higher scores indicated increased mindfulness. According to studies, the FFMQ is highly reliable, presents valid data, and is dependable for analysing psychological symptoms (Baer et al., 2006). Similarly, the facet scale had adequate internal consistency, and the relationship between the scale and other variables was consistent with study predictions. Other mindfulness approaches, such as MBCT and MBSR, were assessed using the scale for their effectiveness and significance in individual well-being (Baer et al., 2006). Recent research has investigated the psychometric properties of the short and long versions (FFMQ-SF and FFMQ-LF) to support the questionnaire’s link to other MBIs (Baer et al., 2006; Neff, 2003). Al-Tammar (2019) translated a short version of the FFMQ into Arabic to assess the program's impact on the parents of children with type 1 diabetes, and the results revealed the questionnaire's effectiveness in measuring well-being and awareness. It provides a clear justification for conducting additional studies on using FFMQ in the Arab community.

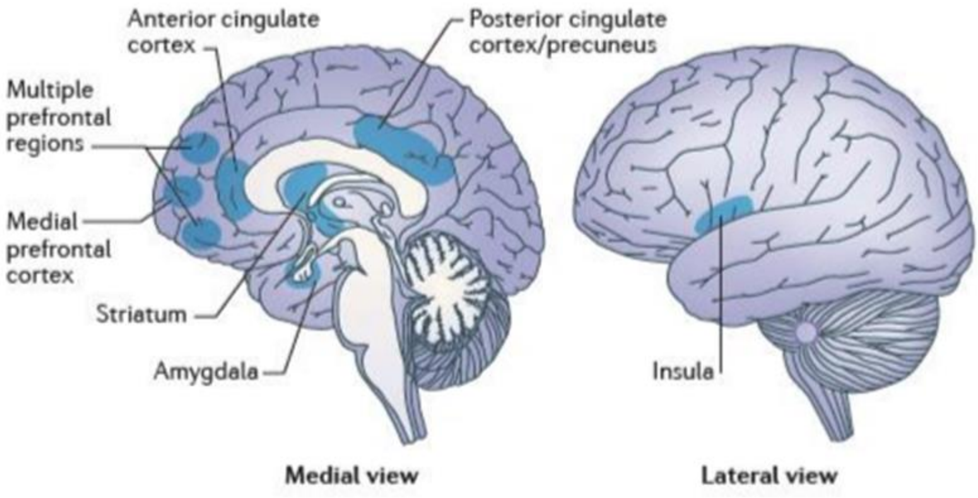
3.5 Mindfulness in Neuroscience

Consistent with mindfulness literature by neuroscientists, mediator changes may be associated with improved emotion regulation and increased allotment of attention and executive control (Hölzel et al., 2011). Neuroscientists, such as van der Velden and Roepstorff (2015), discovered how mindfulness training can have a significant impact on brain activity. According to Chaskalson (2014), mindfulness training increased grey matter in areas of the brain that deal with attention, perception, cortical thickness, and emotional regulation. Cognitive neuroscience and psychology studies have shown that meditation and mindfulness training increase cognitive processes (e.g., Cahn & Polich, 2006). Other research illustrated the influence of mindfulness training on functions that guide and govern cognitive processes for planning, working, making decisions, self-regulation, and numerous aspects that control behaviour (Black et al., 2009; Gallant, 2016; Sanger & Dorjee, 2015; Teper et al., 2013).

According to Tang et al., (2015), this causes neuroplasticity changes in brain structure and functioning that influence self-awareness, emotion, and attention. The authors conducted neuroimaging research to demonstrate that mindfulness meditation affected eight brain regions, including the structures that control emotional response and meta-awareness. The researchers obtained data from various neuroimaging measurements that revealed changes in grey matter density, thickness of brain tissues (Hölzel et al., 2011; Vestergaard-Poulsen et al., 2009), and white matter and cortical surface area (Lazar et al., 2005; Farb et al., 2013). According to Tang et al. (2015), meditation affects brain networks and their functioning. The ACC in the brain is thought to harbour aspects of mindfulness training; it enables and controls executive attention by detecting any conflicts from incompatible information processing. The researchers discovered that mindfulness meditation causes changes in the activity and structure of the ACC, which is associated with attention (Tang et al., 2015). The following figure describes the brain regions associated in the aspects of mindfulness meditation.

Figure 3.2

Brain Regions Involved in the Components of Mindfulness Meditation (Tang et al., 2015)



Similarly, the DLPC is responsible for attention and undergoes functional changes following mindfulness training. The DLPC is responsible for enhancing responses in executive processing and parietal attention regions. This area (i.e., the PFC) exhibits increased activation after an MBSR course in patients with social anxiety. Studies of mindfulness meditators have reported training to be associated with more positive self-representation, higher self-esteem, and higher acceptance of oneself. Such concepts are not easy to capture in neuroscientific studies. The insula is activated in meditation sessions, leading to an increase in awareness of the current situation. Individuals attending a 6-week course of mindfulness training (MT) exhibited increased dorsolateral prefrontal responses and improvements in cognitive inhibition (Allen et al., 2012), and individual attending an intensive 3-month retreat exhibited reduced electroencephalogram variability and attentional improvements (Lutz et al., 2009).

3.6 Mindfulness and the Attention Network Theory

Several seminal investigations on the impact of meditation on attention have focused on the broad framework established by Posner and Petersen (Jha et al., 2007; Tang et al., 2007). According to this concept, the three subsystems of attention serve diverse functions and are anatomically distinct (Posner & Petersen, 1990; Petersen & Posner, 2012). Recent component-process models of mindfulness meditation argue that one essential mechanism by which mindfulness causes change is attention regulation (Hölzel et al., 2011). Two separate attentional processes—focused attention and open monitoring—are highlighted in neurocognitive meditation models (Lutz et al., 2008; Manna et al., 2010). Maintaining prolonged selective attention to a volitionally chosen object (e.g., localised sensation of breathing) and participating in self-monitoring for intrusive ideas and attentional distractors constitutes focused attention (FA). In contrast, open-monitoring (OM) entails active monitoring and acceptance of internal and external sensations to build a receptive field of non-judgemental awareness. OM attention processes pertain to both attentional and affective/attitudinal mindfulness features, whereas FA exploits purely attentional skills by fostering an attentional focus on internal emotional sensations while understanding them as subjective and prone to personal bias.

Three fundamental attention networks, namely alerting, orienting, and executive control, are identified in more general functional models of attention (Fan et al., 2002). The activation of a properly watchful state is referred to as 'alert'. It has a broad spatial scope and permits dispersed processing of temporally anticipated but not spatially localised events, and it is synonymous with the sustained nature of the self-regulatory attention allocation models (Josefsson & Broberg, 2011). The selection and steering of resources towards the spatial location of anticipated/salient stimuli is referred to as 'orienting'. Executive control includes higher-level processes, such as resolving conflicts between competing inputs and absorption of sensory input, to maintain proper attentional allocation (Botvinick et al., 2001).

Mindfulness meditation affects various aspects of cognition, including attention stability during dichotic listening (Lutz et al., 2009), cognitive capacity in attentional blink paradigms (Slagter et al., 2007), and working memory (Chambers et al., 2008; van Vugt & Jha, 2011) (for a recent systematic review, see Chiesa et al., 2011). Furthermore, during a focused breathing task, beginner meditators showed higher activity on fMRI in front-parietal areas associated with attention control compared with controls in a 'mind-wandering condition' (Dickenson et al., 2013). Recent research has suggested that mindfulness can improve attentional efficiency; during interceptive attention, 8-week MBSR training reduced recruitment of the dorsomedial prefrontal cortex (Farb et al., 2013).

While enhanced attentional stability and prefrontal inhibition would support projected increases in executive attention over better alerting/orientation, the existing studies on the impact of mindfulness meditation on attention network function have produced mixed results. After an additional month of rigorous practice, experienced mindfulness meditators can exhibit increased orienting function (van den Hurk et al., 2010), executive control (Jha et al., 2007; van den Hurk et al., 2010), and alerting function (van den Hurk et al., 2010). Similarly, studies on naive/novice participants reported that 8 weeks of MBSR exercise improved orienting function (Jha et al., 2007), while short integrative body-mind interventions (IBMT) consisting of five 20-minite sessions over 1 week improved executive attention (Tang et al., 2007), with two 15-minuted focused-breathing mindfulness sessions shown to improve alerting function (Polak, 2009). The intensive mindfulness course appears to be more effective and more acceptable to patients than the traditional 8-week course (MacLean et al., 2010; Elliott et al., 2014). The previous mixed results could be due to differences in the mindfulness-meditation practices used across studies, such as the extent to which they emphasise focused attention (Polak, 2009) or open-monitoring (Tang et al., 2007). This underscores a need to better understand the role of component meditation processes in modulating cognition and emotion processes (Lutz et al., 2008).

3.7 Mindfulness in Clinical Populations

Attention and concentration problems, memory deficits, irritability, and exhaustion are among the most typically reported issues, and one study indicated that patients who struggled to accomplish two tasks at once (divided attention) were more likely to have poor employment status after a brain injury (Zomeren & van den Burg, 1985). Efforts to alleviate attentional deficits have yielded mixed results. Some controlled-group studies (Sturm & Willmes, 1991; McMillan et al., 2002) demonstrated benefits after treatment, including late improvements visible 6 months after the conclusion of treatment (Sturm & Willmes, 1991; McMillan et al., 2002; Gray et al., 1992). Gray and Robertson (1989), Sohlberg and Mateer (1987), Sturm et al. (1997), and Wilson and Robertson (1992) all reported favourable changes in their case studies; however, no effect was reported in additional controlled experiments (Ponsford & Kinsella, 1988; Novack et al., 1996; Wood & Fussey, 1987). Researchers have reviewed the controlling for spontaneous recovery and placebo effect, proper group matching, and assessment if improvements persist during follow-up and found that are all important factors in determining the therapeutic success of rehabilitation approaches for attentional problems (Robertson, 1990; Sturm et al., 1997).

Different studies have aimed to establish the efficacy of each model in addressing mindfulness. According to a meta-analysis of MBSR by Grossman et al. (2004) involving 1,605 participants in 20 different studies, the model had widespread application in a wide range of clinical conditions. Similar results have emerged from studies conducted by

Hofmann et al. (2010) and Evans et al. (2018), indicating that MBIs can positively influence anxiety and depression. Several studies have also been published regarding the effectiveness of mindfulness on psychological symptoms, like chronic depression (Kabat-Zinn, 1982; Kabat-Zinn et al., 1984), eating disorders (Kristeller & Wolever, 2010; Segal et al., 2002), cancer pain (Ledesma & Kumano, 2009). Other researchers evaluated the relationship between the use of mindfulness and different conditions, like cancer. Van der Lee and Garssen (2012), Carlson, and Garland (2005) reported on two studies that found that MBIs reduce fatigue in cancer patients. Some evidence is provided by the outcomes reported by a study conducted by Baer (2003), whereby patients claimed that mindfulness helped them to enjoy the present moment and decreased their stress levels. Mindfulness alters how individuals relate to their thoughts, feelings, actions, and emotions, which changes how they engage with unhelpful information (Baer, 2003). The mindfulness list of actions includes attention regulation, emotion regulation, and body awareness (Hölzel et al., 2011). By recognising what is happening in the present, individuals begin to enjoy life instead focusing on the past or thinking about the future (Williams, 2010).

In the next sections, I review the studies conducted on the application of the mindfulness programme in patients suffering from attention impairment, specifically patients with brain injuries and refugees with PTSD.

3.7.1 Mindfulness for People with Brain Injuries

Chronic mTBI is difficult to treat as it has a wide range of symptoms that can overlap with PTSD (Rose et al., 2015; Schneiderman et al., 2008). The prevalence of chronic mTBI varies significantly with different screening methodologies, ranging from 5% to 43% of concussed persons with chronic symptoms (Bazarian et al., 1999; Iverson, 2005; Voormolen et al., 2018). Furthermore, symptom clusters are interconnected, can intensify one another via circular feedback loops, and have social repercussions (e.g., headache, disrupted sleeping patterns, impaired academic, occupational, or athletic performance, a state of mental anguish), and the difficulty in treating these symptoms increases as a result. Other chronic mTBI symptoms may be exacerbated and maintained by stress, anxiety, and depression. These biopsychosocial consequences emphasise the importance of intervening early to alleviate emotional and psychological issues (Link et al., 2016).

Behavioural interventions to decrease the persistence of debilitating symptoms after mTBI are generally missing from current treatment protocols (Thomas et al., 2015). For example, rest has been the major therapeutic strategy for decades (Silverberg & Iverson, 2013); however, additional proactive treatments are urgently needed (Thomas et al., 2015). New treatment methods are beginning to approach mTBI as a rehabilitative injury, allowing patients to take active actions to improve their conditions rather than passively waiting to recover. Recent research has investigated physical activities, such as aerobic exercise (Sullivan et al., 2018) and cognitive therapeutic options (Read et al., 2020) to aid in recovery; however, these approaches do not directly target emotional and psychological problems. Although CBT is commonly used to treat the psychological symptoms of TBI (Gomez-de-Regil et al., 2019), it may not be appropriate for all groups. Previous research showed that meditation and MBIs are useful in the treatment of chronic mTBI symptoms. Mindfulness-based techniques encourage self-regulation of attention to the present moment and non-judgemental acceptance of the present moment (Bishop et al., 2004).

Recent meta-analyses have shown that meditation, yoga, and mindfulness-based therapies have moderate effects on depression, anxiety, and stress symptoms (Breedvelt et al., 2019) and may improve cognitive performance (Gothe & McAuley, 2015) and pain management (Breedvelt et al., 2019; Hilton et al., 2017; Lauche et al., 2019). The brain regions commonly injured in mTBI (e.g., frontal, parietal, and white matter pathways) coincide with the brain regions enhanced by MBSR and MBCT, according to a literature assessment of MBIs for mTBI (Link et al., 2016). In addition, difficulties with emotion regulation have been linked to reduced function of the default mode and executive networks in chronic mTBI patients (van der Hornet al., 2017). MBIs have been shown to have favourable impacts on major brain regions (e.g., hippocampus, amygdala, prefrontal cortex, and cingulate cortex) and emotion-related brain networks (e.g., the default mode network) (Boccia et al., 2015; Fox et al., 2014).

Many hospitals in the United Kingdom (Acabchuk et al., 2021; 'Brain Injury Rehabilitation Centre: Mersey Care NHS Foundation Trust', 2021) and other countries (Martorella et al., 2021; Shirvani et al., 2021) have implemented mindfulness programmes as a method of cognitive and psychological rehabilitation for people with brain injuries before returning to normal life. This implementation is still lacking in some Middle Eastern countries, such as Kuwait, where such a cognitive rehabilitation programmes for people with attention impairment are also needed.

3.7.2 Mindfulness for People With PTSD

Adverse life events, whether direct or vicarious, have always been a part of the human experience; however, not everyone recovers in the same way after a stressful incident. Although most people begin to feel better after a few weeks or months, trauma can cause severe distress in some people, leading to a mental health condition known as a PTSD (Falsetti et al., 1993). Individuals with PTSD have heightened sympathetic nervous system activity that was not present before the trauma, resulting in symptoms, such as hyperarousal or hypervigilance, poor concentration, anhedonia, elective hypoamnesia, and dysfunctional mood regulation (Omidi et al., 2013; Polusny; 2015). They also have frequent flashbacks or traumatic memories, intrusive thoughts, and behavioural avoidance, which could be due to the failure of the prefrontal cortex to regulate the fear response (Etkin & Wager, 2007). As a result, an individual's psychophysiological homeostasis is disrupted in PTSD, resulting in severe suffering. Excessive emotional arousal can be treated effectively in people with mood and emotional instability syndromes like PTSD. Furthermore, because veterans' mood states interact with other PTSD symptoms, improving their emotional state may have an impact on PTSD recurrence and relapse (Ehring & Quack, 2010; Price et al., 2006).

According to Libby et al. (2012), 77% of the Department of Veterans Affairs specialised programmes for PTSD include some form of mindfulness training. Mindfulness can be used alone or in combination with other transformation tactics to provide more thorough treatment. Banks et al. (2015) reviewed the literature on mindfulness-based therapies for PTSD, which included four randomised-controlled trials, one nonrandomised-controlled trial, three uncontrolled trials, and four pilot studies. Most of the research found that mindfulness training improved PTSD symptoms and that the effects were generally long-lasting. However, overall, the research lacked sufficient methodological rigor to draw definite conclusions (Banks et al., 2015). Polusny et al. (2015) conducted a randomised-controlled trial for veterans with PTSD, comparing MBSR to a nonspecific psychotherapy control, both administered in a group setting. Individuals who completed MBSR had greater reductions in PTSD symptoms and improved quality of life at the end of treatment and at 2-month follow-up; however, the effect size of the between-group difference in symptom improvement was small-to-medium (Cohen's d = 0.40), and there was no difference in depressive symptoms or the likelihood of fully treating the PTSD.

Mindfulness-based treatments may be an alternative to trauma-focused treatments, like cognitive processing therapy (CPT) and prolonged exposure therapy, which are considered ‘present-centred’ in the sense that they teach non-judgement and acceptance of thoughts and feelings as they arise in the present moment. A recent analysis found that present-centred therapy for PTSD was similarly effective and had much lower drop-out rates when compared to evidence-based, trauma-focused therapies (Frost et al., 2014). Mindfulness focuses on accepting one's experiences without judgement, even unpleasant ideas or feelings, and evidence of its impact on attentional control and physiological arousal is growing. Acceptance without judgement appears to combat the avoidance and thought suppression that are common in PTSD (Banks et al., 2015). Changes in autonomic arousal may also help with PTSD-related reactivity and hypervigilance, and attentional control may help combat intrusive thoughts.

Despite the effectiveness of mindfulness and meditation-based interventions in a variety of physical and neuropsychiatric disorders, a better understanding of the neuropsychological mechanisms of action in mindfulness and meditation-based interventions is needed to improve treatment protocols for clinical populations and to better inform a growing population of people who choose to incorporate regular meditation into their lives (see Hölzel et al., 2011; Rubia, 2009). The author also believes that comparing MBCT to CBT, which has been shown to be effective in mTBI patients and refugees with PTSD, is beneficial. While these two therapies are similar in some ways, they are not identical. The next section will briefly outline CBT before comparing it to MBCT.

3.8 Cognitive Behavioural Therapy in Clinical Populations

According to current treatment guidelines, brain injury rehabilitation should be offered as part of a comprehensive neuropsychological and multidisciplinary rehabilitation programme that addresses cognitive, emotional, and behavioural difficulties to improve engagement in meaningful daily activities (*SIGN 130 • Brain injury rehabilitation in adults,* 2013). CBT is a suitable treatment for post-injury depression and anxiety according to current psychological therapies because it is a systematic approach focused on concrete thoughts and behaviours (Hodgson et al., 2005). CBT is a group of therapies (Hofmann et al., 2013) based on the belief that ‘cognitive activity impacts behaviour’, ‘cognitive activity can be monitored and adjusted’, and ‘cognitive change can be achieved through cognitive transformation’ (Dobson, 2013). CBT involved procedures, treatment strategies (e.g., exposure to fearful stimuli, arousal control skills training), and content-related components (e.g., establishing new ideas about self, the world, and the future). Individualised formulations derived from the cognitive model guide the negotiation of specific goals, the use of active change strategies (e.g., challenging unhelpful beliefs), completion of between-session tasks (e.g., homework), and a ‘here and now’ focus, all of which distinguish CBT from other therapies (Flach et al., 2015; Tolin, 2010). Assignment of tasks or homework to gather more information about the relationships between thoughts and action, meditation on experience, and intentional planning to improve thoughts and behaviour while evaluating the adaptability of thoughts and behaviour are all examples of treatment components (Dobson, 2013).

CBT is recommended in practice for the treatment of anxiety symptoms following mild-to-moderate TBI as part of a wider neurorehabilitation programme (*SIGN 130 • Brain injury rehabilitation in adults*, 2013). In addition, the National Institute for Health and Clinical Excellence (NICE) guidelines for the diagnosis and treatment of PTSD acknowledge the efficacy of psychotherapeutic therapies, such as CBT (Schauer et al., 2004). A study of psychotherapy treatment in adult refugees and asylum seekers (Nicholl & Thompson, 2004) was published with broader inclusion criteria that included case studies and accounts of treatment outcomes that were somewhat anecdotal. In her evaluation of the effectiveness of CBT in PTSD, Cloitre (2009) mentioned refugee PTSD outcome studies intermittently as part of the overall CBT treatment outcome literature on PTSD. The outcomes demonstrate the programme's efficacy (Cloitre, 2009).

3.8.1 Mindfulness-Based Cognitive Therapy versus Traditional Cognitive Behavioural Therapy

MBCT appears to be a compelling psychological intervention that continues to gain widespread acceptance for preventing and treating relapse and other depressive symptoms (Chiesa & Serretti, 2011; Galante et al., 2013). It is associated with substantial improvements in well-being, depressive symptoms, anxiety, and quality of life in patients with or without other conditions (Hofmann et al., 2010; Khoury et al., 2013). CBT is widely used to treat depressive symptoms and prevents the occurrence of depression (Beshai et al., 2011; Butler et al., 2006). MBCT and CBT interventions differ significantly: MBCT focuses on meditation and yoga exercises while CBT deals with behavioural activation and addresses the adaptation to dysfunctional thoughts. Different studies have examined the issues of observant awareness and attention in supporting the well-being of an individual; therefore, it is essential to change the relation to and knowledge of thoughts as opposed to changing the thought content. MBCT offers an opportunity to address emotional pain and distress.

Mindfulness teaches people to recognise and accept their mental process as a subconscious event rather than a real-life event; it can align an individual's relationships and attitudes in such a way that their subsequent behaviours and sentiments are unaffected. In contrast, CBT aims to reorganise and challenge cognition and beliefs about one's surroundings. I combined increased mindfulness and CBT in this study to better understand the effects of the therapies and the programme's applicability in a sample of patients from the Arab population. Acceptance-based mindfulness and change-based cognitive behaviour treatments are combined in these two theories, resulting in effective treatment (Butler et al., 2006).

3.9 Summary

The reviewed studies appear to support the use of mindfulness interventions in alleviating mental conditions, like anxiety and depression, which affect a considerable number of patients. Mindfulness may also reduce adverse effects, including fatigue, in some cancer patients. Mindfulness appears to have a positive effect on attention in addition to depression, self-esteem, and awareness. Most of the previous mindfulness studies investigated emotion regulation and reducing stress and anxiety; few studies have been published on how mindfulness is able to improve attention systems or other cognitive functions. Therefore, there is a gap in the literature, which this thesis partially addresses. To date, limited studies have considered the use of mindfulness training for people with mTBI or refugees with PTSD. Clinicians should understand the different mindfulness interventions and their contributions to improving health and brain performance. Such understanding can be helpful in addressing some of the underlying mental conditions affecting many people around the world.

Although a growing body of evidence supports the efficacy of all four primary types of mindfulness-oriented therapies (MBSR, ACT, DBT, and MBCT), future studies will need to address several key research problems. Because many of these interventions have several components, future research should investigate how intensified mindfulness courses work, specifically how mindfulness training works for the clinical population in the Middle East. Furthermore, these interventions teach mindful awareness in diverse ways, and future studies should assess the efficiency of different mindfulness teaching approaches in developing increased mindful awareness in daily life for patients. Perhaps this is what drove me to conduct this research in the first place; to bridge the gap between research studies and the pressing need for these therapies in the Middle East. As a result, this thesis examines the role of mindfulness in improving attention and psychological well-being in Kuwaiti outpatients with mTBI and Syrian refugees with PTSD in Turkey. The second chapter will address attention measures, and the third chapter will present previous studies in the field of Mindfulness, followed by the studies conducted in this thesis.

3.10 Aims

The aims of this study were as follows:

1. Investigate neuropsychological evaluations for patients with attention deficits.
2. Investigate the effectiveness of the Arabic version of the FFMQ - long version.
3. Assess the effectiveness of MBIs versus CBT in improving well-being and attention systems.
4. Improve neurocognitive rehabilitation services in Kuwaiti hospitals by identifying the short- and long-term consequences of mTBI.

3.11 Hypothesis

1. The Arabic version of the Stroop task is as effective in measuring attention and cognitive functions as the English version.
2. Participants' performance improved on the FFMQ after receiving a course of Mindfulness.
3. Mindfulness-based interventions, like a cognitive behavioural therapy, have a positive impact on the lives of participants.

3.12 Epistemology

Researchers must comprehend the philosophical environment in which their data are collected because epistemology and ontology are so crucial in scientific inquiry. Epistemology is a philosophical field concerned with how we, as humans, learn to know things about the world, including our beliefs and assumptions (Elliott et al., 1999). In epistemology, the extent, validity, and limits of this knowledge are all examined (Willig, 2012). In contrast, ontology is a person's philosophy of reality and how they interpret the world around them (Bunge, 1974). Researchers should be aware of how their epistemological position affects their methodological designs, data collection, and analysis (Barker & Pistrang, 2005). Although it is beyond the scope of this thesis to provide a complete description and critique of the critical realism method, the current research was conducted using this method.

The world is real, regardless of who is looking at it, and it is thus measurable, according to realism. The researcher's purpose as a realist is to comprehend the world's properties as precisely as possible (Voss et al., 2013). This approach has grown into a critical realist viewpoint in clinical psychology over the last 50 years, and it postulates that there is a real world with observable regularities (Voss, et al., 2013) but questions the ability to know realities with absolute certainty. In contrast, a critical realist recognises that all scientific study is flawed and prone to human mistake and cultural bias (Trochim & Donnelly, 2001). Researchers should be transparent regarding the methods utilised when taking a critical realism viewpoint so that research may be repeated. Furthermore, the use of numerous measurements to assess the same construct is encouraged to provide reliable knowledge of the observed reality.

The decision to take on a critical realism perspective was made explicitly with the goal of qualifying constructions within a ‘real’ reality while acknowledging that knowledge is located within a broader cultural and social context. As a result, data judgements and conclusions are prone to human mistakes. The researcher acknowledges the socially constructed nature of the concepts covered in the study by adopting a critical realism approach. This permits us to consider that the neuropsychological constructs presented here, such as cognition and basic neuropsychological processes, are developing in nature. The next chapters describe the methods, experiments, study design, neuropsychological assessments, and where participants were randomly allocated to receive either MBCT or standard CBT as a method to investigate the potential effectiveness of MBI in improving attention.

Chapter 4: Normative Data of a Computerised Arabic Language Version of the Stroop Task

Abstract

Background: The majority of Stroop tasks are only available in English; as a result, there is a need to develop a measure appropriate for Arabic cultures to investigate attention and cognitive function across different countries and cultures.

Objective: The purpose of this research is to produce a computerised and open-source Arabic version of the Stroop task and to record the performance of a normal sample to use as a comparison benchmark.

Method and Findings: The Arabic version of the Stroop task was designed in stages based on the guidelines of the PsyToolkit Online Stroop Task (Stoet, 2016). A sample of 90 Kuwaiti adults participated in pilot testing, and they reported no problems with the items. According to the findings, a name that does not match the colour influences response speed and error rate.

Conclusion: The current study's findings indicate that PsyToolkit is a viable method for conducting general and psychological-specific experiments, with the effects replicating both response choice and response time. Furthermore, the computerised Arabic Stroop task can be used to assess attention in Arabic-speaking countries.

4.1 Overview

The Stroop test is used to assess many cognitive processes, such as attention and executive function (Banich et al., 2019; Botvinick et al., 2001; Goethals et al., 2004; MacDonald et al., 2000). A computerised version of the test was developed and widely used due to its ease of use. In neurological and psychiatric patients, the Stroop test is considered a highly sensitive tool for detecting lesions on the frontal lobes and is commonly used in clinical settings (DiBonaventura et al., 2010; Parsons & Barnett, 2018). Only a paper version of the Arabic version of the Stroop test has been applied in the Kingdom of Saudi Arabia (Al-Ghatani et al., 2010); therefore, this study is considered as a novel study as- to the best knowledge of the researcher- there is no version of the computerised Stroop task in Arabic. For patients for whom Arabic is their first language, an available and easy to use Arabic Stroop test is needed.

4.2 Method and Recruitment

4.2.1 Participants

This study included 90 healthy students from Kuwait University whose first language was Arabic. They were students in Dr. Khashawi's course who volunteered for this study. The mean age of the participants was 22.9 ± 7 years.

4.2.2 Ethics

Ethical approval was obtained from the Research Ethics Committee of Kuwait University and Bangor University.

4.2.3 Measure

PsyToolkit was used because it is designed for use in a classroom setting, with minimal technical barriers and free web-based hosting of their studies. Students can examine and modify an existing library of psychological scales and experiments, and extensive online documentation and tutorials are available to assist them if they encounter any difficulties (Stoet, 2016). PsyToolkit is intended to allow students to randomise the item order in questionnaires and cognitive experiments to provide a convenient method of scoring and to provide feedback to participants on their test scores; these options are not available in all internet-based instruments. To conduct experiments with the internet-based version of PsyToolkit, researchers first create a free account (Stoet, 2016). Stoet (2018) claims that both the internet and Linux versions of PsyToolkit can reliably measure small effects of less than 50 ms. It uses the internet-based version in the lab room to reduce the impact of external influences, such as noise, in addition to answering any question that the participants may have or solving electronic malfunctions.

4.2.3.1 Validity. The content validity of a measurement tool refers to how accurately it represents each element of a construct or how well the material is sampled; this is also known as logical validity or face validity (Hardesty & Bearden, 2004). Face validity implies that the items accurately reflect the questionnaire's objectives. Logical validity entails a more thorough and careful process, such as a panel of experts evaluating a procedure's content validity (Rubio et al., 2003). However, Kim et al. (2019) strongly supported the idea that the PsyToolkit results are comparable to those obtained in a laboratory setting, where the results for response time (RT) indicate no interaction effects involving the version at a 95% confidence level. Dr Rudi Coetzer, a consultant neuropsychologist in the UK National Health Service, reviewed the Stroop task design for this study.

4.2.4 Main Variables of the Design

This study aims to quantify the following variables: it is the difference between the colour that corresponds to the word's colour and the name of a colour that does not correspond to the word's colour.

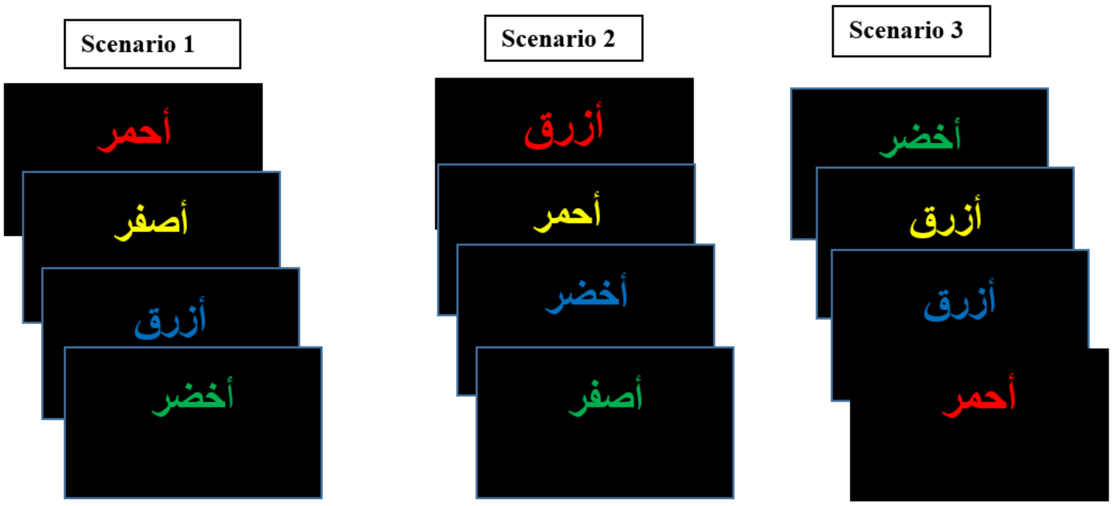
4.2.5 Procedures

A computerised Stroop task using four colours and words (red, yellow, green, and blue) was translated into Arabic, and three scenarios in various combinations were used in the congruent and incongruent trials. Ms Mubarak, Dr Khashawi, and Dr Coetzer designed the Stroop task using the PsyToolkit website (https://www.psytoolkit.org/2021; Stoet, 2016).

The test was conducted in the laboratory of the Department of Psychology at the College of Social Sciences, Kuwait University. The researcher and his colleagues instructed the participants before starting. At the start, 20 trials words were displayed in their congruent colour (e.g., red display in a red colour). Then, 10 of the congruent and incongruent test trials presented the Stroop task (e.g., red display in blue colour) to prepare participants for the main test. Participants were instructed to respond as quickly and as accurately as possible to the colour of each trial while ignoring the meaning of the word (Zajdel & Nowak, 2007). Finally, 60 congruent and incongruent trials were presented randomly, except no word or colour of the incongruent trial was the same as the preceding congruent colour and word to avoid the priming effect. Participants were instructed to select the appropriate response option by pressing the answer button. The keyboard comes in four different colours buttons: red, green, yellow, and blue. This research focused on determining the effect of the intervention in improving attention by reducing the reaction time (RT). The figure below present the measure model.

Figure 4.1

The measure design by using online Stroop task



The performance of a normal sample was then recorded to use as a benchmark to compare with existing, unpublished data collected by Mubarak, Khashawi, and Coetzer (for more information, see Appendix E). In addition, I administered this version to a small group of mild traumatic brain injury (mTBI) outpatients before applying it to the main sample (see Appendix F). Therefore, it will provide a good measurement tool for cognitive processes and a good diagnostic tool for lesions of the frontal lobes that can be used in clinics.

4.3. Data Analysis

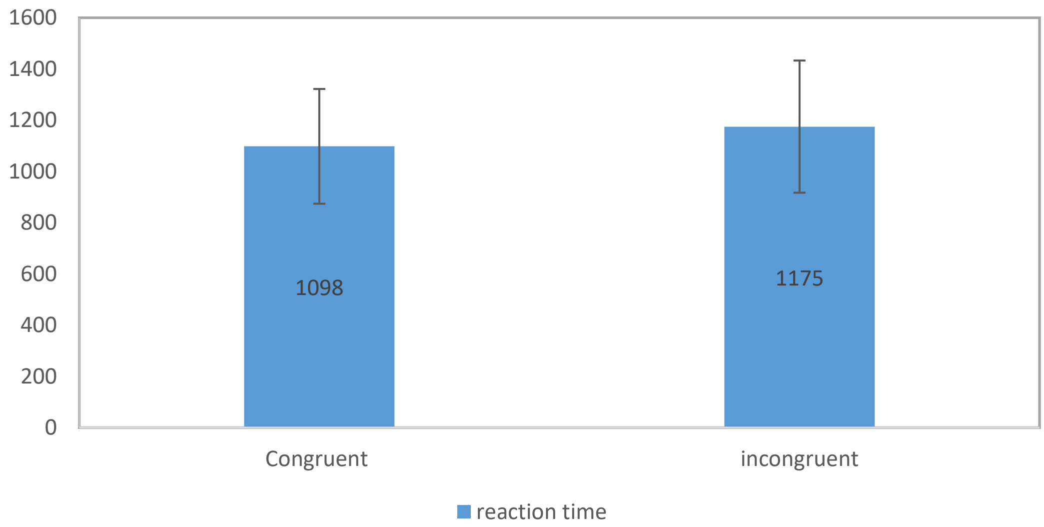
A two-tailed test was used to examine both sides of a specified data range (congruent and incongruent), as defined by the probability distribution involved. Based on predetermined standards, the probability distribution represented the likelihood of a specific outcome. As a result, when the name of the colour conflicted with the colour of the word, participants had difficulty concentrating, which affected RT and the number of possible errors compared with when the name of the colour matched the colour of the word. Where the speed was more and errors are less.

4.4 Results

Participants' performance showed an average RT of 1,098 ms in the congruent task, with a standard deviation of 224 ms. Regarding the incongruent task, their RT was 1,175 ms, with a standard deviation of 258 ms. Two tailed *t*-test indicated significant differences between congruent and incongruent tasks (t (82) = 2.04, $p < .05$).

Figure 4.2

Comparison of Reaction Time (in Milliseconds) Between Computerised Congruent and Incongruent Arabic Language Versions of the Stroop Task in Healthy Students (n = 90)



4.5 Discussion

Computerised neuropsychological tests can be useful in a variety of new and evolving psychological assessment areas. The computerised application of the Stroop colour-word test provides a considerable advantage in time measurement analysis as it enables precise recording of RT in thousandths of a second, improving sensitivity (Stoet, 2016). In addition, computerisation increases the standardisation of the settings for presenting stimuli and collecting responses, allowing for more rigour in the control of the evaluation conditions, making the test a more reliable resource for neuropsychological evaluation (Pilli et al., 2013). Multiple Stroop Color and Word Test (SCWT) scoring procedures are available in the literature, with Golden's (1978) version being the most utilised. The metrics of performance speed and accuracy, which are critical for detecting the Stroop effect, are evaluated differently in each study, indicating methodological differences (Reips, 2000, 2002). Some of the examined studies only considered the speed with which the task was completed (Amato et al., 2006; Valgimigli et al., 2010); others measured both speed and accuracy of performance, but they did not compare the subjects' performance across SCWT settings (Barbarotto et al., 1998; Brugnolo et al., 2015). Caffarra et al. (2002) proposed a scoring method that computes errors and speeds separately. Previously, there was no available normative data on computerised Arabic scoring methods, which are needed to score performance accurately and informatively in the SCWT. The purpose of this pilot study was to determine whether the Arabic Stroop test is as useful to native Arabic speakers. Our results support the results of studies that indicated an increase in RT in the incongruent trials compared with the congruent trials in addition to the measures of performance in the Stroop task (RT in each type of trial) (Bar-Haim et al., 2007; Williams et al., 1996). The Stroop conflict and ignored repeated conditions had significantly higher RTs than the neutral condition (i.e., when the word and the ink colour were the same). Although mean RTs in the congruent condition were faster than in the neutral condition, the differences were not significant (Vitkovitch et al., 2002). The results of this pilot study allow us to conclude that the Arabic translation is suitable for the Stroop test. More research is needed to collect normative data for this scoring approach and to investigate its clinical application.

Chapter 5: A Comparison of the Effects of a Mindfulness-Based Intervention and Standard Cognitive Behavioural Therapy on Performance on the Stroop Test by Syrian Refugees with Post-traumatic Stress Disorder and Healthy Control Participants

Abstract

Background: Scholars believe that mindfulness can help people become more aware of themselves and others. This method can also be used in neuropsychological counselling. Recent studies have shown that mindfulness improves cognitive performance, attention, and emotional regulation. However, research on the extent to which mindfulness programmes can be used as a rehabilitation method in the neuropsychological field, especially in the Arab community, are limited.

Objective: The purpose of this study is to investigate whether there is a difference in attention training between Syrian refugees with post-traumatic stress disorder (PTSD) who participated in the mindfulness programme for 2 weeks (N = 10) and refugees who trained in cognitive behavioural therapy (N = 10). Furthermore, the groups were compared to a control group of healthy participants (N = 17).

Method and Findings: The Arabic version of Stroop test was developed in stages following the PsyToolkit Online Stroop Task guidelines. This study included 20 Syrian refugees with PTSD and 17 healthy Kuwaiti adults. The findings on the Stroop R-Arabic version revealed a significant intrapersonal difference in the main effect of conditions after the intervention (congruent and incongruent). Whereas the correct answer, had fewer errors and was faster. There was no statistically significant difference between the two types of interventions.

Conclusion: According to the findings, a name that does not match the colour influences RT and error rate. In addition to the effect of psychological stress on attention and cognition, the results indicated the effectiveness of therapeutic programmes in improving participants' performance.

5.1 Overview

The SCWT is one of the most widely used tools in clinical and experimental neuropsychological settings, and it is regarded as one of the gold standards of attentional assessments (Strauss et al., 2006). A prospective cohort study was conducted to assess the attention of Syrian refugees with PTSD and healthy participants. Syrian refugees were treated at the Ataa Centre, located near the Syrian-Turkish border in Hatay, Turkey. Ataa is a humanitarian relief association that receives refugees who have been hurt psychologically or physically; they collaborate with local hospitals to provide refugees with the care they need. The purpose of this study was to investigate the third phase of the Stroop test (Stroop interference) and determine whether there is any improvement in processing speed after the application of two different interventions: mindfulness-based intervention (MBI) and cognitive behavioural therapy (CBT). The performance of Syrian refugees with PTSD and healthy controls was assessed.

5.2 Design

This interventional study used a mixed factorial design for both the pre-test and post-test research to assess the effectiveness of an MBI in improving attention and well-being in individuals with PTSD who suffered from attention impairment and poor well-being and compared their results to a healthy group. Participants completed neuropsychological assessment as a baseline before starting the MBI or CBT sessions, which lasted for 2 weeks and comprised four sessions per week. Post-intervention, the neuro-psychological assessment was repeated.

The following strategies and measures were used to maximise fidelity to the intervention:

- **Intervention:** MBI and CBT were performed for refugees with PTSD and a healthy group; each group of participants received MBI or CBT sessions 2 hours a day over eight sessions for a 2-week period.
- **Training:** Ms Mubarak, who received training from Bangor University's Mindfulness Centre, UK, and a clinical phycologist delivered the MBI sessions. A clinical phycologist, Mr. Almutairi, delivered the CBT sessions for the control group.
- **Delivery:** The checklist was completed by participants every session and was reviewed by the researcher. A checklist of homework was discussed in the proceeding sessions.
- **Receipt:** Participants received reminder massage one day before and immediately prior to the sessions. Attendance of the participants was recorded. Almost all participants attended all sessions.
- **Enactment:** The online Stroop task was used to observe the improvement in the participants. For more information about the agenda and the homework that was provided for the participants in each session, please see Appendix L.

5.3 Ethics

5.3.1 Ethical approval

Ethical approval was obtained from the Research Ethics Committee of Bangor University, Research Ethics Committees of the Ministry of Health Kuwait, and Research

Ethics Committee of Kuwait University, and approval was obtained from the Ataa Humanitarian Relief Association, Turkey (see Appendix A for all ethical approval).

5.3.2 Consent Form

Before participating in the study, all potential participants signed a written consent form (Appendix B). Before agreeing to participate, each participant was given an information sheet (Appendix C) that explained the study objective, confidentiality, methods, and their right to withdraw at any time. Participants were given a debrief sheet once the research was completed, and they were encouraged to ask questions and to request a copy of the study results. The debrief sheet included information on organisations that could help participants if they had any concerns after participating in the study (Appendix D).

5.3.3 Confidentiality

To maintain confidentiality, participants were given a unique participation code that was kept anonymised from their data. No personally identifying information was linked to any of the data collected. The researcher is the only person who has access to the data, which is kept in a locked cabinet. A unique code was used during the analysis and an ID number was used to access the electronic databases. All participants were informed about the importance of maintaining confidentiality.

5.3.4 Protection

Completing a neuropsychological assessment, which may induce mild tiredness, was part of the process. During the assessment, participants were allowed frequent pauses to reduce the chance of impairment due to fatigue. The evaluation was created to keep the number of tests to a minimum to achieve the purpose of the research.

5.4 Method

5.4.1 Participants

Thirty-seven young adults (aged 21–45 years) participated in the study; as shown in the following table. Participants in the healthy group were randomly assigned to either the experimental (MBI) or the control (CBT) group. Male participants in the refugee group refused to be offered treatment by a woman; likewise, women preferred to be trained by a woman. Therefore, the control group was entirely male, and the experimental group was entirely female. Participants in the experimental group participated in an MBI course led by Ms Mubarak, while a psychologist, Mr Almutairi, delivered the CBT course to the control group.

Table 5. 1

Demographic Characteristics of the Participants

Demographic Characteristics	Refugees with PTSD		Healthy Group	
	MBI (*n* = 10)	**CBT (*n* = 10)**	**MBI (*n* = 7)**	**CBT (*n* = 10)**
Gender				
Male		10 (100%)		7 (70%)
Female	10 (100%)		7 (100%)	3 (30%)
Education Level				
High school	2 (20.0%)	2 (20.0%)		
Diploma	1 (10.0%)	1 (10.0%)	1 (14.3%)	
Undergraduate	7 (70.0%)	7 (70.0%)	5 (71.4%)	7 (70.0%)
High diploma				2 (20.0%)
Postgraduate			1 (14.3%)	1 (10.0%)
Handedness				
Right	9 (90%)	10 (100%)	7 (100%)	9 (90%)
Left	1 (10%)			1 (10%)
Age (year)				
Range (Min., Max.)	(29, 45)	(21, 45)	(20, 39)	(26, 42)
(mean ± *SD*)	(39.4±5.9)	(30.8±7.4)	(30.5±6.2)	(35.9±5.4)

Note. PTSD, post-traumatic stress disorder; MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

5.4.2 Power Calculation for Sample Size

It was not possible to perform a power calculation as the size of the effect of the interventional was unknown because this is a novel approach. This was an opportunity sample.

5.4.3 Recruitment

5.4.3.1 Refugees With Post-traumatic Stress Disorder. Competent psychotherapists from Ataa delivered information leaflets and consent forms to the participants. The researcher collected and returned the signed consent papers. Ms Mubarak and Mr Almutairi held a preliminary meeting with potential participants to discuss the entire programme before it began.

5.4.3.2 Healthy Group. Participants in Kuwait were recruited through a social media campaign (TV programme, Instagram, and Twitter) that included the researcher’s contact information. Before deciding whether to participate, the participants were given an information sheet explaining the study.

5.5 Inclusion and Exclusion Criteria

Patient participants were eligible to take part in the study if they were:

1. Aged between 21 years and 45 years 11 months.
2. Diagnosed with PTSD as assessed by the clinical psychologist.
3. Were able to understand and speak Arabic as a first language.

Participants were excluded if they were:

1. Unable to read size 14 font as the assessments required adequate vision for completion in a standardised manner.
2. Diagnosed with hearing loss or deafness. The assessments required adequate hearing for completion in a standardised manner.
3. Suffering from behavioural disorders, such as aggression.

5.6 Stroop task

PsyToolkit (Stoet, 2016) was applied before and after intervention. For more information about the task procedures, see Sections 4.3.2–4.3.5.

5.7 Main Variables

The study aimed to quantify the following variables. It is the difference between the colour that corresponds to the word's colour and the name of a colour that does not correspond to the word's colour. The study aimed to determine whether there is a difference in performance between the two groups (MBI and CBT) and what effect psychological stress has on attention and cognition?

5.8 Procedures

5.8.1 Data Collection

5.8.1.1 Syrian Refugees with Post-traumatic Stress Disorder. Ataa Humanitarian Relief Association in Turkey was provided with the participants' information sheets and consent forms to enable their distribution to participants by a competent psychotherapist. Signed consent forms were returned and collected by Ms Mubarak. The information sheets included researcher contact information in case participants had any questions about the research or had any problems. Participants were assigned to receive either MBI or standard CBT. Participants in the experiment group met with Ms Mubarak 4 days a week for a 1-hour individual session for a total of 2 weeks. The researcher had been trained to teach mindfulness courses from the Mindfulness Centre at Bangor University. Participants in the control group met Mr Almutairi, a clinical psychologist, 4 days a week for a 1-hour individual CBT sessions for a total of 2 weeks. Therapeutic sessions were held in the meeting rooms at the Wounded Health Centre under the supervision of the Ataa Humanitarian Relief Association and the International Charitable Organization and the protection of the Turkish government.

At the start of the study, participants were asked to complete the computerised Stroop task and other attentional scales (pen and paper tasks such as; trail making test, coding, and symbol search), which took no more than 30 min, before attending courses. At the end of the 2-week period, they were asked to complete a computerised Stroop task again, which took no longer than 30 min.

5.8.1.2 Healthy Group. Kuwaiti participants were provided with information sheets and consent forms using the Google Forms link on the researcher's website. Signed consent forms were available online; however, only the researcher was able to access and download the forms. The information form included the researcher's contact information in case the participants had any questions about the research or experienced any problems. The same procedure was performed for the PTSD group, apart from the CBT sessions, which were held in the meeting room at the Edraak Centre for Psychological Consultations with cooperation from the owner, Professor Rashid Al-Sahel. The MBI sessions were held at Nine Circuits Health Centre under the patronage of owner Mr Ahmed Al-Hafiz.

5.9 Data Analysis

Two separate three-way mixed ANOVA models (within-within-between) were performed to assess the Stroop effect and Stroop R effect (repetition) and to evaluate the differences within conditions (within-subjects effect: congruent-incongruent) when two separate interventions were applied to refugee participants and the healthy group (between-subjects main effect: MBI vs. CBT).

Data were not pre-processed at an earlier stage of data analysis for the following reasons. The effect of outliers was minimised in this research by adopting specific inclusion and exclusion criteria for each study group. For example, for the healthy group, participants were excluded if they were:

1. Unable to read size 14 font, as the assessments required adequate vision for completion in a standardised manner.
2. Diagnosed with hearing loss or deafness. The assessments required adequate hearing for completion in a standardised manner.
3. Suffering from behavioural disorders, such as aggression.

For more details about inclusion and exclusion criteria for other groups, see Section 5.4.

Finally, boxplots were created for all collected data within all research treatment methods, as in the figures in Appendix M. In most cases, there were no outliers; in some cases, there were unusual values in a pre-intervention data set, while in the post-intervention data of same method, no outliers existed, and vice versa. Such results made the data more interesting to understand the changes in participants' behaviour within different research methods.

5.10 Results

5.10.1 Refugees With Post-traumatic Stress Disorder

As shown in Figure 5.1, before the intervention, refugees with PTSD in the MBI group had a higher mean RT compared with participants in the CBT group on the congruent main test Stroop task (Model 2) (mean difference, M = 178) and in the incongruent main test Stroop task (Model 2) (M = 161). In addition, the incongruent main test Stroop task (Model 2) had higher mean RT compared with the congruent main test for refugee participants in both the MBI and CBT groups. Standard deviation was used to plot the error bars for all bar charts within this chapter; it provided an indication about the spread of data around the mean value, where small error bars indicated low variation of data from the mean score.

Figure 5. 1

Comparison of Reaction Time (in Milliseconds) for the Main Test of the Stroop Task (Model 1) Before the Intervention for Refugees with PTSD in the MBI Group (n = 10) and CBT Group (n = 10)

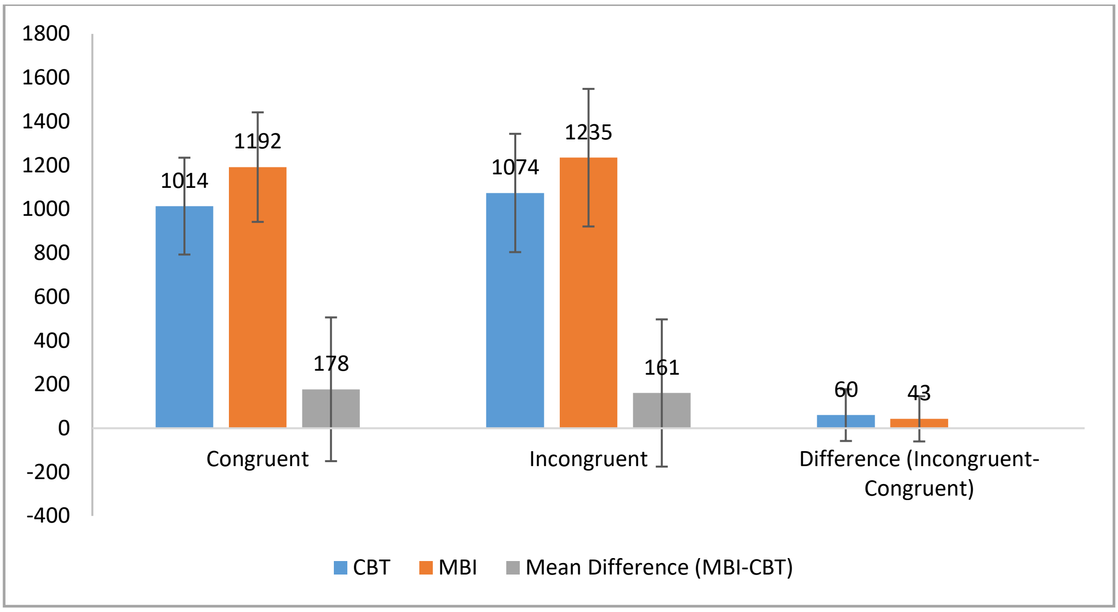


Figure 5.2 shows that after the intervention, refugees in the MBI group had a higher mean RT than participants in the CBT group in the congruent main test Stroop task (Model 2) (M = 57) and in the incongruent main test Stroop task (Model 2) (M = 84). As shown in Figure 5.3, the incongruent main test Stroop task (Model 2) had a higher mean RT than the congruent main test in both the MBI and CBT groups.

Figure 5. 2

Comparison of Reaction Time (in Milliseconds) for the Main Test of the Stroop Task (Model2) After the Intervention for Refugees with PTSD in the MBI Group (n = 10) and CBT Group (n = 10)

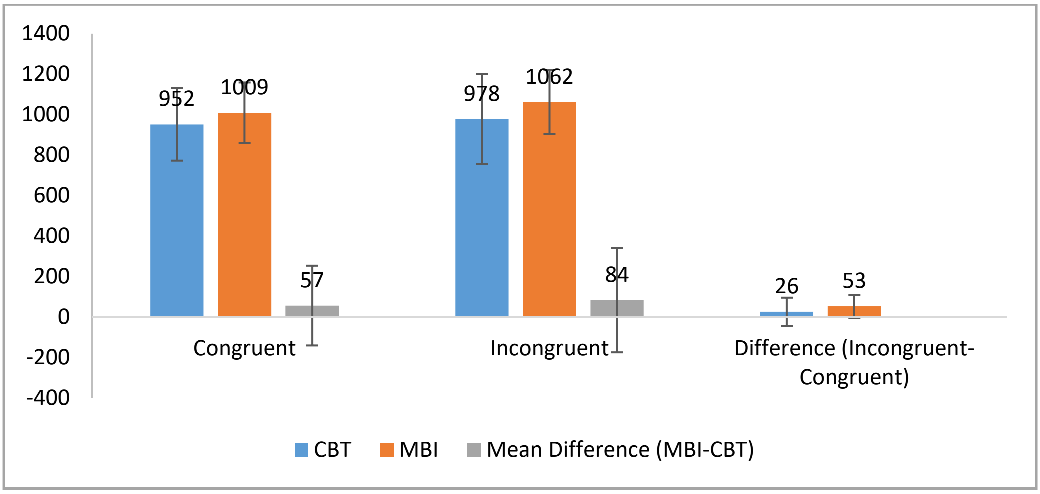
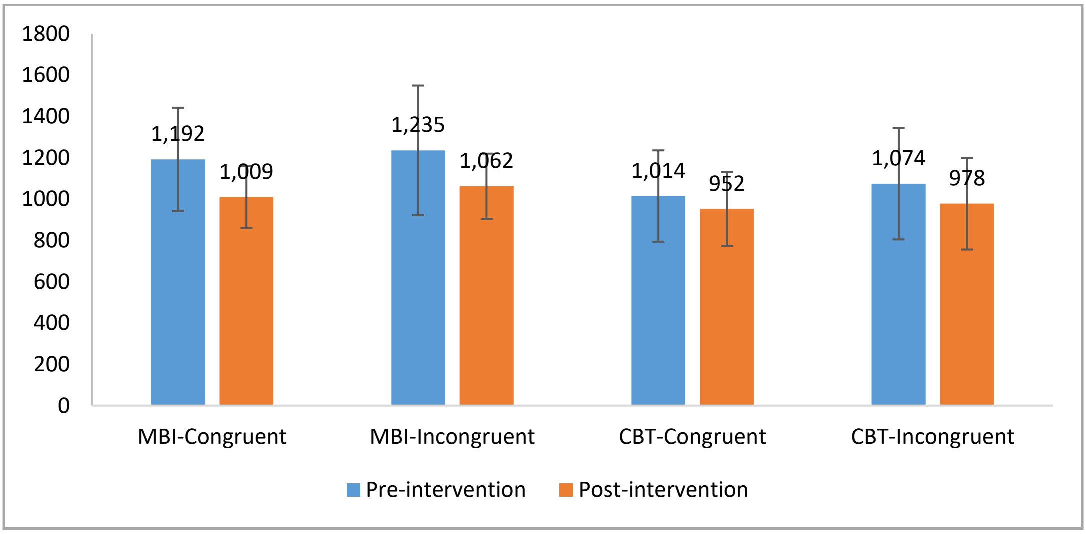


Figure 5. 3

Comparison of Reaction Time (in Milliseconds) for the Main Test of the Stroop Task (Model2) for Refugees with PTSD in MBI Group (n = 10) and CBT Group (n = 10) Pre-intervention and Post-intervention



5.10.2 Healthy Group

Two separate interventions were applied to healthy participants, and two separate three-way mixed ANOVA models (within-within-between) were used to determine the

Stroop effect and Stroop R effect (repetition) and to evaluate differences between conditions (within-subjects effect: congruent-incongruent) (between-subjects main effect: MBI vs. CBT).

5.10.2.1 Stroop Task: Comparison Between Interventions Within the Healthy Group. As indicated in Table 5.2, there was no significant effect in Model 1 (Stroop task before intervention). In Model 2 (Stroop task after intervention), we identified a within-subjects main effect of Stroop (F [2, 36] = 6.148, p = 0.006, partial-eta = 0.291). Similarly, a significant effect of condition (congruent-incongruent) was found (F [2, 36] = 17.04, p = 0.001, partial-eta = 0.532). The MBI group outperformed the CBT group in the congruent item during a main test (Stroop interference) in the Stroop task before the interventions; however, after the interventions, the CBT group outperformed the MBI group in the congruent item during a mean test in the Stroop task. In addition, there was no significant two-way interaction effect of Stroop and the interventions.

Table 5.2

Statistical Testing for the Main Effect and Interaction Effects in Model 1 and Model 2 for the Healthy Group

	Model 1 Stroop effect			Model 2 Stroop R effect		
Source	F	Sig.	Partial Eta Squared	F	Sig.	Partial Eta Squared
Stroop	2.286	.119	.132	6.148	.006	.291
Stroop * Therapy	.469	.630	.030	.580	.566	.037
Conditions	2.225	.157	.129	17.074	.001	.532
Conditions * Therapy	.130	.724	.009	.349	.564	.023
Stroop * Conditions	.939	.402	.059	3.092	.060	.171
Stroop * Conditions * Therapy	.216	.807	.014	.270	.765	.018
Therapy	.829	.377	.052	.582	.457	.037

As shown in Figure 5.4, before the intervention, healthy participants in the CBT group had a higher mean RT than participants the in the MBI group for the congruent main test Stroop task (Model 2) (M = 74.4) and for the incongruent main test Stroop task (Model 2) (M = 51.5). In addition, the incongruent main test Stroop task (Model 2) had a higher mean RT than the congruent main test for healthy participants in both the MBI and CBT groups.

Figure 5.4

Comparison of Reaction Time (in Milliseconds) for the Main Test of the Stroop Task (Model 2) Before the Intervention for Healthy Participants in the MBI Group (n = 7) and CBT Group (n = 10)

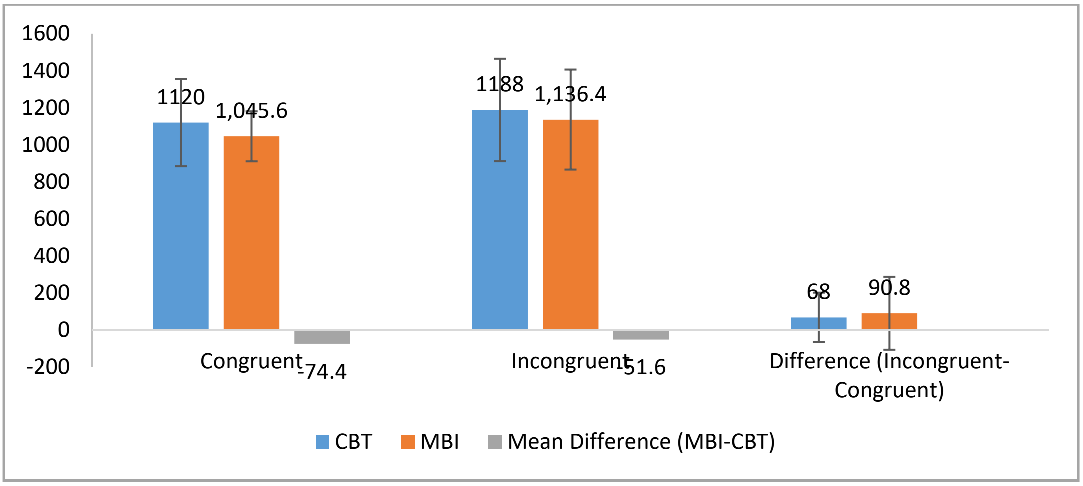


Figure 5.5 shows that after the intervention, healthy participants in the CBT group had a lower mean RT compared with participants in the MBI group for the congruent main test (third phase) of the Stroop task (Model 2) (M = 152) and for the incongruent main test Stroop task (Model 2) (M = 152). According to Figure 5.6, the incongruent main test Stroop task (Model 2) had a higher mean RT than the congruent main test for the healthy participants in both the MBI and CBT groups.

Figure 5.5

Comparison of Reaction Time (in Milliseconds) for the Main Test of the Stroop Task (Model 2) After the Intervention for the Healthy Participants in the MBI Group (n = 7) and CBT Group (n = 10)

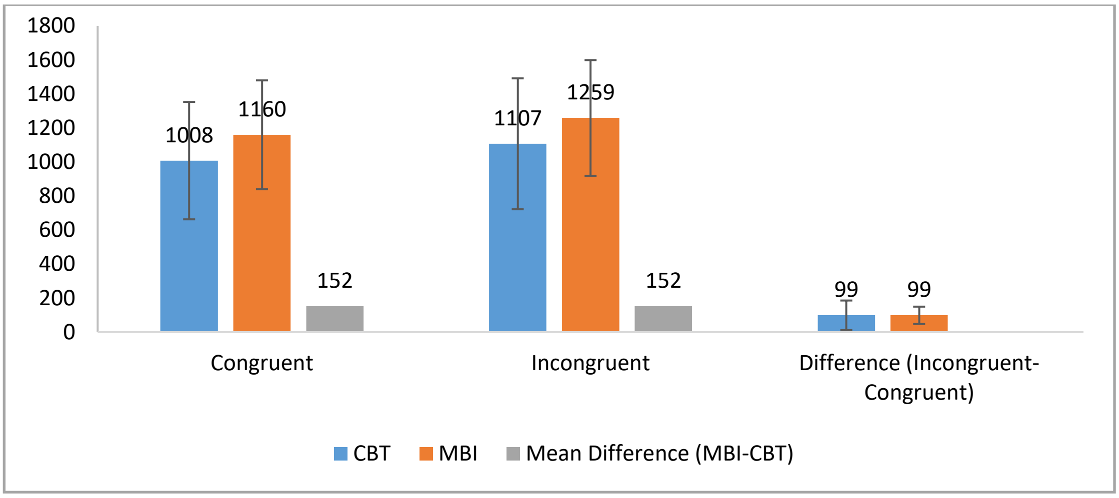
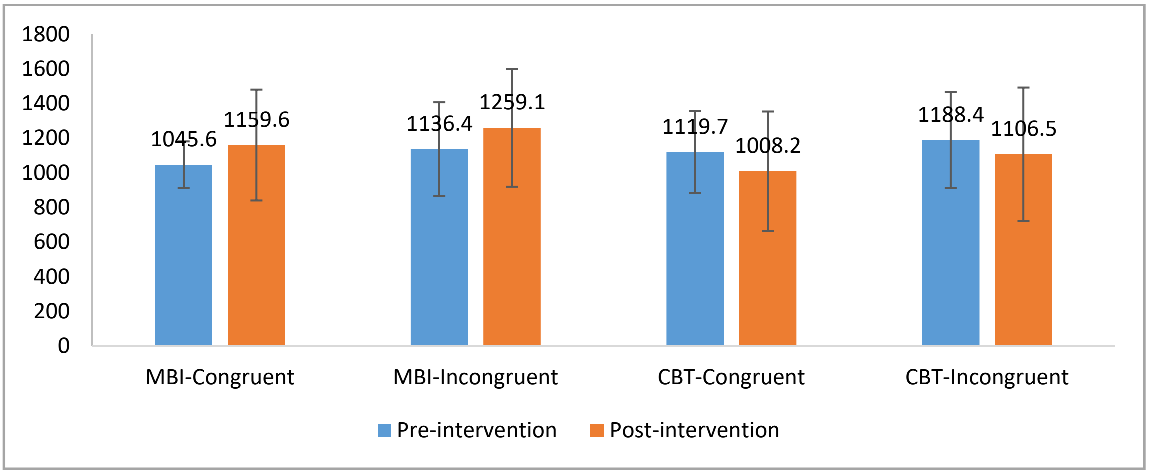


Figure 5. 6

Comparison of Reaction Time (in Milliseconds) for the Main Test of the Stroop Task (Model 2) for Healthy Participants in the MBI Group (n = 7) and CBT Group (n =10) Pre-intervention and Post-intervention



5.10.3 Comparison of Refugees versus Healthy Participants in the Stroop Task

In this section, the Stroop task was compared between the two conditions of the intervention (MBI vs. CBT) for healthy participants and refugees with PTSD. Table 5.3 shows the results of comparisons between healthy participants and refugees in the MBI and CBT groups, where mean scores of congruent and incongruent main Stroop tasks were calculated before and after the interventions. Two independent samples t-tests were used to conduct the comparisons at a significance level of .05. The null hypothesis claims that there is no significant difference in mean RT for the main Stroop task (Model 2) between healthy participants and refugees in each of the MBI and CBT groups before the intervention and after the intervention.

The results indicated no significant differences in mean RT for the main Stroop task (Model 2) between healthy participants and refugees in the MBI and CBT groups before the intervention and after the intervention at a significance level of .05. Furthermore, the p-value = .364 for the comparison between healthy participants in the CBT group (n = 10) and refugees with PTSD in the CBT group (n = 10) regarding the mean RT for the incongruent Stroop main task (Model 2) after the intervention.

Table 5. 3

Comparison of Refugees versus Healthy Participants in the Stroop Task

Group/Assessment Type	Intervention				Comparison between Groups[a]	
	Before		After		Before	After
	M	***SD***	***M***	***SD***	***P*-value**	***P*-value**
MBI						
Congruent						
Healthy **(*n* = 7)**	1045.6	135.4	1159.6	319.6	.181	.211
Refugees **(*n* = 10)**	1191.9	249.6	1009.3	149.9		
Incongruent						
Healthy **(*n* = 7)**	1136.4	270.1	1259.1	339.8	.511	.126
Refugees **(*n* = 10)**	1235.2	314.5	1061.7	158.2		
CBT						
Congruent						
Healthy **(*n* = 10)**	1119.7	236.4	1008.2	345.3	.317	.653
Refugees **(*n* = 10)**	1014.4	221.0	952	178.9		
Incongruent						
Healthy **(*n* = 10)**	1188.4	277.4	1106.5	384.7	.364	.371
Refugees **(*n* = 10)**	1074.4	269.7	977.6	222.3		

Note. MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

[a]Two independent samples t-tests ($\alpha = .05$).

5.11 Discussion

There was a robust Stroop effect in both the healthy participant and refugee groups. The effect size was between 68 and 99 ms in the healthy group and between 23 and 60 ms in the refugee group. Similar findings were reported in previous studies of the Stroop effect (Chen et al., 2001; Zakzanis, 2001). In addition, the findings of the Stroop R-Arabic version showed a significant intrapersonal difference in the main effect of conditions after the intervention (congruent and incongruent). This implies that the interference effects of the Arabic version of the Stroop task are consistent with the original Stroop results, as the participant takes longer to respond during the interference test (Stroop, 1935; Neely & Kahan, 2001; Simon & Berbaum, 1990; Eriksen & Hoofman, 1974). Overall, the refugees with PTSD had a longer mean RT than the healthy participants. The findings suggest that stress affects attention in people with PTSD (Brewin et al., 2007; Buckley et al., 2000; McNally et al., 1990; Aupperle et al., 2012), and the Arabic version of the test appears to be a useful tool for assessing cognitive function. For healthy participants, MBI increased mean RT in the main Stroop test (Model 2), whereas CBT reduced it. This finding cannot be explained by a simple practice effect, which would have been anticipated to affect both groups similarly. For refugees, both interventions reduced mean RTs, with MBI having the greater effect. This is unlikely to be merely due to a practice effect given the results of the healthy group and the difference in effect size in the MBI and CBT groups.

Chapter 6: Comparison of the Effects of Mindfulness-Based Intervention and Standard Cognitive Behavioural Therapy on Performance on the Stroop Test for Patients with Mild Traumatic Brain Injury

Abstract

Background: mTBIs are among the most common injuries, and research into methods of diagnosis and patient care remains limited. Kuwaiti hospitals lack neuropsychological services, making this study necessary to determine the utility of diagnostic tools and treatment programmes.

Objective: The purpose of this study was to determine the suitability of Stroop task methods (manual and vocal response) for assessing the improvement of attention in patients after receiving two different psychotherapy programmes.

Method and Findings: Over an 8-day period, the experimental group (n = 9) received mindfulness sessions, while the control group (n = 10) received CBT sessions. The participants were given both parts of the Stroop task (verbal and manual) before and after the treatment sessions. Participants in both groups had improved performance after treatment, indicating the effectiveness of both programmes (MBI and CBT). There was no significant difference between the two types of interventions. Furthermore, it was noted that the participants' performance in manual responses were superior to those in verbal responses.

Conclusion: According to the findings, it is critical to focus on the neuropsychological aspects of patients with mTBIs and to provide them with the necessary psychological and rehabilitative care. The findings also highlight the need for additional research and resources in this area.

6.1 Overview

In this study, I examined the effect of MBI versus CBT on Stroop task performance in a group of patients with mTBI. mTBIs account for the majority of TBIs (75%) and are characterised by physical, cognitive, and psychological symptoms in the initial period followed by a symptom recovery typically within 1 month (Chamelian & Feinstein, 2004). However, an estimated 10–20% of patients continue to report symptoms associated with social and occupational dysfunction, such as low income and job and marital problems (Bleiberg et al., 2004; Vanderploeg et al., 2005) months to years following the injury (Ruff et al., 1996; Rohling et al., 2012). As a result, finding effective treatments for cognitive impairments caused by mTBI is an important objective.

I compared two models of response in the Stroop test: manual and vocal. Although many studies have measured the RT to vocalise a verbal response, some used a key-press RT (Chen et al., 2001). I aimed to ensure that I obtained a reliable effect using manual responses, as I planned to employ manual responses in a functional magnetic resonance imaging (fMRI) study. For technical reasons, I had to measure performance as a correct response rate rather than RT; this has been done in some previous Stroop studies (Spreen & Strauss, 1991). Pre-test and post-test evaluations were employed detect changes in performance following a period of intervention (2 weeks).

6.2 Ethics

6.2.1 Ethical Approval

Ethical approval was obtained from the Research Ethics Committee of Bangor University, Research Ethics Committees in Ministry of Health, Kuwait, and the Research Ethics Committee of Kuwait University (see Appendix A for all ethical approval).

6.2.2 Consent Form

Before participating in the study, all patients signed a written consent form (Appendix B). Before agreeing to participate, each patient was given an information sheet (Appendix C) that explained the study objective, confidentiality, and methods, in addition to their right to withdraw at any time. Participants were given a debrief sheet once the research was completed, and they were encouraged to ask questions and to request a copy of the study results. Participants were instructed to contact the study supervisor or their general practitioner if they were concerned about the results or their health due to participation in the study. The debrief sheet included information on organisations that could help participants if they had any concerns after participating in the study (Appendix D).

6.2.3 Confidentiality

To maintain confidentiality, participants were given a unique participation code that was anonymised from their data. No personally identifying information was linked to any of the data collected. The researcher is the only one who has access to the data, which is kept in a locked cabinet. A unique code was used during the analysis and an ID number was used to access the electronic databases. All participants were informed about the importance of maintaining confidentiality.

6.2.4 Protection

Completing a neuropsychological assessment, which can induce mild tiredness, was part of the process. During the examination, participants were allowed frequent pauses to reduce the chance of impairment due to fatigue. The evaluation was designed to keep the number of tests to a minimum to achieve the research's purpose.

6.3 Methods

6.3.1 Design

This interventional used a mixed factorial design for both the pre-test and post-test evaluations to assess the effectiveness of an MBI on improving attention and well-being among mTBI patients with attention impairment. Patients completed the Stroop task as a baseline before starting MBI or CBT sessions, which lasted for 2 weeks and comprised four sessions in each week. Post-intervention, the Stroop task was repeated. For more information, see Appendix L.

6.3.2 Sample Size

It was impossible to perform a power calculation, as the size of the effect of the MBI was unknown, as this is a novel approach. However, a review of the current literature in the field was used to determine the sample size. The planned sample size was equivalent to other samples used in similar research exploring concussions and neuropsychological testing outcomes (Cossette et al., 2016; Hinton-Bayre & Geffen, 2002), and neuroimaging studies often have sample sizes around 12–15 (Szucs & Ioannidis, 2020). Studies with this approximate number of participants often provide strong findings in the clinical neuropsychological and neuroimaging intervention literature.

6.3.3 Participants

Nineteen mTBI outpatients (8 male and 11 female) who had not received prior neuropsychology rehabilitation treatment from Kuwait hospitals were included in the study. Participants were randomly allocated to either the experimental or the control group. Participants in the experimental group (n = 9) received an MBI course from Ms Mubarak, while the psychologist Mr Almutairi delivered a CBT course to the control group (n = 10).

Table 6. 1 Demographic Characteristics of the Participants

Demographic Characteristics	mTBI MBI (*n* = 9)	mTBI CBT (*n* = 10)
Gender		
Male	4 (44.4%)	4 (40.0%)
Female	5 (55.6%)	6 (60.0%)
Education Level		
High school	4 (44.4%)	3 (30.0%)
Diploma		
Undergraduate	3 (33.3%)	4 (40.0%)
High diploma		
Postgraduate	2 (22.3%)	3 (30.0%)
Handedness		
Right	9 (100%)	10 (100%)
Left		
Age (year)		
Range (Min., Max.)	22, 40	23, 36
(mean ± *SD*)	31.8 ± 6.8)	29.4 ± 4.8
Weight (kg)		
Range (Min., Max.)	70, 120	63, 98
(mean ± *SD*)	96.9 ± 19.7	81.5 ± 12.2
Length (cm)		
Range (Min., Max.)	156, 189	156, 189
(mean ± *SD*)	173.3 ± 13.0	169.4 ± 12.3
Injury type		
Car	7 (77.8%)	7 (70.0%)
Fall/Motorbike	2 (22.2%)	3 (30.0%)

Note. mTBI, mild traumatic brain injury; MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

6.3.4 Data Collection

mTBI patients were recruited from the brain injury service in Amairi and Adan hospital. All patient files were thoroughly checked to ensure that all of them were suffering from mTBI. Ms Mubarak selected the participants; she reviewed their medical notes and physician evaluations to identify potential participants with mTBI who were suffering from attention difficulties. After checking the patient files, participants were given information leaflets and consent forms by the neurologist or by communicating with them directly via the phone number in their files.

6.3.5 Inclusion and Exclusion Criteria

Participants were eligible to take part in the study if they were:

1. Aged between 21 years 0 months and 45 years 11 months.
2. Able to understand and speak Arabic.
3. Categorised as mild according to globally acknowledged brain injury parameters (Glasgow Coma Scale [GCS] ≥13, loss of consciousness <30 min, no intracranial abnormalities, post-traumatic amnesia, <24 hours).
4. Diagnosed with a mTBI by a consulting neurologist at least 1 month prior to the research study.

Participants were excluded if they were:

1. Diagnosed either with a previous TBI or had a history of neurological disability, developmental learning, or attentional impairment. These factors may have confounded the results of the assessment of the individual's cognitive functioning.
2. Non-Kuwaiti.
3. Involved in other research to avoid overloading participants with too many assessments.
4. Failed a test for colour blindness (https://enchroma.com/pages/color-blind-test).
5. Had behavioural disorders, such as aggression.

6.3.6 Main Variables

The aim was to compare the effects of two different types of rehabilitation courses (MBI and CBT) on attention and cognition.

6.3.7 Procedures

Kuwaiti hospitals were provided with the patient information sheets and consent forms to facilitate their distribution to the participating patients by a competent doctor. Signed consent forms were returned and collected by the researcher. In addition, medical records were accessed in the Adan and Amiri hospitals in Kuwait to contact patients and invite them to participate. Participants' injury and demographic data were acquired directly from them and from their medical records (with their permission). Date of injury, dates of admission and discharge from the hospital, earliest GCS score, duration of loss of consciousness, duration of post-traumatic amnesia, and cause of injury were among the clinical data obtained. Age at time of injury, present age, gender, partnership status, ethnicity, past use of mental health services, and physical or mental health conditions were among the demographic data collected.

The researcher approached the patients for their permission to participate. If permission was granted, the researcher explained the study and gave them the appropriate patient information sheet (see Appendix C). The researcher explained the ethical requirements of the study when obtaining consent from the patients (see Appendix B). The information sheets included researcher contact information in case participants had questions about the research or experienced any problems. Participants in the experiment group met Ms Mubarak 4 days a week for a 1-hour individual MBI sessions for a total of 2 weeks. The researcher has been trained to teach mindfulness courses at the Mindfulness Centre of Bangor University. At the start of the study, patients were instructed to complete the Stroop task; at the end of the 2-week period, they were again asked to complete Stroop task. The psychologist Mr Ahmad Almutairi followed the same procedure with the control group.

6.3.8 Measure

6.3.8.1 Stimuli. Twelve stimuli were presented in the congruent and incongruent trials. Trials presented individuals in bold Arial (body) font, size 96, in the centre of the screen on a black background. First the vocal and then the hand responses were assessed, as stated in previous studies (Yamamoto et al., 2016).

Four colours and words (red, yellow, green, and blue) were translated into Arabic and applied in various combinations in the congruent and incongruent stimuli (PsyToolkit Server, 2020). Look to the figure presented in an earlier chapter, for more information about task design.

6.3.8.2 The Stroop Task

1. One practice trial was performed to ensure that the participants clearly understood the task.
2. The stimuli were presented in pure blocks containing 12 stimuli for each part.
3. The responses of the participants were recorded manually.
4. Two assistants were recruited to record the participants' responses.
5. A camera was installed to record the responses, and the recordings were referenced to avoid manual recording errors.
6. Participants were instructed to respond as quickly and as accurately as possible if the colour ink was congruent or incongruent with the meaning of the word.
7. The run was repeated 10 times, meaning that each participant completed 120 trials.

8. Each trial commenced with a fixation cross for 500 ms. The stimuli were presented for 1000 ms followed by an interstimulus interval of 1,000 ms during which a black screen was shown, and a break of 10 s was allowed. Each test session took approximately 30 min (Parris et al., 2019).

6.3.8.3 Reliability

Inter-rater reliability assessment was applied to assess whether there was reliable consistency between rating in pre- and post-intervention periods at a significance level of .05. The intra-class correlation (ICC) was calculated to serve this purpose, where it took values between 0.0 and 1.0. According to Cicchetti (1994), the following values are used to describe the consistency level for each tool based on the calculated (ICC) values: less than 0.40 indicates a poor level of consistency of the tool, between 0.40 and 0.59 is fair, between 0.60 and 0.74 is good, and between 0.75 and 1.00 indicates an excellent level of consistency.

Table 6.2 summarises both the Cronbach's alpha and inter-rater agreement for the Stroop task. It is clear from results that the Stroop hand task was fairly consistent based on (ICC = .58). In contrast, the Stroop speech task had a poor level of consistency for observations between the pre-intervention and post-intervention phases (ICC = .31).

Table 6. 2

Reliability Statistics for Research's Questionnaires (Symbol Search, Coding, Trail Making Tests, Stroop Task)

Tool (Pre & Post)	**Cronbach's Alpha**	**ICC Single measures**	**Sample Size**	**Group**
Stroop Speech	.47	.31	19	mTBI
Stroop Hand	.73	.58	19	mTBI

Note. ICC, intra-class coefficient; mTBI, mild traumatic brain injury.

6.4.6.4 Validity. For more information about task validation, see Section 4.3.3.1.

6.4.6.5 Expert Review. It was difficult to calculate errors and RT across the tool due to the lack of available capabilities; therefore, the study design was presented to Dr Ben Parris from Department of Psychology - Bournemouth University, who in turn reviewed the steps used and made relevant recommendations.

6.5 Data Analysis

Throughout this section, different types of statistical analysis techniques were applied. Descriptive statistics measures, such as mean score and standard deviation, were calculated for the impact of the MBI and standard CBT on performance in the Stroop test for patients with mTBI. In addition, paired sample t-test (at a significance level of .05) was used to compare significant differences in the mean scores of the manual and vocal Stroop tasks before and after intervention. The Mann–Whitney means rank test was applied to determine the distribution of the Stroop test (vocal and manual) for patients who underwent MBI and CBT intervention. They were the same in pre- and post-intervention phases, at a significance level of .05. Furthermore, histograms were plotted to allow for visual comparison of the performance. The data were not pre-processed earlier in the data analysis process; the effect of outliers was minimised in this study using a set of inclusion and exclusion criteria.

Furthermore, due to the scarcity of the target population, unexpected values may have occurred naturally for one or more of the applied measurement treatments. There is nothing wrong with such data (e.g., no error in data entry or the applied treatments); they are considered as normal part of the data distribution, and they can be legitimate observations and are sometimes the most interesting ones. Therefore, it is not a common practice to remove such cases when conducting the data analysis. Moreover, the planned statistical analysis techniques (descriptive statistics and non-parametric inferential statistics).

(Guidelines for Removing and Handling Outliers in Data, website: https://statisticsbyjim.com/basics/remove-outliers/), for more information see Appendix M.

6.6 Results

6.6.1 Stroop Task (Vocal and Manual) Results for the MBI and CBT Groups of mTBI Patients

This part of the analysis summarises the mean scores for the number of correct responses achieved by patients with mTBI on both Stroop vocal (speech) and manual (hand) assessments. Table 6.3 lists the mean scores and standard deviations for all combinations of patients with mTBI. Paired t-tests were applied to compare mean scores in each group, and test results are listed for mean score comparisons within each of the MBI and CBT groups.

For both the vocal and the manual Stroop tests, each group (MBI or CBT) showed an improvement in performance after intervention.

Table 6. 3

Descriptive Statistics Comparing Stroop Items for Patients With mTBI Between MBI and CBT Groups Using Speech and Hand Measurement Data Pre-intervention and Post-intervention

Group/Assessment Type	Intervention				Comparisons
	Before		After		Within Groups[a]
	M	***SD***	***M***	***SD***	***P- value***
MBI (*n* = 9)					
Stroop Speech (correct responses)	53.6	5.5	59.4	5.4	**.012**
Stroop Hand (correct responses)	61.8	3.7	64.0	2.0	**.038**
CBT (*n* = 10)					
Stroop Speech (correct responses)	54.1	5.0	60.3	2.8	**.008**
Stroop Hand (correct responses)	59.9	3.6	63.9	1.9	**.001**

Note. MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

Figure 6.1 shows that performance was significantly higher after intervention for both vocal and hand Stroop assessments for patients with mTBI in the MBI group (n = 9).

Figure 6.1

Comparing Assessment Measurements of Stroop (Vocal, Manual) Task for Patients With mTBI Pre- and Post-intervention in the MBI Group (n = 9)

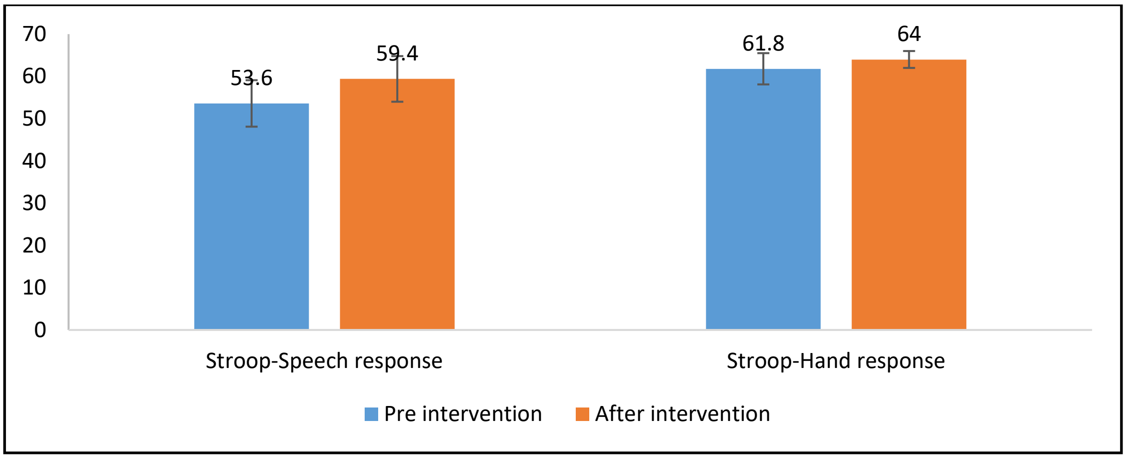
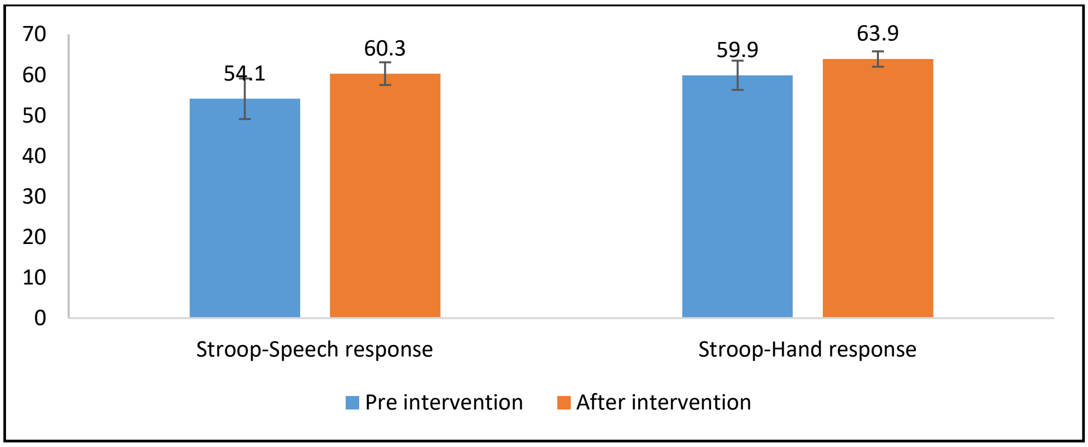


Figure 6.2 shows that performance was significantly higher after the intervention phase for both vocal and hand Stroop assessments for patients in the CBT group (*n* = 10).

Figure 6.2

Comparing Assessment Measurements of Stroop (Vocal, Manual) for patients with mTBI Before and After Intervention in the CBT Group (n = 10)

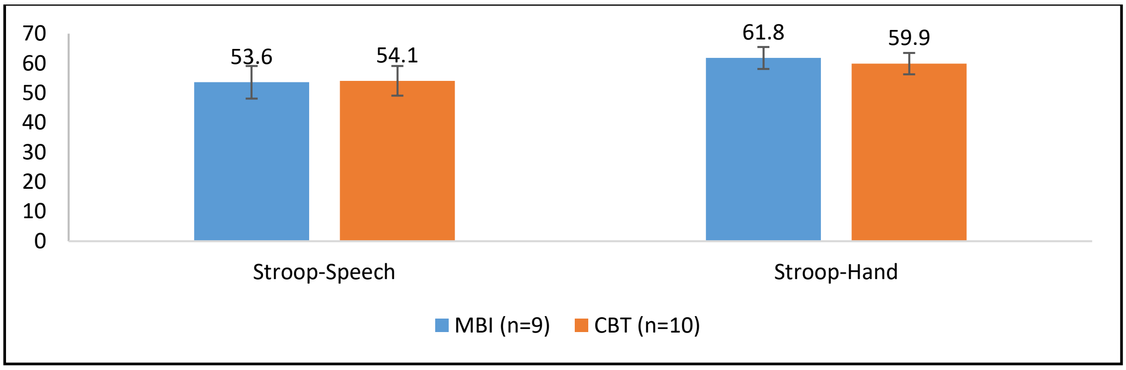


6.6.2 Comparison of the Manual and Vocal Stroop Tests

Figures 6.3 and 6.4 show that patients consistently performed better in the manual than vocal Stroop tests.

Figure 6.1

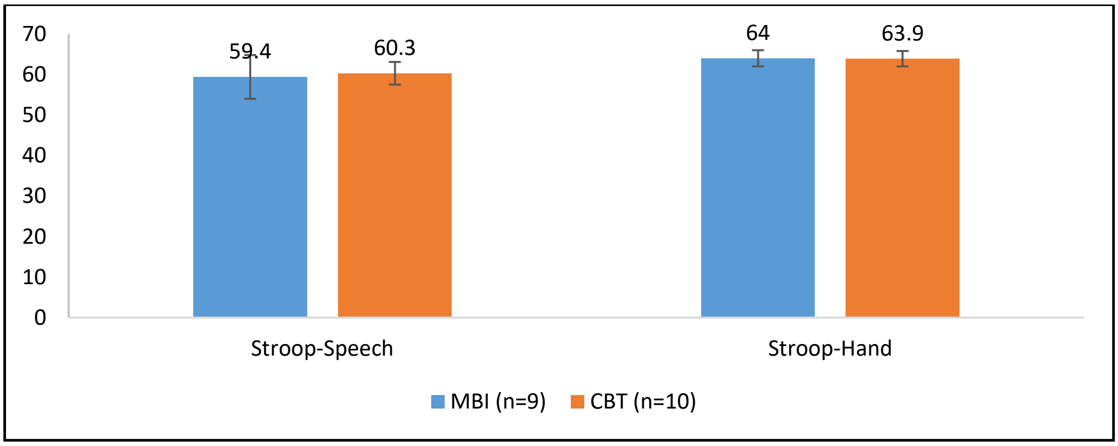
Comparing Assessment Measurements of Stroop (Vocal, Manual) for Patients with mTBI Between MBI (n = 9) and CBT (n = 10) Groups before Intervention



The MBI group had a higher mean manual Stroop score compared with the CBT group before and after intervention; however, the difference was not significant.

Figure 6.2

Comparing Assessment Measurements of Stroop (Vocal, Manual) for Patients with mTBI Between MBI (n = 9) and CBT (n = 10) Groups after Intervention



Moreover, the results of the Mann–Whitney rank test indicated that there were no significant differences between patients with mTBI in the MBI (n = 9) and CBT (n = 10) groups when applying assessment measurements, namely the Stroop-vocal and Stroop-manual tests, in both pre-intervention and post-intervention phases (p >.05 for all comparisons) (Table 6.4).

Table 6.4

Mann–Whitney U Test Comparing Vocal and Mean Manual Stroop Assessment Responses Between Patients with mTBI in the MBI and CBT Groups

Test	Stroop speech pre-intervention correct responses	Stroop speech post-intervention correct responses	Stroop hand pre-intervention correct responses	Stroop hand post-intervention correct responses
Mann–Whitney U	44.500	44.000	25.500	42.500
P-value	.967	.934	.108	.834

6.7 Discussion

Both interventions are effective to a similar extent; therefore, there is some evidence to support their use in clinical settings to improve attention. Although practice improves attentional control, as indicated in a classic Stroop experiment (1935), this training can increase performance if the period is short or if it is repeated several times (Ellis et al., 1989). Manual response performance was better overall. When a manual response is required, the colour-naming pathway is diverted from the semantic system to a manual output system rather than entering the lexical system (Sharma & McKenna, 1998). In contrast, the dominance rule prevents the words from interfering with the semantic system's colour pathway. As a result, when a manual response is supplied, the lexical effect is no longer apparent (Glaser & Glaser, 1989). This approach might explain why there are more lexical effects for vocal responses than for manual responses (Glaser & Glaser, 1989). The findings of this study are support the findings of Sharma and McKenna (1998), who reported that overall interference for the vocal response was greater than for the manual word response. Other studies demonstrated that switching from verbal to manual response reduces interference (McClain, 1983; Klein, 1964; White, 1969). The robust manual response suggests that conducting fMRI studies is feasible.

This preliminary study aimed to determine whether the computerised Stroop task is useful for patients with mTBI. It also aimed to identify the similarities and differences between the two methodologies and to compare this to prior research in the field. Although Stroop interference is usually considered a single phenomenon, there is evidence that it may be more accurate consider the effect as a collection of components (Glaser & Glaser, 1989; La Heij et al., 1990). Examining the method and the role of response output illustrates this idea well (Palef & Olson, 1975; Virzi & Egeth, 1985). The importance of response output as a method for investigating the content of the Stroop effect (Arioli et al., 2021; Pompon, at al., 2015; Sharma & McKenna, 1998) is supported by these findings. Furthermore, the findings highlight the importance of further research into the many components that make up the Arabic version of the Stroop effect. For a more detailed discussion, see Chapter 10.

Chapter 7: Efficacy of Mindfulness-Based Intervention and Cognitive Behavioural Therapy on Neuropsychological Assessment Performance in Refugees with Post-traumatic Stress Disorder and Healthy Controls

Abstract

Background: According to existing research, MBIs have a positive impact on psychological well-being and cognitive functions, such as attention. Therefore, providing neuropsychological services is now a requirement, especially given the scarcity of scientific research in this field. In addition, there is a lack of neuropsychological assessments to evaluate the effect of the rehabilitation programmes.

Objective: The aim of this study was to determine whether there are differences in attention training between Syrian refugees with PTSD (*N* = 10) who were enrolled in the mindfulness programme for 2 weeks and those who were trained in CBT (*N* = 10) using neuropsychological assessments, such as Symbol Search, Coding, and the Trail Making Test. The participants were compared to a control group of 17 healthy participants.

Method and Findings: The Arabic version of the Processing Speed Index-Wechsler Adult Intelligence Scale fourth UK edition (WAIS-IV UK) and the Trail Making Test were applied for all participants, the Syrian refugees with PTSD (*N* = 10) and the CBT group (*N* = 10), before and after the intervention. Both interventions improved performance in all assessments for both the refugees with PTSD and the healthy participants. Except for the Coding test, where CBT produced better results, there was no significant difference between the two intervention approaches (MBI and CBT).

Conclusion: The study's findings indicate that treatment improves participants' cognitive performance, and more clinical studies are needed to establish a department for the treatment and rehabilitation of patients with neuropsychiatric diseases.

7.1 Overview

This chapter presents the second and complementary study to Chapter 5, which was conducted on Syrian refugees and compared their performance to a group of healthy participants. Standard neuropsychological measures, that is, Symbol Search, Coding, and the Trail Making Test [TMT], were compared between the two types of interventions (MBI and CBT) for refugees with PTSD and a healthy control group. The purpose of this study was to highlight the difficulties that refugees with PTSD face and to take the necessary steps to identify their problems. Furthermore, it was hypothesised that MBI could aid patients with attention issues.

7.2 Methods

Neuropsychology assessments were administered in a single block of time before and after the interventions. Participants were allocated to one of two groups: experimental (MBI) and control (CBT).

For 2 weeks, Ms Mubarak provided an MBI to the experimental group, while psychologist Mr Almutairi provided CBT to the control group. See Chapter 5 for more details on methods and procedures.

7.2.1 Main Variables

The aim was to determine the effect of the intervention on the attention and well-being of patients with PTSD compared to a group of healthy subjects.

7.2.2 Participants

The study compared a group of 17 healthy adults (3 males and 14 females) in Kuwait to a group of 20 Syrian refugees with PTSD (10 male and 10 female) who had not attended any neuropsychology rehabilitation courses from the Ataa Humanitarian Relief Association in Turkey. In the healthy group, participants were randomly assigned to either the experimental (MBI) or control (CBT) group. As discussed in Chapter 5, 10 male refugees were in the control (CBT) group, and 10 female refugees were in the experimental (MBI) group. Ms Mubarak delivered an MBI course to the experiment group, while a psychologist, Mr Almutairi, delivered CBT to the control group.

The same ethical approval, procedures, demographic characteristics, and recruitment methods that were applied in Chapter 5 were applied in the present study. The additional neuropsychological measures are detailed below.

7.2.3 Measures

7.2.3.1 Symbol Search and Coding from Processing Speed Index Wechsler Adult Intelligence Scale fourth UK edition. The WAIS-IV is an individually administered IQ test for people aged 16–90 years (Strauss et al., 2000; Benson et al., 2010). There are 10 core and five supplemental subtests in total. The current study used only the core subtests of Processing Speed Index (PSI), such as Symbol Search and Coding (Wechsler, 2008). The tasks rely on visual processing speed in addition to visual perception and analysis. The same translation of the codified version in Kuwait was utilised.

7.2.3.1.1 Symbol Search. The participants must evaluate two target symbols before moving on to a collection of symbols to determine whether the target symbols are repeated within 120 s. The test is intended to measure processing speed, but other cognitive qualities, such as visual motor coordination and attention, are also considered. In the Neuropsychological Assessments chapter, several validities estimates of the Technical and Interpretive Manual are presented (see Section 2.1.3.2 for more information).

7.2.3.1.2 Coding. The participant is given a key with the numbers 1 to 9 associated with different symbols; they must then utilise this key to fill in the correct symbols for a list of integers between 1 and 9 within 120 s. The test was created to measure processing speed, but other cognitive functions, such as learning, short-term memory, and concentration, influence performance.

7.2.3.2 Trail Making Test Parts A and B. The TMT (Retain, 1958) was translated into Arabic and administered to participants by Ms Mubarak. These versions were designed to be identical to the English versions, with the exception that Arabic numbers and letters were used in place of the corresponding English symbols. Furthermore, the words ‘begin’ and ‘end’ were translated into Arabic. As a native Kuwaiti neuropsychology doctoral candidate, the researcher tested all participants and translated test instructions into Arabic; back-translation of the instructions was also attempted.

The TMT is divided into two parts; each part consists of 25 circles spread across a sheet of paper with samples. The circles in Part A are numbered in Arabic (١–٢٥), and the participant must draw lines in ascending sequence to connect the numbers. The circles in Part B feature both numbers (١–١٣) and Arabic letters (أ– ش). In Part B, the participant is instructed to draw lines to connect the circles in an ascending manner, as in Part A, but with the extra challenge of switching between the numbers and letters (i.e., ١–أ - ٢– ب etc.). Without lifting the pen or pencil from the page, the participant is instructed to join the circles as quickly as possible. As the participant links the ‘trail’, the researcher records the time it takes. In this study, mistakes were pointed out to the participants immediately, and the participant was allowed to correct the mistake. Errors only influenced the participant's score as the time spent correcting errors was factored into the task's total completion time. Both TMT A and B results include the number of seconds needed to complete the test;

consequently, higher scores indicate greater impairment. Please see the Neuropsychological Assessments chapter for more information about this task.

7.2.3.3 Reliability. The original WAIS-IV has strong psychometric properties. The WAIS-IV manual reports high internal consistency, test-retest reliability, and inter-rater agreement in terms of reliability (Wechsler, 2008). The subtests and composite scores were evaluated using the split-half method and Cronbach's alpha to determine internal reliability. Internal reliability coefficients range from 0.87 to 0.98 on average across all age groups. Split-half reliability coefficients could not be used for the PSI with timed subtests (Symbol Search, Coding, and Cancellation); instead, test-retest stability coefficients were used. The WAIS was administered twice to establish test-retest reliability, with test-retest intervals ranging from 8 to 82 days (mean interval = 22 days). The coefficients of test-retest stability ranged from 0.74 (Visual Puzzles subtest) to 0.90. Finally, the WAIS demonstrated excellent inter-rater reliability, with all subtests ranging from 0.98 to 0.99.

The WAIS-IV manual also demonstrates strong validity (Wechsler, 2008). Numerous correlational studies compared the WAIS-IV to neuropsychological measures that were conducted to examine both the convergent and discriminant validity of the test. Finally, structural validity was evaluated using a variety of confirmatory factor analyses (see Wechsler, 2008). In addition, the high retest reliability scores and TMT B/A ratios highlight the high comparability and reliability of the new TMT A and B (Wagner et al., 2011).

However, for the Symbol Search, Coding, and TMT research tools, the inter-rater reliability assessment was applied to determine whether there is a reliable consistency between rating within the pre- and post-intervention periods at significance level of .05; ICC was calculated to serve this purpose, where it takes a value between 0.0 and 1.0. According to Cicchetti (1994), the following values are used to describe the consistency levels for each tool based on the calculated ICC values[1]: less than 0.40 is poor, between 0.40 and 0.59 is fair, between 0.60 and 0.74 is good, and between 0.75 and 1.00 indicates an excellent level of consistency.

Table 7.1 summarises both Cronbach's alpha and inter-rater agreement measurements for the Symbol Search, Coding, and TMT tools. Symbol Search was fairly consistent based on ICC value (ICC = .57), and each of Coding and TMT reported a good level of consistency, with ICC = .66, .71, and .65, respectively.

Table 7.1

Reliability Statistics for Research Questionnaires (Symbol Search, Coding, Trail Making Tests Stroop Task)

Tool (Pre & Post)	Cronbach's Alpha	ICC Single measures	Sample Size	Groups
Symbol Search	.72	.57	37	Healthy, and PTSD
Coding	.80	.66	37	Healthy, and PTSD
Trail 1	.83	.71	37	Healthy, and PTSD
Trail 2	.78	.65	37	Healthy, and PTSD

Note. PTSD, post-traumatic stress disorder; ICC, intra-class correlation.

7.3 Data Analysis

The power analysis computed for all measurement tools was applied in this research using partial-eta squared (η_p^2). In the SPSS environment, such statistics can be obtained by implementing generalised linear models and selecting the repeated-measures option to define a factor of two levels, where the factors would be Symbol Search, Coding, Trail 1, and Trail 2, within the refugees with PTSD group (n = 20) and the healthy group (n = 17).

The rules-of-thumb based on Cohen's D^2 suggests the following cut-offs for describing the estimated effect size using partial eta-squared η_p^2 values: small if $\eta_p^2 \geq .01$ and $< .06$, medium if $\eta_p^2 \geq .06$ and $< .14$, and large if $\eta_p^2 \geq .14$. Results in Table 6 indicate that the observed (post-hoc) power levels for the research's assessments, namely Symbol Search, Coding, TMT 1 and 2, in the PTSD (n = 20) and healthy (n = 17) participants groups were large and ranged between 0.85 and 1.00, with η_p^2 = .35, .21, .39, and .40 ≥ .14 respectively. Of note, the Greenhouse–Geisser test results listed in case sphericity assumption were not met (Cohen, 2013).

Table 7.2

Within-Subject Effects in The PTSD And Healthy Groups (N = 37)

Source		**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**	**Observed Power***
Symbol	Sphericity Assumed	624.66	1	624.66	19.22	0.00	0.35	0.99
	Greenhouse–Geisser	624.66	1	624.66	19.22	0.00	0.35	0.99
Coding	Sphericity Assumed	1192.01	1	1192.01	9.49	0.00	0.21	0.85
	Greenhouse–Geisser	1192.01	1	1192.01	9.49	0.00	0.21	0.85
Trail 1	Sphericity Assumed	3284.45	1	3284.45	23.38	0.00	0.39	1.00
	Greenhouse–Geisser	3284.45	1	3284.45	23.38	0.00	0.39	1.00
Trail 2	Sphericity Assumed	5329.51	1	5329.51	23.94	0.00	0.40	1.00
	Greenhouse–Geisser	5329.51	1	5329.51	23.94	0.00	0.40	1.00

*Computed using α = .05.

7.4 Results

Section 7.3.1 summarises the results of different types of statistical analysis techniques applied in analysing the responses of refugees with PTSD. Descriptive statistic measures, such as mean score and standard deviation, were calculated for the efficacy of MBI and CBT on performance in standard neuropsychological assessment within the PTSD group. In addition, paired sample t-tests were used to determine whether there were significant differences between the mean scores of Symbol Search and Coding assessments and between the mean RT (in seconds) using TMT A and B assessments before and after each intervention. Histograms were plotted to allow for visual comparison of performance in the PTSD group in different interventions (MBI and CBT) pre- and post-intervention for each assessment. Except for the Coding test, where CBT produced better results, there was no significant difference between the two intervention approaches (MBI and CBT).

7.4.1 Symbol Search, Coding, and Trail Making Tests for Refugees With PTSD

This part of the analysis summarises mean scores for the number of correct responses achieved by refugees with PTSD in the Symbol Search and Coding assessments in addition to the RT in the TMT A and B assessments. Table 7.3 lists the mean scores and standard deviations for all combinations of refugees with PTSD. Paired t-tests were applied to compare the mean scores of the responses of refugees with PTSD in each group, and test results are listed for mean score comparisons in each of the MBI and CBT groups at a significance level of $\alpha = .05$.

Performance in all measures improved after both interventions (see Table 7.3). There were significant differences in the mean scores of Symbol Search and Trail B in the CBT group before and after the intervention ($p < .05$). Furthermore, there were significant differences between the mean scores for the Coding and Trail B assessment within the MBI group before intervention and after intervention ($p < .05$). The full results for paired-t tests for all groups are presented at the end of this report, in Appendix L.

Table 7.3

Descriptive Statistics of Comparing the Symbol Search, Coding, Trail A, and Trail B Items for Refugees with PTSD in the MBI and CBT groups Before and After Intervention

Group/Assessment Type	**Intervention**				**Comparisons**
	Before		**After**		**Within Groups[a]**
	M	***SD***	***M***	***SD***	***P*-value**
MBI (*n* = 10)					
Symbol Search *(correct responses)*	23.7	6.6	25.2	6.1	.444
Coding (*correct responses)*	34.8	12.8	41.2	14.6	**.019**
Trail A *(in Seconds)*	59.2	25.3	49.8	19.9	.061
Trail B *(in Seconds)*	111.6	14.8	95.9	29.4	**.035**
CBT (*n* = 10)					
Symbol Search *(correct responses)*	25.8	10.5	27.8	9.4	**.044**
Coding *(no. of correct responses)*	49.8	17.5	52.6	18.6	.301
Trail A *(in Seconds)*	47.8	27.5	36.3	20.5	.059
Trail B *(in Seconds)*	104.9	24.8	79.1	26.8	**.003**

Note. MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

[a]Text.

Figure 7.1 shows that number of correct responses was higher after the intervention for both Symbol Search and Coding assessments for refugees with PTSD in the MBI group ($n = 10$). It is clear from Figure 7.1 that the mean RT was higher before intervention for both Trail A and B in the MBI group ($n = 10$).

Figure 7.1

Comparing Symbol Search and Coding Assessment Measurements Before and After Intervention for Refugees with PTSD in the MBI Group (n = 10)

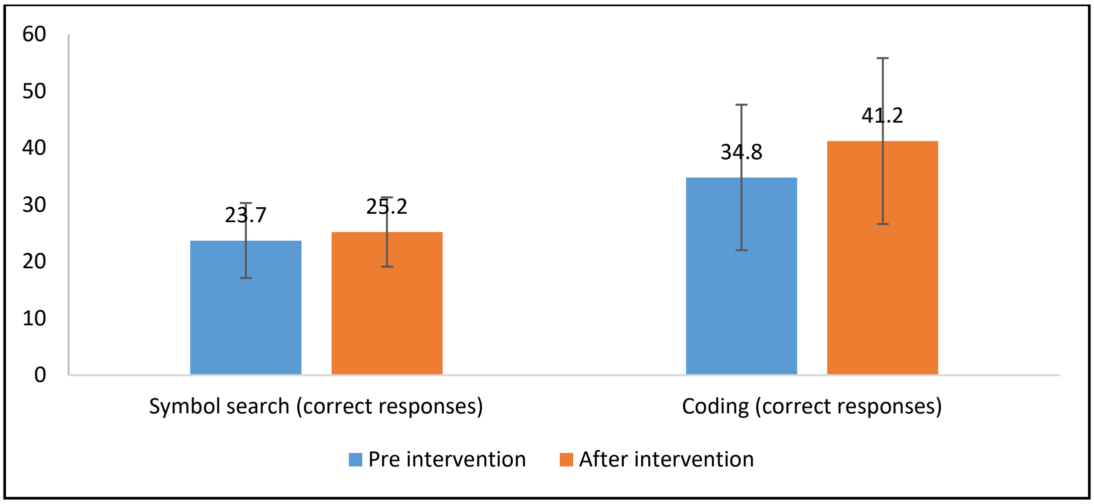
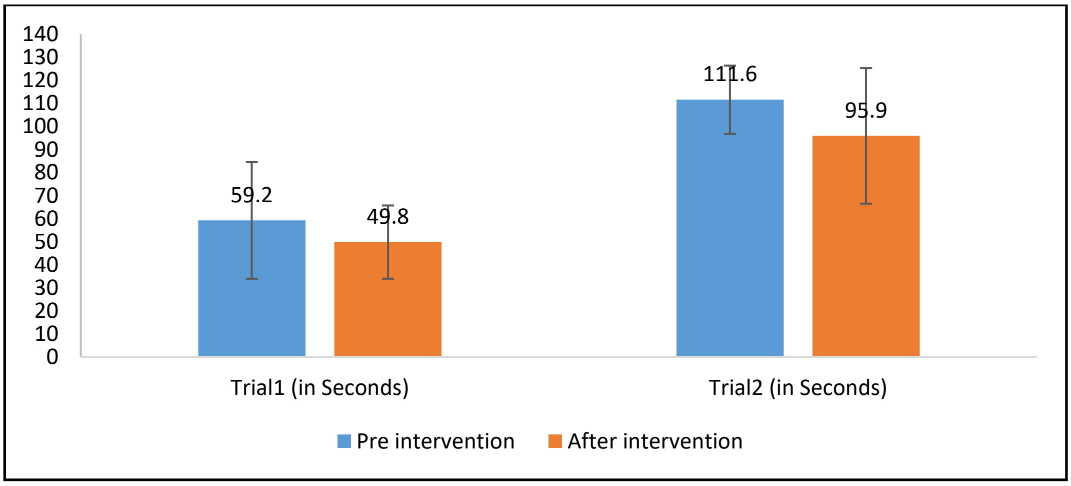


Figure 7.2

Comparing TMT A (1) and B (2) Measurements Before and After Intervention for Refugees with PTSD in the MBI Group (n = 10)



Similarly, Figure 7.3 shows that number of correct responses was higher after the intervention for both Symbol Search and Coding assessments for the refugees with PTSD in the CBT group (*n* = 10). Figure 7.4 illustrates that the mean RT was higher before the intervention for both Trail A (1) and Trail B (2) for the refugees with PTSD in the CBT group (*n* = 10).

Figure 7.3 Comparing Symbol Search and Coding Assessment Measurements Before and After Intervention for Refugees with PTSD in the CBT Group (n = 10)

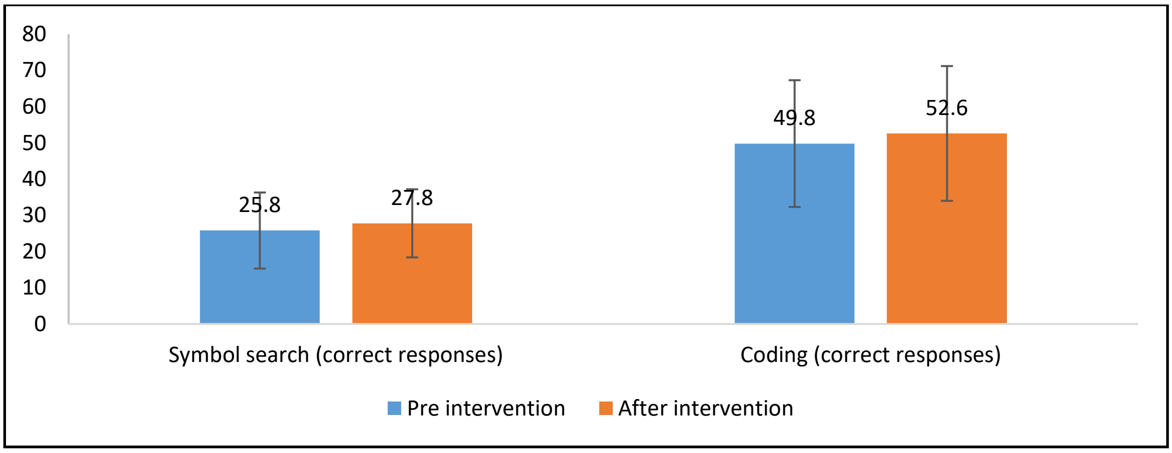
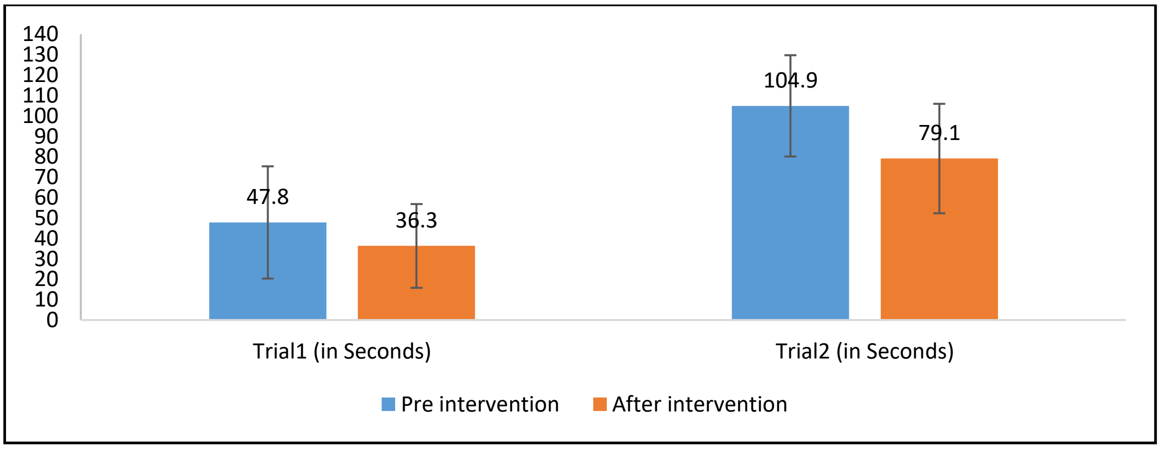


Figure 7.4

Comparing Trail Making 1 and 2 Assessment Measurements Before and After Intervention for Refugees with PTSD in the CBT Group (n = 10)



The correct responses were higher in the MBI group for TMT A (1) and B (2) compared with the CBT group for refugees with PTSD before and after the intervention. In contrast, the CBT group had higher mean correct response scores for the Symbol Search and Coding assessments compared with the MBI group before and after intervention.

Figure 7.5 illustrates that the mean number of correct responses for refugees with PTSD in both the MBI and CBT groups increased after the intervention regarding the Symbol Search and Coding assessments.

Figure 7.5

Comparing Symbol Search and Coding Assessment Measurements Before and After Intervention for Refugees with PTSD in the MBI (n = 10) and CBT (n = 10) Groups

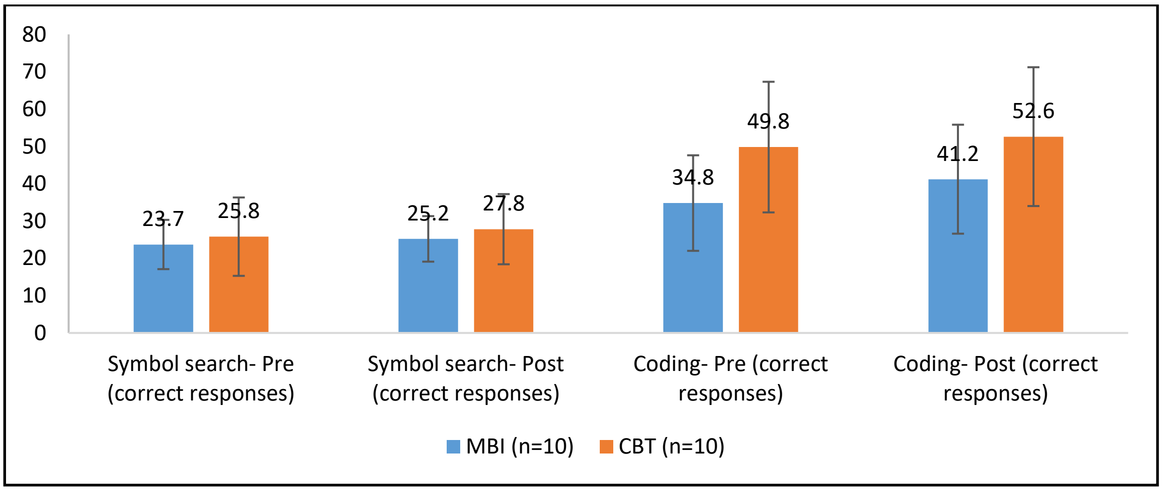
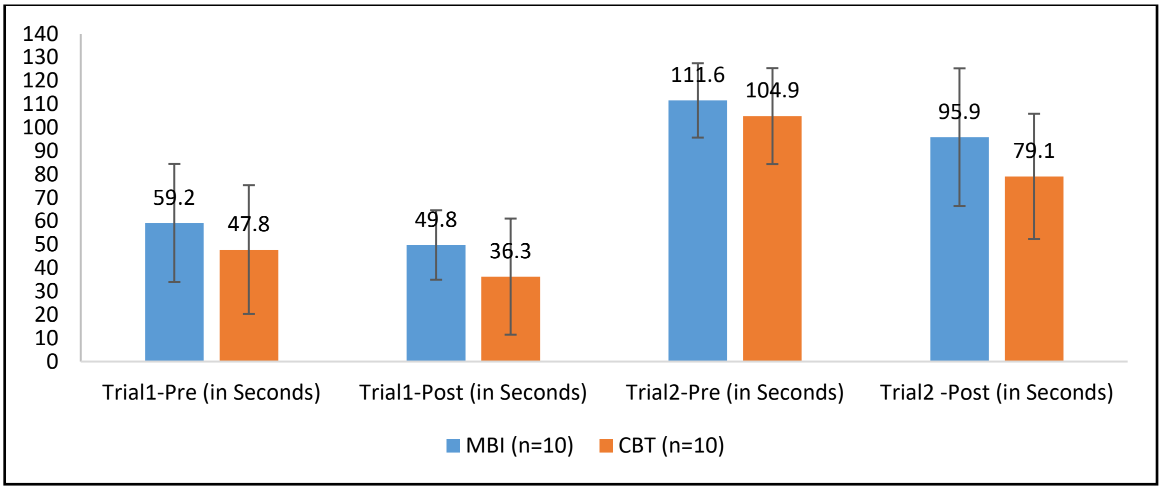


Figure 7.6 illustrates that the RTs for refugees with PTSD in both the MBI and CBT groups decreased after the intervention in TMT A (1) and B (2) tests.

Figure 7.6

Comparing TMT A (1) and B (2) Measurements Before and After Intervention for Refugees with PTSD in the MBI (n = 10) and CBT (n = 10) Groups



Section 7.4.2 summarises the results of different types of statistical analysis techniques applied for analysing the healthy controls' responses. Descriptive statistics measures, such as mean score and standard deviation, were calculated to determine the efficacy of MBI and CBT on performance in standard neuropsychological assessment in healthy controls. In addition, paired sample t-tests (at a significance level of .05) were used to assess whether there were significant differences in mean scores of Symbol Search and Coding assessments and the RT (in seconds) for TMT A and B assessments before and after each intervention. In addition, two independent samples t-tests were performed to examine whether there were significant differences between the mean response scores of refugees with PTSD and healthy participants for Symbol Search, Coding, and RT in TMT A and B assessments. Histograms were plotted to facilitate visual comparison of performance for each assessment before and after intervention.

7.4.2 Symbol Search, Coding, and Trail Making Tests in Healthy Participants

Table 7.4 lists the mean scores and standard deviations for all combinations of healthy participants. In addition, paired t-tests were applied to compare the mean scores of healthy participants in each group, and the results are listed for each of the MBI and CBT groups. Table 7.4 indicates that there are significant differences in the mean scores of Symbol Search (number of correct responses) and Trail A (1) (in seconds) for both the MBI and CBT groups ($p < .05$).

Furthermore, there was a significant difference in the mean TMT B (2) score (in seconds) in the MBI group before and after the intervention ($p = .031$). The full results for the paired t-tests for all groups can be found at the end of this report, in Appendix L.

Table 7.4

Descriptive Statistics for the Comparison of the Symbol Search, Coding, Trail 1, and Trail 2 Items for Healthy Participants Between the MBI and CBT Groups Pre- and Post-intervention

Group/Assessment Type	**Intervention**				**Comparisons**
	Pre to		**Post to**		**Within Groups[a]**
	M	***SD***	***M***	***SD***	***P*- value**
MBI (*n* = 7)					
Symbol Search *(correct responses)*	24.4	8.1	35.4	11.4	**0.47**
Coding (*correct responses)*	65.4	9.8	72.1	14.1	.055
Trail A *(in seconds)*	43.9	24.9	27.7	6.7	**.040**
Trail B *(in seconds)*	106.4	22.4	89.1	30.7	**.031**
CBT (*n* = 10)					
Symbol Search *(correct responses)*	26.2	5.8	36.5	7.4	**.001**
Coding *(no. of correct responses)*	57.1	14.1	67.2	14.1	.102
Trail A *(in seconds)*	43.4	25.5	29.1	11.0	**.030**
Trail B *(in seconds)*	92.2	23.8	83.7	26.5	.284

Note. MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

7.4.2.1 Symbol Search, Coding, and Trail Making Test Results for the Healthy Participants in the MBI Group. Figure 7.7 shows that the mean correct responses was higher after the intervention for both Symbol Search and Coding assessments for the healthy participants in the MBI group (*n* = 7). It is clear from Figure 7.8 that RT was higher before intervention for both TMT A (1) and B (2).

Figure 7.7

Comparing Symbol Search and Coding Assessment Measurements Before and After Intervention for Healthy Participants in the MBI Group (n = 7).

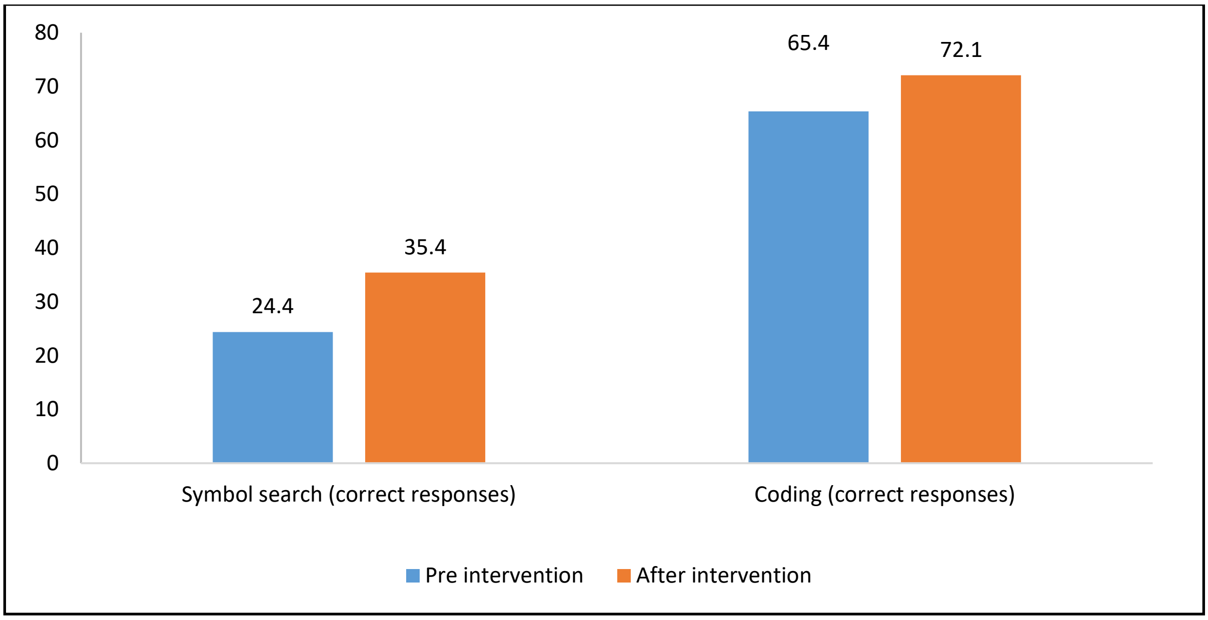
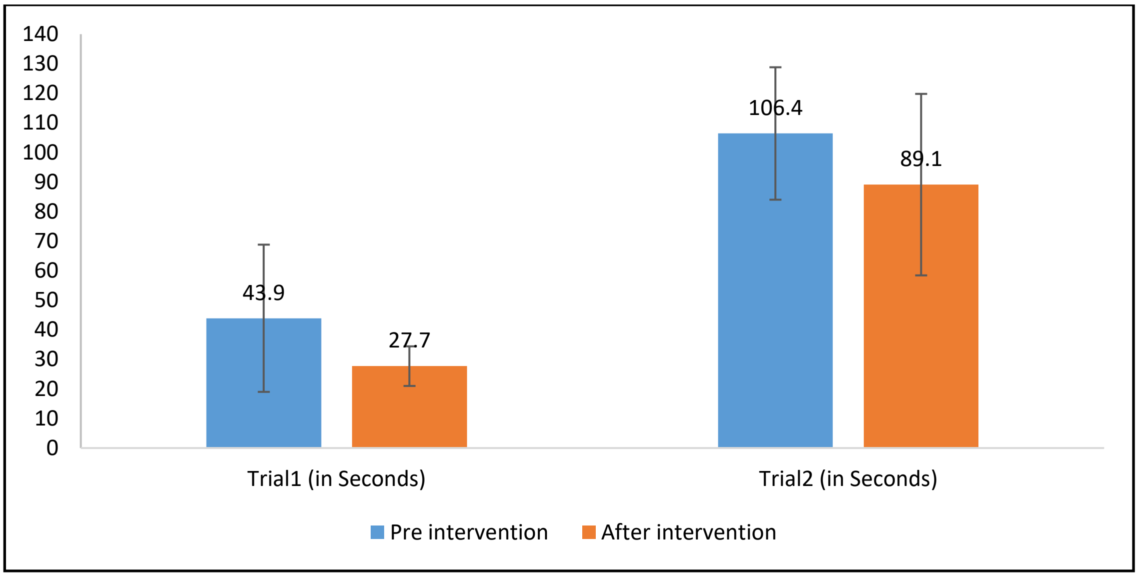


Figure 7.8

Comparing TMT A (1) and B (2) Measurements Before and After Intervention for Healthy Participants in the MBI Group (n = 7)



7.4.2.2 Symbol Search, Coding, and Trail Making Test Results for the Healthy Participants in the CBT Group. Figure 7.9 shows that the mean correct responses were higher after the intervention for both Symbol Search and Coding assessments for the healthy participants in the CBT group (*n* = 10). It is clear from Figure 7.10 that the mean RT was higher before intervention for both TMT A (1) and B (2) for the healthy participants in the CBT group (*n* = 10).

Figure 7.9 Comparing Symbol Search and Coding Assessment Measurements Before and After Intervention for Healthy Participants in the CBT Group (n = 10)

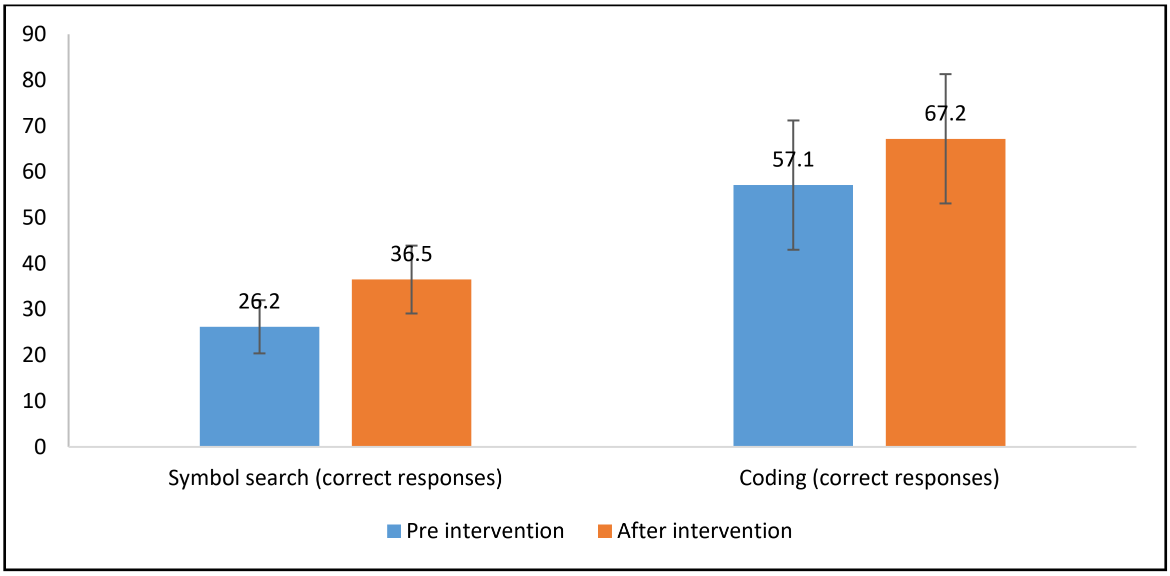
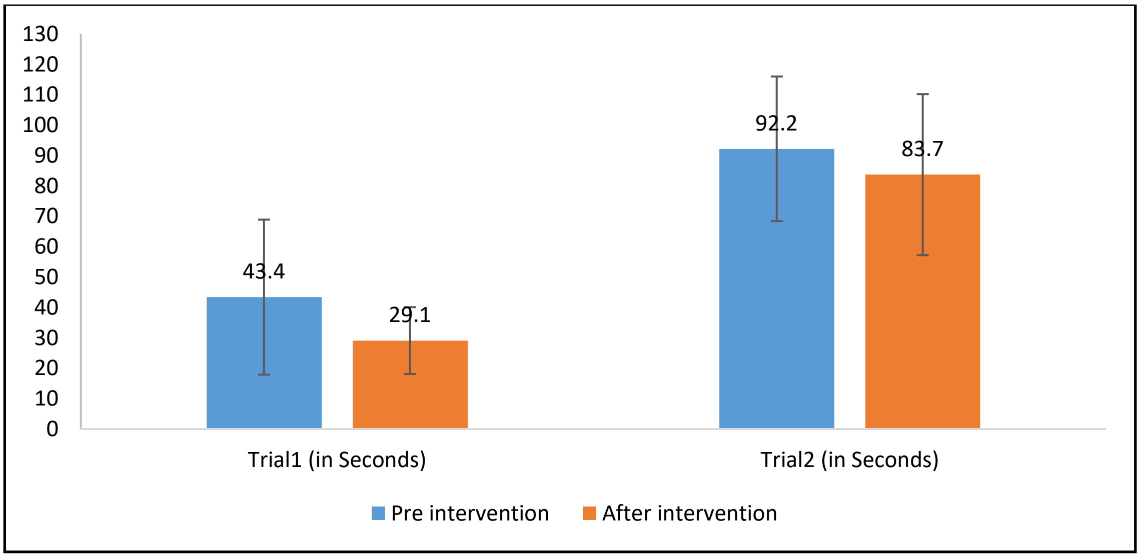


Figure 7.10

Comparing TMT A (1) and B (2) Measurements Before and After Intervention for Healthy Participants in the CBT Group (n = 10)



7.4.3 Comparing Symbol Search, Coding, and Trail Making Tests Before and After Intervention in Healthy Participants

Scores were higher within the MBI group for Coding and TMT A (1) and B (2) assessments compared with the CBT group for healthy participants before intervention. The CBT group had a higher mean number of Symbol Search correct responses and mean TMT A (1) RT (in seconds) compared with the MBI group after intervention. Figure 7.11 illustrates that the mean correct responses on the Symbol Search and Coding assessments in both the MBI and CBT groups increased after the intervention for the healthy participants.

Figure 7.11

Comparing Symbol Search and Coding Assessment Measurements Before and After Intervention for Healthy Participants in the MBI (n = 7) and CBT (n = 10) Groups

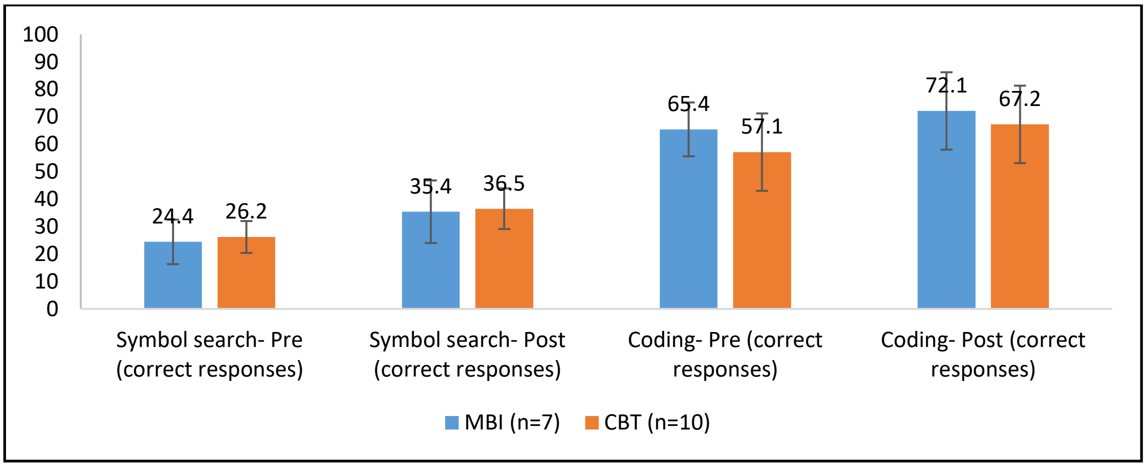
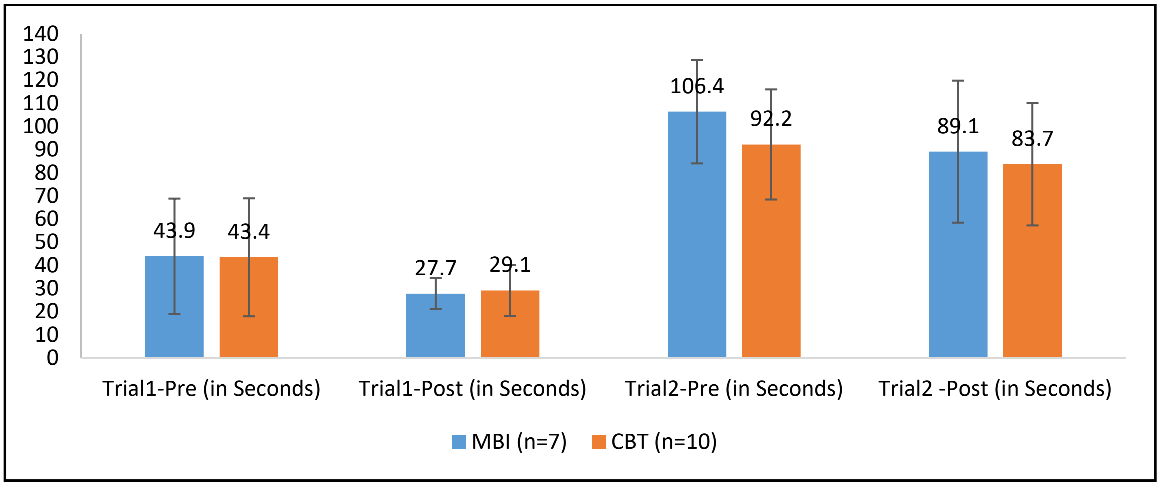


Figure 7.12 illustrates that the RTs in TMT A (1) and B (2) for healthy participants in both the MBI and CBT groups decreased after intervention.

Figure 7.12

Comparing TMT A (1) and B (2) Measurements Before and After Intervention for Healthy Participants in the MBI (n = 7) and CBT (n = 10) Groups



7.4.4 Comparison Between Refugees with PTSD and Healthy Participants Regarding Symbol Search, Coding, and Trail Making Tests

Figure 7.13 and Figure 7.14 show that the mean scores for the Symbol Search and Coding assessments for healthy participants in both the MBI and CBT groups were higher before and after the intervention. For example, the mean number of correct responses in the Coding assessment for the healthy participants in the MBI group after the intervention was 72.1, which is higher than the mean number of correct responses in the Coding assessment for the refugees with PTSD (*M* = 41.2).

Figure 7.13

Comparing Symbol Search Test Results Before and After Intervention for the Healthy Participants and the Refugees with PTSD in the MBI and CBT Groups

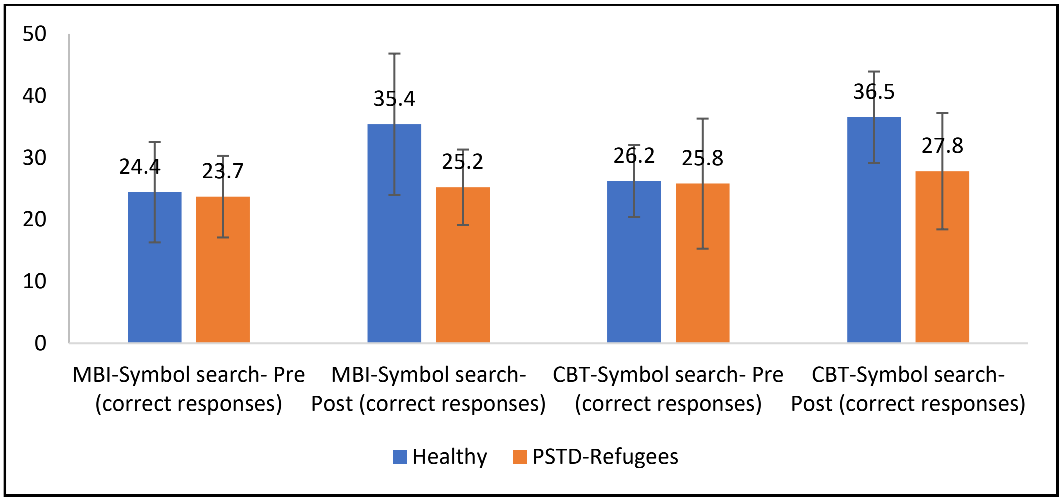
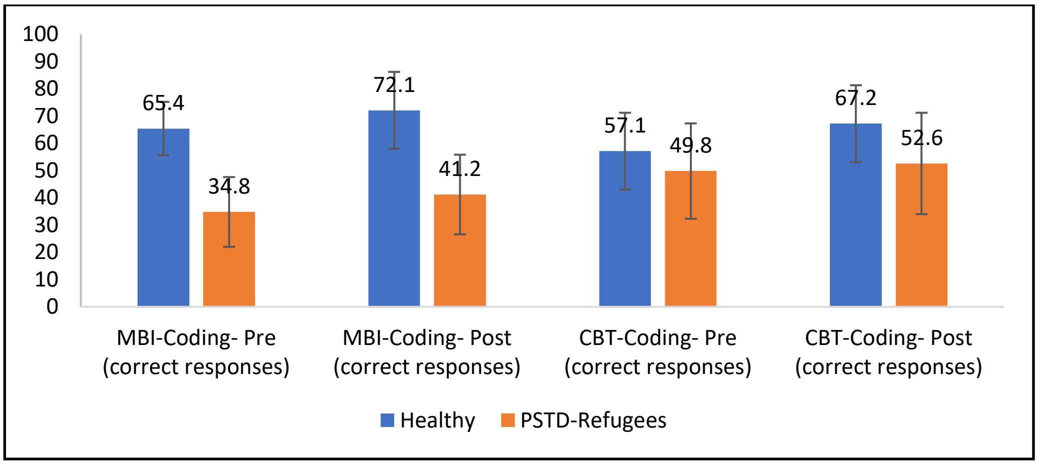


Figure 7.14 Comparing Coding Test Results Before and After Intervention for the Healthy Participants and Refugees with PTSD in the MBI and CBT Groups



Figures 7.15 and 7.16 present that the mean RTs for refugees with PTSD in both the MBI and CBT groups was higher than after intervention in TMT A (1) and B (2).

Figure 7.15 Comparing TMT 1 Before and After Intervention for Healthy Participants and Refugees with PTSD in the MBI and CBT Groups

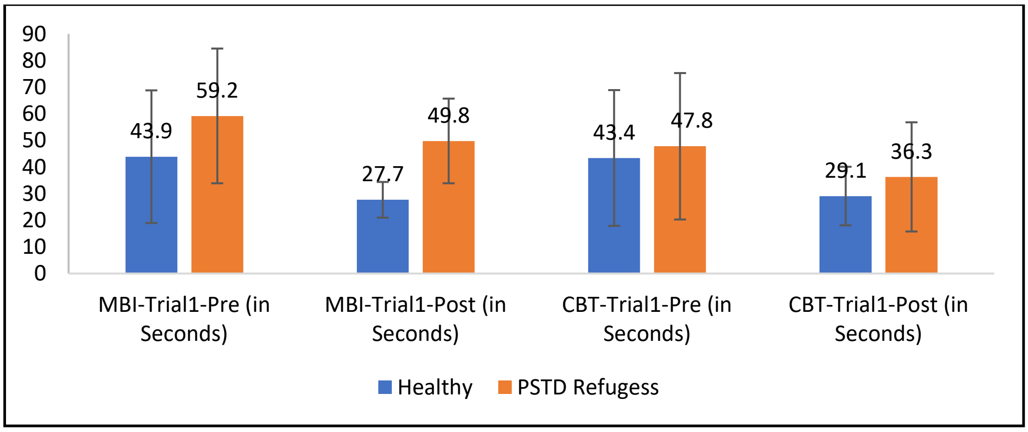


Figure 7. 16 Comparing TMT A (1) and B (2) Before and After Intervention for Healthy Participants and Refugees with PTSD in the MBI and CBT Groups

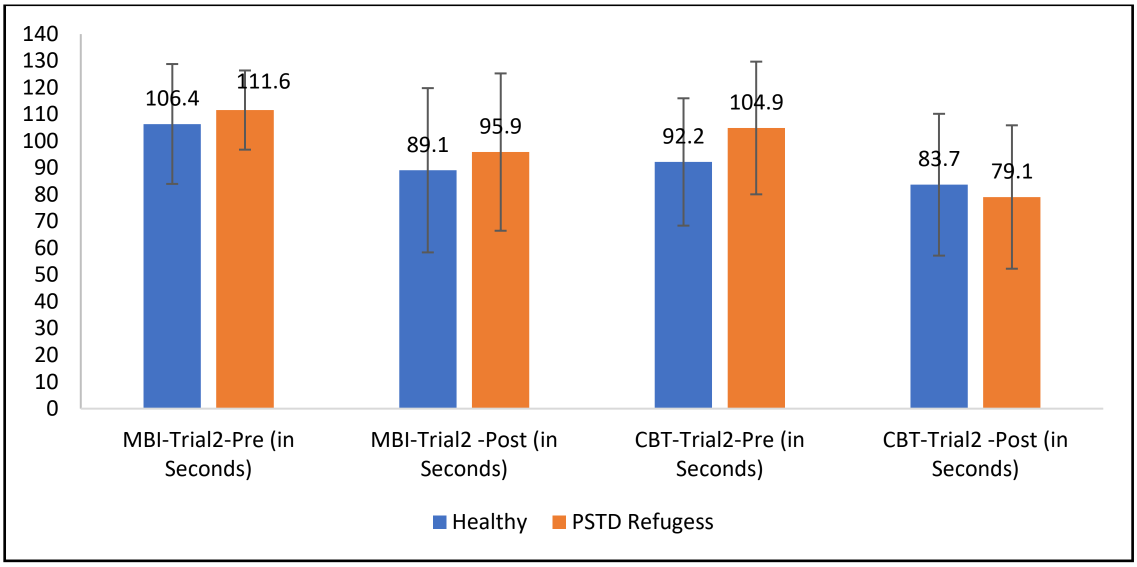


Table 7.5 summarises the results of the two independent samples t-tests. There was a significant difference ($\alpha = .05$) in the mean Coding assessment scores between the refugees with PTSD and the healthy groups pre-intervention ($p = .017$, $M = 14.9$), where the healthy group had a higher overall mean pre-Coding response score compared ($M = 57.2$) with the refugees with PTSD ($M = 42.3$). There was a difference between refugees with PTSD and the healthy participants regarding the Symbol Search assessment post-intervention ($p = .001$, $M = 9.6$), where the healthy participants had a higher mean post-Symbol Search response overall score ($M = 36.1$) compared with the refugees with PTSD ($M = 26.5$).

Moreover, Table 7.3 shows that there was a significant difference ($\alpha = .05$) in mean response scores between refugees with PTSD and healthy participants regarding the Coding assessment post-intervention ($p < .001$, $M = 22.3$), where the healthy participants had a higher mean post-Coding response overall score ($M = 69.2$) compared with the refugees with PTSD ($M = 46.9$). Finally, there was a significant difference between the refugees with PTSD and the healthy participants regarding the Trail Making A (1) assessment (in seconds) post-intervention (p = .004, M = 16.2), where refugees with PTSD had a higher mean overall post-TMT response score (M = 43.1) compared with the healthy controls (M = 26.9).

Table 7.5

Independent Samples T-Test Comparing the Responses Between the Refugees With PTSD and Healthy Participants for the Symbol Search, Coding, and TMTs for Both the MBI and CBT Interventions

Intervention	**Assessment**	**Test Statistic *t* (17)**	***P*-value**	**Mean difference**
Before	Symbol Search	-.281	.780	-0.7
	Coding	-2.516	.017	-14.9
	TMT A	1.177	.247	9.9
	TMT B	1.362	.182	9.8
After	Symbol Search	-3.469	.001	-9.6
	Coding	-4.281	<.001	-22.3
	TMT A	3.047	.004	16.2
	TMT B	.168	.868	1.6

Note. TMT, Trail Making Test.

7.4.5 Correlation Between Age and Performance

Spearman's correlation coefficients were calculated between age (in years) and participants' scores in Symbol Search, Coding, and TMT 1 and 2 assessments for refugees with PTSD and healthy participants for both intervention (MBI and CBT) at a significance level of .05. Age (in years) was significantly negatively correlated with the number of correct responses for the refugee group (n = 10) on the Symbol Search and Coding tests after MBI (Symbol Search: r_s = -.778, p = .008; Coding: r_s = -.826, p = .003) (Table 9). Moreover age (in years) was significantly negatively correlated with the number of correct responses in the healthy group (n = 10) on the TMT 1 after CBT (r_s = -.706, p = .022) (Table 10). It is important to note that the interpretation of the correlation was made based on the on the rule of thumb[3].

Correlation Coefficient *(r_s)*	Interpretation
± 0.01 to ± 0.30	Negligible
± 0.31 to ± 0.50	Low
± 0.51 to ± 0.70	Moderate
± 0.70 to ± 0.90	High

Table 7.6 Spearman's Correlation Coefficient Between Age (in Years) and Research Measurement Method for the Refugees With PTSD After MBI (n = 10) and CBT (n = 10)

Measurement	***Research Group***			
	PTSD with MBI		***PTSD with CBT***	
	Correlation Coefficient	***p*-value**	**Correlation Coefficient**	***p*-value**
post_symbol search _correct responses	-.778**	.008	-.192	.595
post_coding_correct responses	-.826**	.003	.229	.524
post_trail1_in seconds	.517	.126	.140	.699
post_trail2_in seconds	.533	.112	.400	.252

Note. PTSD, post-traumatic stress disorder; MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

Table 7.7

Spearman's Correlation Coefficients Between Age (in Years) and Research Measurement Method for the Healthy Group After MBI (n = 7) and CBT (n = 10)

Measurement	***Research Group***			
	Healthy with MBI		***Healthy with CBT***	
	Correlation Coefficient	***p*-value**	**Correlation Coefficient**	***p*-value**
post symbol search _correct responses	.414	.355	.506	.136
post_coding_correct responses	.393	.383	.107	.769
post_trial1_in seconds	-.126	.788	-.706*	.022
post_trial2_in seconds	-.464	.294	-.402	.250

Note. MBI, mindfulness-based intervention; CBT, cognitive behavioural therapy.

7.5 Discussion

According to the refugees with PTSD findings, performance in all assessment improved after both interventions. There were significantly different mean scores for Coding and TMT B after MBI. There were significantly different mean scores for Symbol Search and TMT B after CBT. CBT had a greater effect than MBI on all three measures. However, healthy group outcomes refer that performance in all assessments improved after both interventions. Although, MBI had a greater effect on the Coding measure than CBT.CBT had a greater effect on the TMT B than MBI.

Both interventions increased performance for both refugees with PTSD and healthy participants in all assessments. For all assessments, healthy participants had better performance than refugees with PTSD; in addition, both interventions had a more significant effect on the healthy group. There was no significant difference in performance on the following neuropsychological assessments between the refugees with PTSD and the healthy group before intervention: Symbol Search and TMT A and B. In addition, there was no significant difference in performance on the TMT B neuropsychological assessment between the refugees with PTSD and the healthy group after the intervention. Nevertheless, there was a difference in the mean scores between the PTSD and healthy group, implying that the refugees with PTSD took longer to complete the task than the healthy group. Furthermore, the results support the role of the Coding test in detecting cognitive function (Erdodi & Lichtenstein, 2017; Pearson, 2009; Trueblood & Schmidt, 1993; Trueblood, 1994) in addition to the ability of the TMT to verify the extent of a patient's concentration (Reitan, 1958; Shamosh et al., 2008).

There was no significant difference between the two intervention approaches (MBI and CBT), except on the Coding test, in which CBT produced higher results, confirming the effectiveness of the programme for improving the performance of participants regarding neuropsychological assessments (Cloitre, 2009; Dobson & Dozois, 2010, p.4; Sign, 2013). However, a potentially relevant difference was noted. TMT errors were analysed to determine impaired and improved attention in clinical settings (Christidi et al., 2013; Kopp et al., 2015). In the present study, the participants' RT decreased when MBI and CBT interventions were implemented. Interestingly, the CBT group outperformed the MBI group in the TMT 2 (B) and Symbol Search assessments. PSI is regarded as a crucial component of cognitive abilities (intelligence); it has the potential to affect executive function. Working memory, flexible thinking, organisation, planning, and attention abilities, like concentrating and executive control, are all affected by processing speed (Wechsler, 2008). In contrast, the MBI group outperformed the CBT group in the TMT. TMT-B, in addition to visuomotor and visuoperceptual skills, require mental flexibility to switch between numbers and letters, which is primarily dependent on executive functioning of the frontal lobe (Salthouse, 2011; Salthouse et al., 2000). TMT-B also entails connecting numbers and letters in an ascending and alternating pattern.

This study demonstrated that standard neuropsychological assessments could be valuable for assessing the efficacy of interventions. These findings support the application of neuropsychological scales to evaluate a patient’s response to treatment (Boone, 2008; Mallin et al., 2008; Miranda et al., 2006).

Chapter 8: Efficacy of MBI and CBT on performance in standard neuropsychological assessments and measure of well-being in mTBI

Abstract

Background: Patients with mild traumatic brain injury (mTBI) may experience a range of problems, including cognitive and emotional issues that can impact their work and social interactions. Assessment of mTBI symptoms can help identify individuals who are experiencing symptoms that are hindering their ability to function and assist them in receiving appropriate treatment and support.

Objective: The aim of this study was to assess attention improvement in mild traumatic brain injury (mTBI) patients through a mindfulness-based intervention in order to understand its impact on the attention system and overall well-being. The study also highlights the significance of rehabilitation services in Kuwaiti hospitals.

Method and Results: The experimental group (n=9) received mindfulness sessions for an eight-day period, while the control group (n=10) received cognitive-behavioural therapy sessions. Participants underwent neuropsychological assessments, GAF7, and PHQ-9, before and after the treatment sessions. The results of cognitive assessments showed that both interventions improved participants' scores. There was no significant difference between groups, but there was a significant difference within groups. The GAD-7 scores of mTBI patients were significantly different between the two interventions, with the CBT group scoring higher.

Conclusion: The findings indicate that both interventions were effective in improving attention, and the scales used were effective tools in measuring patients' attention and well-being. However, this study is preliminary and conducted on a sample of mTBI patients in Kuwait, so further research in this field is necessary.

8. Overview

TBI is a significant global public health concern, affecting an estimated 69 million people worldwide each year (Dewan et al., 2019). The severity of brain trauma ranges from ‘mild’ (mTBI) to ‘severe’ (sTBI). Most TBI cases worldwide are caused by mild TBI or concussion, which causes a brief change in mental status or consciousness (Rutherford, 1989). Severe TBI, on the other hand, leads to an extended period of unconsciousness, post-traumatic amnesia, and irreversible brain injury (Faul, 2010). According to research conducted through the Arab Gulf and Kuwait, in particular, and following a meeting with Kuwaiti neurologists working in Kuwait hospitals, such as Dr Hussain Al Kandari, Dr Abduallah Alozairi, and Dr Mohammad Ashkanani, a scarcity of research and rehabilitation services has been noted in this field. This study is complementary to the study described in Chapter 6, where additional measures were used to verify the effect of the therapeutic interventions. The results of the study are presented in the following order: Symbol Search and Coding from the Wechsler Adult Intelligence Scale - fourth UK edition (WAIS-IV UK), the Trail Making Test, the GAD-7, and the PHQ-9 results, and a comparison of the participants’ performance before and after the interventions.

8.1 Recruitment

The same recruitment processes that were applied in sections 6.1.1 to 6.2.4 were also applied here.

8.2 Method

The same method, demographic characteristics, data collection, inclusion, exclusion and procedures that were applied in section 6.3 in Chapter 6 were also applied here, except for the additional measures that will be described in details in the following sections. Before and after the intervention, neuropsychological assessments were conducted in one session. The following questionnaires were used: the Online Generalized Anxiety Disorder Assessment (GAD-7) and the Patient Health Questionnaire (PHQ-9) were administered both before and after the interventions.

8.2.1 Generalised Anxiety Disorder Assessment (GAD-7)

The Generalised Anxiety Disorder Assessment (GAD-7) is a seven-item questionnaire used to assess the severity of Generalized Anxiety Disorder (GAD). Participants were asked to rate the intensity of their symptoms over the past two weeks with options including "not at all," "several days," "more than half the days," and "almost every day" (Kertz et al., 2013). A higher score indicates greater levels of anxiety; see Appendix J for more information.

8.2.2 Patient Health Questionnaire (PHQ-9)

The depression module of the PHQ-9 assigns scores from "0" (not at all) to "3" (extremely severe) to each of the nine DSM-IV criteria (present almost daily). It has been validated for primary care use (Cameron et al., 2008) and is used to monitor the severity of depression and gauge its response to treatment (Cameron et al., 2008). A high score represents more severe symptoms of depression.

8.2.3 Reliability

The GAD-7 is a widely used anxiety assessment tool with high reliability (α = .92) and validity (Spitzer et al., 2006). The seven items are rated on a 4-point scale with a total score ranging from 0 to 21 (Spitzer et al., 2006). The PHQ-9 also has a high level of reliability (α = .89) (Kroenke et al., 2001) and is based on DSM-IV criteria for major depression, including nine items with 4-point response scales (Kroenke et al., 2001). The scale ranges from 0 to 27. Both measures are available in Arabic (Ohaeri et al., 2010).

This study assessed the reliability of the scales. The overall Cronbach's Alpha for the PHQ-9 questionnaire was 0.887, which indicates an acceptable level of internal consistency. The overall Cronbach's Alpha for the GAD-7 questionnaire was 0.915, which indicates an excellent level of internal consistency among the mTBI subgroup (n=19).

8.2.4 Validity

To assess the construct validity of the PHQ-9 questionnaire in this study, a Pearson product-moment correlation was applied. With a sample size of (n=19) across all research groups and a significance level of 0.05, according to the R-product moment, the critical value of r was calculated as 0.433. The correlation coefficients were calculated between each variable score and the total score for the PHQ-9 before the intervention across all research groups. Table 4 shows that all Pearson correlation coefficients for all variables are significant and equal to or greater than 0.443, with p-values less than 0.001. For example, for the question "*Feeling down, depressed, or hopeless*," $r = .645$, $p = .003 < .05$, providing evidence of construct validity for the questionnaires adapted and used in this research.

Table 8. 1

Pearson Correlation Coefficients between PHQ-9 total Score and its Items (n=19) for mTBI subgroups

Items	Correlation Coefficient *r*	*p*
1. Little interest or pleasure in doing things	.839**	<.001
2. Feeling down, depressed or hopeless	.645**	.003
3. Trouble falling or staying asleep, or sleeping too much	.848**	<.001
4. Feeling tired or having little energy	.827**	<.001
5. Poor appetite or over eating	.809**	<.001
6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down	.592**	.008
7. Trouble concentrating on things, such as reading the newspaper or watching television	.672**	.002
8. Moving or speaking so slowly that other people could have noticed, or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	.738**	<.001
9. Thoughts that you would be better off dead or of hurting yourself in some way	.594**	.007

To assess the construct validity of the GAD-7 questionnaire in this study, a Pearson product-moment correlation was applied. With a sample size of (n=19) across all research groups and a significance level of 0.05, according to the R-product moment, the critical value of r was calculated as 0.433. The correlation coefficients were calculated between each variable score and the total score for the GAD-7 before the intervention across all research groups. Table 5 shows that all Pearson correlation coefficients for all variables are significant and equal to or greater than 0.443, with p-values less than 0.001. For example, for the question “*Becoming easily annoyed or irritable,”* r = .495, p = .031 < .05, providing evidence of construct validity for the questionnaires used in this research.

Table 8. 2 Pearson Correlation Coefficients between GAD-7 total Score and Nine Items (n=19) for mTBI subgroups

Item	Correlation Coefficient *r*	P-value
Feeling nervous, anxious or on edge	.732**	<.001
Not being able to stop or control worrying	.920**	<.001
Worrying too much about different things	.854**	<.001
Trouble relaxing	.861**	<.001
Being so restless it is hard to sit still	.854**	<.001
Becoming easily annoyed or irritable	.495*	.031
Feeling afraid as if something awful might happen	.904**	<.001

8.3 Data Analysis

The power analysis for all measurement tools used in this research was computed using partial-eta squared (η_p^2). This can be achieved in IBM SPSS by using generalised linear models and selecting the repeated-measures option with two levels, such as (Symbol search, Coding, Trial1, and Trial2, PHQ9, and GAD7) within the mTBI group (n=19). Rules of thumb based on Cohen’s *D*[4] suggested the following cut-offs for describing the estimated effect size using partial eta-squared η_p^2 values; small if $\eta_p^2 \geq .01$ and less than .06, medium if

$\eta_p^2 \geq .06$ and less than .14, and large if $\eta_p^2 \geq .14$. Furthermore, results in Table 8.4 show that the observed (post-hoc) power levels for the research's assessments, namely PHQ9 and GAD7 within mTBI (n=19) participants group, are large.

Table 8. 3 Test of Within-Subjects effects within mTBI Group (n=19)

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power*
PHQ9	Sphericity Assumed	63.18	1	63.18	6.52	0.02	0.27	0.68
	Greenhouse-Geisser	63.18	1	63.18	6.52	0.02	0.27	0.68
GAD7	Sphericity Assumed	44.44	1	44.44	3.37	0.08	0.17	0.41
	Greenhouse-Geisser	44.44	1	44.44	3.37	0.08	0.17	0.41

However, data was not pre-processed at the initial stage of data analysis due to the following reasons: The impact of outliers was minimised in this study by using a set of inclusion and exclusion criteria. Please refer to Section 6.3 of Chapter 6 for more information on these criteria. Furthermore, due to the scarcity of some of the targeted population groups, there is a possibility of getting unexpected values naturally at one or more of the applied measurement treatments. In addition, as long as there is nothing wrong with such data (for example, no error in data entry or applied treatments), they are considered a normal part of the data distribution. In other words, they can be valid observations, and they are sometimes the most interesting. As a result, it is not common statistical practise to exclude such cases from data analysis. Furthermore, the proposed statistical analysis techniques (mainly descriptive statistics and non-parametric inferential statistics) are also considered. For more information on removing and handling outliers in data, see https://statisticsbyjim.com/basics/remove-outliers/

Finally, boxplots were established for all collected data within all research treatment methods, as shown in Appendix N, where in most cases, there were no outliers, and in some cases, there were strange values in a pre-intervention of a method while no outliers exist in an after-intervention of the same method, and vice versa. As a result, such data detection results using boxplots make it more interesting to understand the change in participant behaviour within various research methods.

8.4 Results:

Section 8.4.1 summarises the results of several types of statistical analysis techniques applied for analysing patients with mTBI responses. Descriptive statistics measures such as mean score and standard deviation were calculated for Symbol Search, Coding, and Trail Making Test-Comparison between Interventions within the mTBI group. In addition, Paired Sample T-tests were used to compare differences in mean scores of symbol search and coding assessments and the reaction time using Trial making A and B assessments before and after each intervention**.** Histograms were also plotted to allow a visual comparison of performance before and after each intervention (MBI and CBT).

8.4.1 Symbol Search, Coding, and Trial Making Test- Comparison between Interventions in mTBI Group

This section of the analysis summarises the mean *number of correct responses* obtained by the mTBI patients in the symbol search and coding assessments, as well as their reaction time in the Trail Making 1 (A) and 2 (B) assessments. Table 8.1 lists the mean scores and standard deviations for all mTBI patient groups. Paired T-tests were applied to compare the mean scores in each group, and the test results are presented in the table. As shown in Table 8.5, there are significant differences in the mean scores for symbol search and reaction time in Trail Making A (trial1) for both the MBI and CBT groups. Additionally, there is a significant difference in the mean scores for the coding assessment in the CBT group before and after the intervention. The full results for the paired-T tests for all groups can be found in Appendix L at the end of this report.

Table 8. 4

Descriptive Statistics of Comparing (Symbol, Coding, Trail A and B) items for Patients with mTBI between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	**Intervention**				**Comparisons**
	Pre to		**Post to**		**Within Groups [a]**
	M	***SD***	***M***	***SD***	***P*- value**
MBI (*n*=9)					
Symbol search *(correct responses)*	26.8	4.0	38.4	6.3	**.003**
Coding (*correct responses)*	50.6	17.6	60.8	11.8	.106
Trails A *(in Seconds)*	30.4	9.3	25.7	9.3	**.010**
Trails B *(in Seconds)*	109.1	59.2	75.0	14.8	.107
CBT (*n*=10)					
Symbol search *(correct responses)*	26.6	3.9	36.3	7.1	**.007**
Coding *(no. of correct responses)*	48.5	11.3	59.7	11.3	**.017**
Trails A *(in Seconds)*	32.1	9.1	25.8	8.4	**.034**
Trails B *(in Seconds)*	97.9	36.0	75.5	16.9	.051

Figure 8.1 shows that the mean score is higher *after the intervention* for both symbol search and coding assessments for patients with mTBI in the MBI group (*n*=9). Figure 8.2 illustrates that reaction time is higher *before intervention* for both Trails A and B (trial1 and trial2) assessments for patients with mTBI in the MBI group (*n*=9).

Figure 8.1

Comparing Symbol search and Coding Assessments Measurements between before and after MBI intervention for patients with mTBI

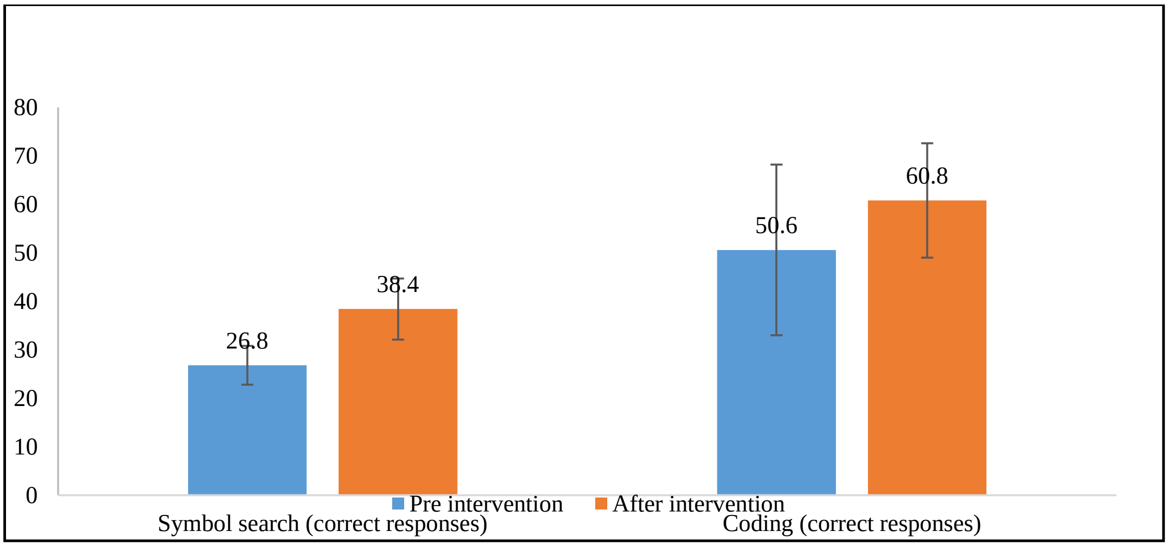


Figure 8.2

Comparing Trails A and B (Trial1 Making and Trial2) Making Assessments Measurements between before and after MBI intervention for patients with mTBI group (n=9)

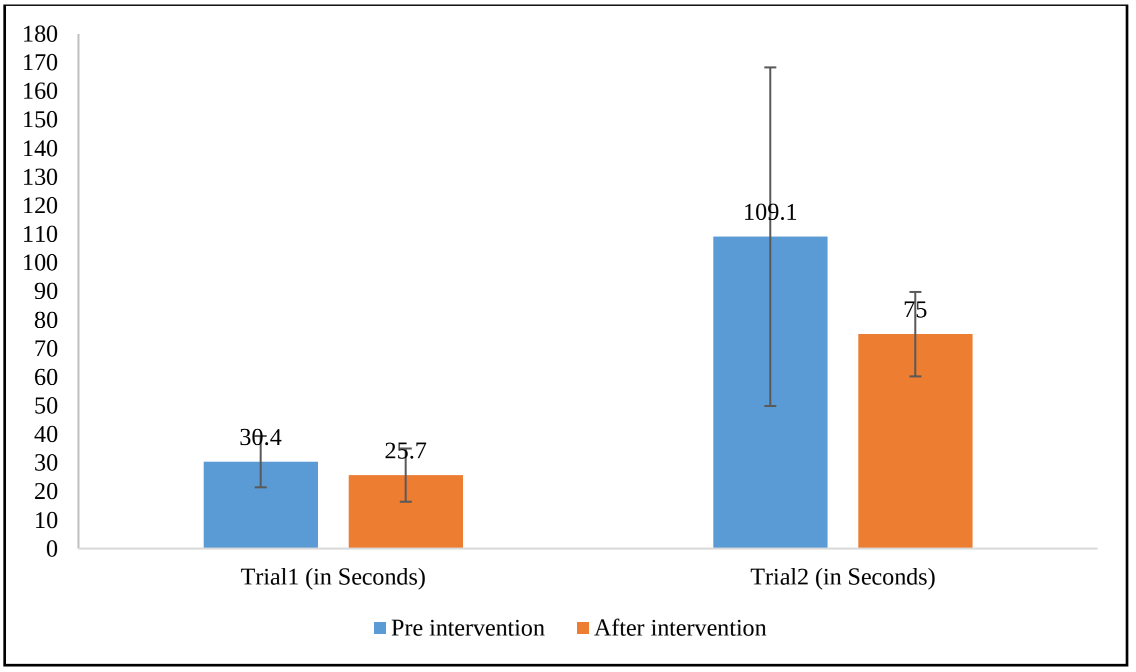


Figure 8.3 shows that the mean score is higher *after the CBT intervention* for both symbol search and coding assessments in the mTBI group (*n*=10). Figure 8.4 illustrates that reaction time is higher *before the intervention* phase for both Trails A and B (trial1 and trial2) assessments.

Figure 8. 3

Comparing Symbol search and Coding Assessments Measurements between before and after intervention for patients with mTBI within CBT group (n=10)

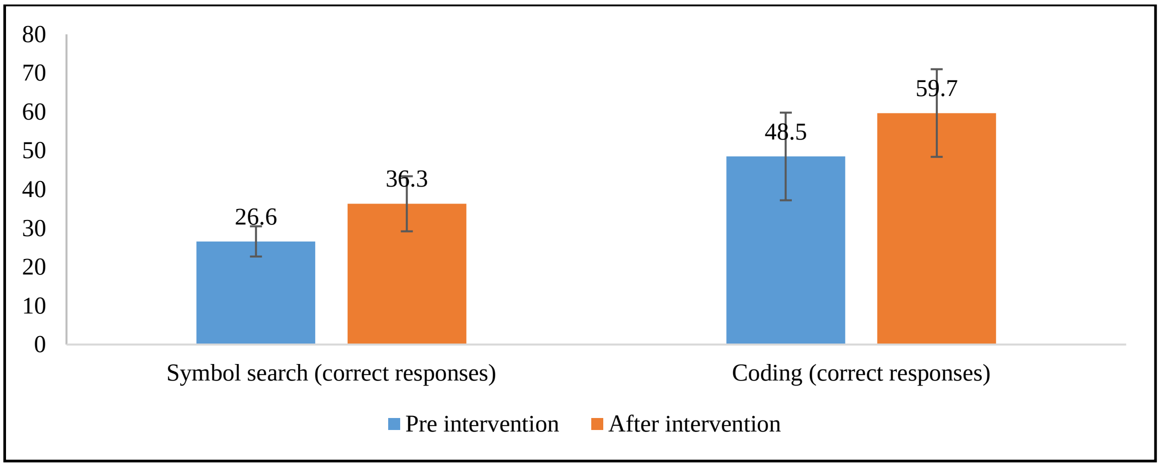
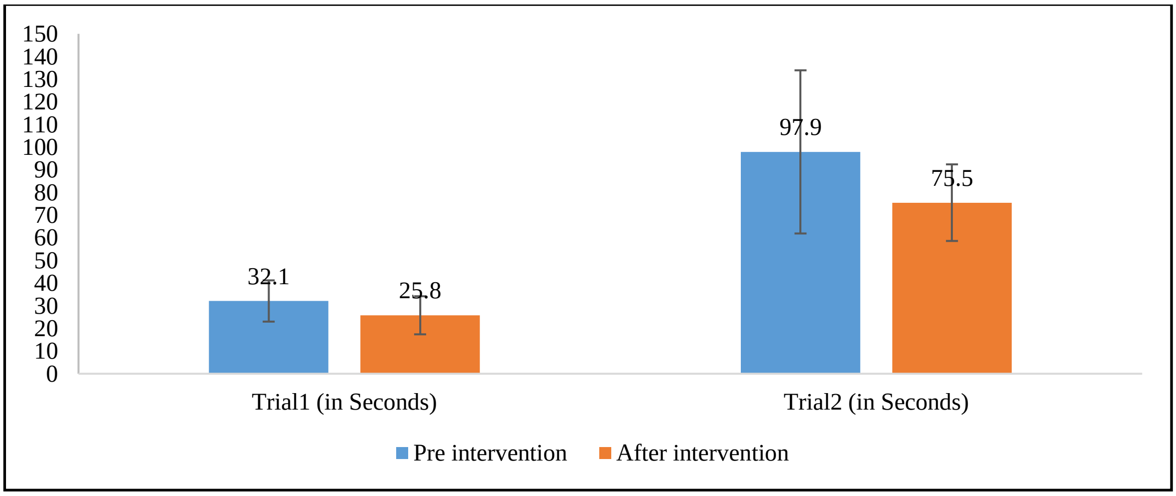


Figure 8.4

Comparing Trials A and B (Trial1 Making and Trial2) Making Assessments Measurements between before and after intervention for patients with mTBI within CBT group (n=10)



The mean correct responses are higher in the MBI group for symbol search, coding, and Trails B (trial2) assessments compared to the CBT group for patients with mTBI before intervention. It can be noted that the CBT group has higher reaction times in Trails A and B (trial1 and trial2) compared to the MBI group after intervention. Figure 8.5 shows that the correct responses for patients with mTBI in both MBI and CBT groups increased after the intervention in symbol search and coding assessments.

Figure 8.5

Comparing Symbol search and Coding Assessments Measurements between before and after intervention for patients with mTBI in the MBI (n=9) and CBT (n=10) groups

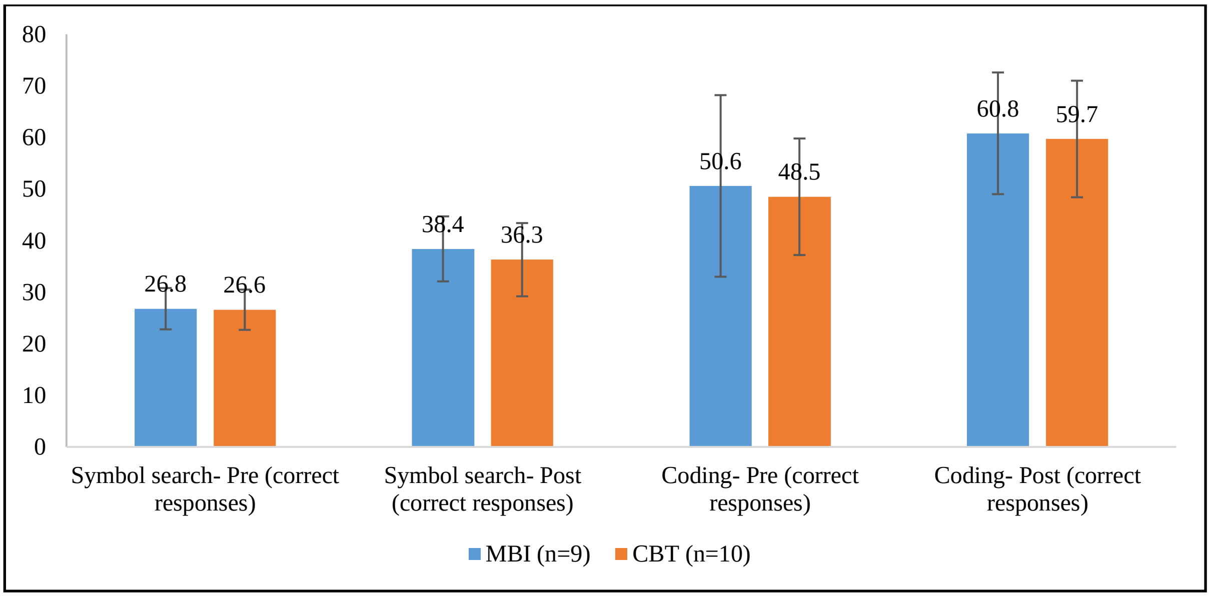
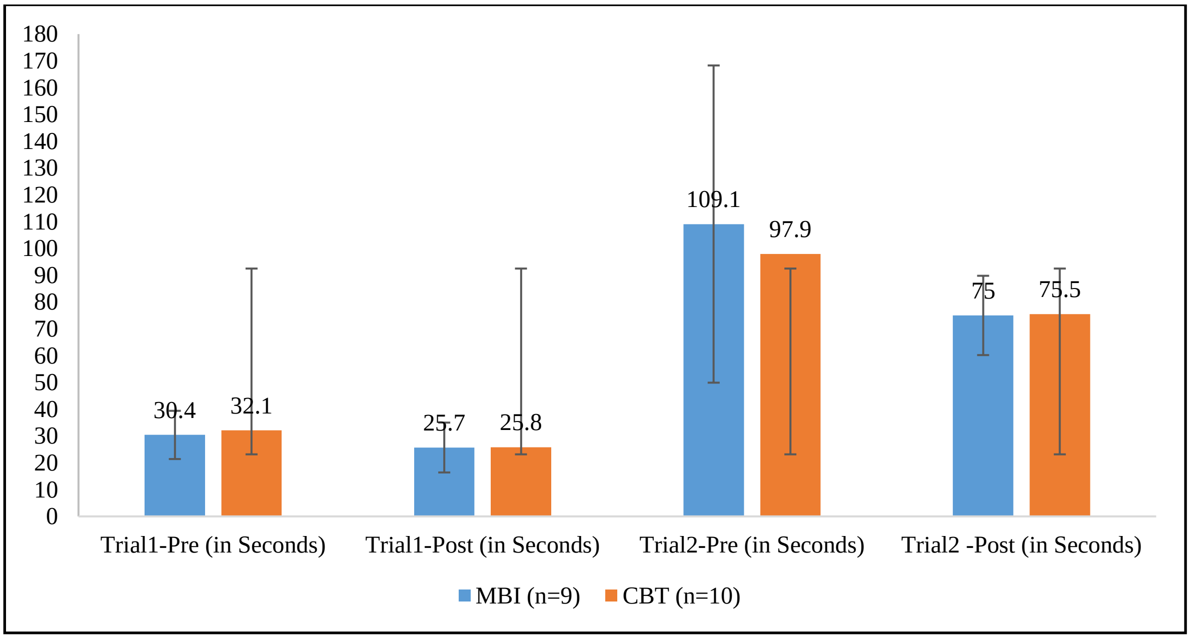


Figure 8.6 illustrates that the reaction time for patients with mTBI in both MBI and CBT groups decreased after the intervention in Trails A and B (trial1 and trial2) making test.

Figure 8.6

Comparing Trial1 Making, Trial2 Making Assessments Measurements between before and after intervention for patients with mTBI between MBI (n=9) and CBT (n=10) groups after intervention



Two independent samples T-test showed that there are no significant differences found (at a significance level of .05) in mean scores of symbol search, coding, Trails A (trial1) and B (trial2) assessments between participants of MBI (n=9) and CBT (n=10) groups for patients with mTBI for both phases pre-intervention and after-intervention.

8.4.2 GAD-7, and PHQ-9, before and after the intervention within and between mTBI groups

This section of the analysis summarises the results of the various statistical analysis techniques applied to analyse the responses of patients with mTBI in the GAD-7 assessment. Descriptive statistics measures, such as mean scores and standard deviations, were calculated to summarise the mean scores of patients with mTBI using the GAD-7 assessment. In addition, Paired Sample T-tests (at a significance level of 0.05) were used to determine if there were significant differences in mean scores of the GAD-7 assessment between pre- and post-intervention. Histograms were also plotted to visually compare the performance of the mean scores before and after the MBI and CBT interventions for each assessment.

Table 8.6 presents the mean scores and standard deviations for all patient groups with mTBI. As indicated in Table 8.6, there is a significant difference in the mean scores on the GAD-7 assessment for the CBT group before and after the intervention. It is noteworthy to mention that the complete results of the Paired-T-tests for all groups can be found in Appendix L at the end of this report.

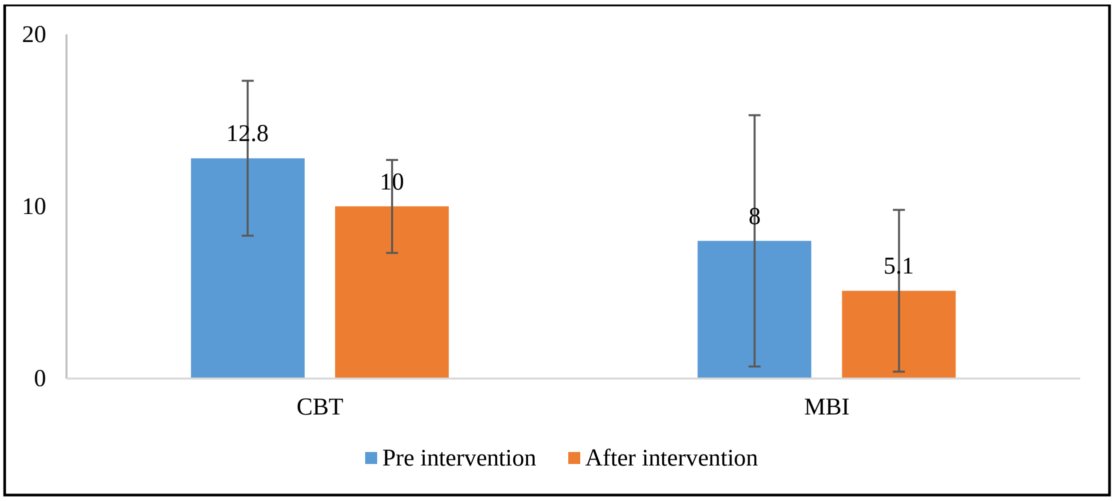
Table 8.5 Descriptive Statistics of Comparing GAD-7 items for Patients with mTBI between MBI and CBT groups during two Phases of intervention (Pre, Post)

Group/ Assessment Type	**Intervention**				**Comparisons**
	Pre to		**Post to**		**Within Groups [a]**
	M	***SD***	***M***	***SD***	***P*- value**
MBI (*n*=9)	8.0	7.3	5.1	4.7	.585
CBT (*n*=10)	12.8	4.5	10.0	2.7	**.007**

Figure 8.7 shows that the mean score using GAD (seven items) for patients with mTBI in the CBT group is higher before than after intervention. The situation is similar in case of MBI group.

Figure 8.7

Comparing GAD-7 Assessment Measurements between before and After Intervention for Patients with mTBI within both MBI group (n=9) and CBT group (n=10)



8.4.3 Analysis of PHQ-9 Questionnaire- mTBI group

This part of the analysis summarises the results of the statistical analysis techniques applied to the PHQ-9 assessment responses of patients with mTBI. Descriptive statistics such as mean score and standard deviation were calculated to summarise the mean scores of patients with mTBI using the PHQ-9 assessment. Paired Sample T-tests were also used to compare the mean scores of the PHQ-9 assessments before and after each intervention. Visual comparisons of scores were made using histograms, which were plotted before and after different interventions (MBI and CBT).

Table 8.7 presents the mean scores and standard deviations for all combinations of patients with mTBI. Paired T-tests were conducted to compare the mean scores in each group, and the results are listed. Table 8.7 shows that there is a significant difference in PHQ-9 scores in the CBT group before and after the intervention, with a P value of .019. The complete results for the Paired T-tests for all groups can be found in Appendix L at the end of the report.

Table 8.6

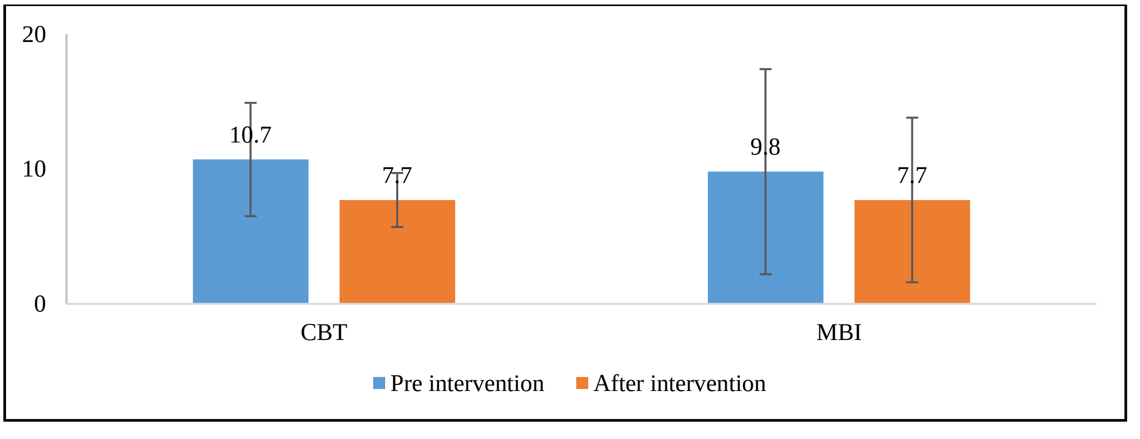
Descriptive Statistics of Comparing PHQ-9 items for Patients with mTBI between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	Intervention				Comparisons
	Pre to		Post to		Within Groups [a]
	M	*SD*	*M*	*SD*	*P*- value
MBI (*n*=9)	9.8	7.6	7.7	6.1	.285
CBT (*n*=10)	10.7	4.2	7.7	2.0	**.019**

Figure 8.8 shows that the response score using PHQ for patients with mTBI in both the CBT and MBI group is higher before the intervention.

Figure 8.8

Comparing PHQ-9 Assessment Measurements between before and After Intervention for Patients with mTBI in CBT group (n=10) and MBI group (n=9)



8.2.3.1 Comparison of GAD-7 and PHQ-9 Scores MBI vs CBT Group-mTBI

Two independent sample T-tests were applied to compare the scores in the GAD-7 and PHQ-9 assessments. The null hypothesis is that there is no statistically significant difference in response mean scores in the PHQ and GAD assessments for patients with mTBI between the MBI and CBT groups pre- and post-intervention. The results showed a significant difference in mean scores in the GAD-7 assessment after the intervention between the MBI and CBT groups, with a mean difference of 4.9 and a P-value of .014, which was higher for the CBT group. However, no other significant differences were reported for the PHQ-9 assessments (pre- and post-intervention) or the GAD-7 assessment (pre-intervention).

Table 8.7

Two Independent Samples T-tests for Equality of Mean Scores of (Symbol Search, Coding, Trial1, and Trial2) between MBI and CBT Groups within mTBI Patients

Variable		**Levene's Test for Equality of Variances**		**t-test for Equality of Means**			
		F	**Sig.**	**t**	**df**	***P*-value**	**Mean Difference**
Pre_symbol search-	Equal variances assumed	.006	.940	.097	17	.924	.178
	Equal variances not assumed			.097	16.716	.924	.178
pre_coding	Equal variances assumed	5.762	.028	.307	17	.763	2.056
	Equal variances not assumed			.300	13.424	.769	2.056
pre_trial1	Equal variances assumed	.065	.803	-.397	17	.696	-1.656

	Equal variances not assumed			-.398	16.846	.696	-1.656
pre_trial2	Equal variances assumed	1.136	.301	.505	17	.620	11.211
	Equal variances not assumed			.492	12.947	.631	11.211
post_symbol search	Equal variances assumed	.108	.746	.690	17	.500	2.144
	Equal variances not assumed			.694	17.000	.497	2.144
post_coding	Equal variances assumed	.081	.779	.203	17	.841	1.078
	Equal variances not assumed			.203	16.639	.842	1.078
post_trial1	Equal variances assumed	.087	.771	-.033	17	.974	-.133
	Equal variances not assumed			-.033	16.316	.974	-.133
post_trial2	Equal variances assumed	.269	.611	-.068	17	.946	-.500
	Equal variances not assumed			-.069	16.992	.946	-.500

NOTE. With respect to t-test p-values in above table, if variances are equal, we report p-value for equal variances assumed row. Variances would be equal if Levene's' test result is not significant (p >.05) for Levene's Test. And vice versa

8.4 Discussion:

Cognitive Performance

The results showed that both interventions improved participants' scores. There was no significant difference found between groups; however, there was a significant difference within the groups. This indicates the effectiveness of the MBI program in the clinical population (Link et al., 2016; van der Horn et al., 2017) and attention system (Hölzel et al., 2011; Chaskalson, 2014). In addition to indicating the replication of additional research on rehabilitation that is necessary for the neuropsychological department in Kuwait hospitals. As stated earlier in the introduction, the provision of such rehabilitation services has become a requirement for a patient with neurological conditions (Manee et al., 2017), not only on a psychological level but also to improve the quality of attention, which is the most common symptom for patients (Chan, 2002; Chan et al., 2003; Felmigham et al., 2004). Many healthcare facilities in the United Kingdom (Acabchuk et al., 2021) and other countries ("Center for Mindfulness in Surgery", 2021; Shirvani et al., 2021) have applied for mindfulness training programs as a procedure of cognitive and psychological rehabilitation for people who have suffered brain injuries before returning to normal life.

This study also showed that standard neuropsychological assessment can be valuable in assessing the efficacy of interventions (Miranda et al., 2006; Boone, 2008; Mallin et al., 2008). For the mTBI experimental group who took MBI, there was a significant difference in the Symbol search test. The results showed that MBI training positively affects patients' visual-perceptual speed, visual working memory, and decision-making abilities. Furthermore, their performance on the Trails A task has improved. TMT-A and TMT-B are both effective measures of psychomotor speed, visual search, and attention (e.g., Reitan and Wolfson, 1985) and are now widely used to assess set switching in patients with brain injuries (Muir et al., 2015). Compared to the mTBI control group that followed the CBT course, there was a significant difference in the Symbol search, Coding test, and Trails A. However, previous studies have shown significant correlations between TMT-A and TMT-B outcome measures in people with brain injuries (Kortte et al., 2002; Muir et al., 2015). Patients may struggle with the TMT-B as it requires more abilities and concentration. There is evidence that the TMT-B increases the need for low-level visual search (Gaudino et al., 1995). For example, the TMT-B requires a longer range between individual visual element parts than the TMT-A, which may place greater, demands on the low-level visuospatial search and motor components (Gaudino et al., 1995). Perhaps more training exercises over longer periods may improve performance.

Psychiatric assessments (GAD-7 and PHQ- 9)

Results indicate that both interventions improved the scores of participants on anxiety (GAD-7) and depression (PHQ-9) scales. mTBI patients' scores showed a significant difference between the two interventions, with the CBT group scoring higher on the GAD-7. This difference could be due to the CBT program's focus on changing negative thoughts into positive ones (Hofmann et al., 2010; Khoury et al., 2013). The MBI program, on the other hand, emphasises meditation, yoga exercises, and training to focus on the present and accept events in a practical manner (Kabat-Zinn et al., 2003).

The findings suggest that the improvement in performance can be attributed to mindfulness training, which focuses on enhancing self-regulation and non-judgmental acceptance of the present moment (Bishop et al., 2004). These results emphasise the significance of using assessments in defining the scope of a diagnosis (Teymoori et al., 2020). However, these are preliminary findings based on limited sample size, and further research is required. A more in-depth discussion of these findings will be provided in the general discussion chapter.

Chapter 9: Five Facet Mindfulness Questionnaire in a Healthy group, PTSD refugees and mTBI patients

Abstract

Background: Mindfulness interventions are designed to help people pay more attention to and be more aware of their current experiences. Over the last two decades, the number of randomised controlled trials (RCTs) of mindfulness interventions has risen significantly. However, among the Arab community, this is a relatively new approach, and there are few studies in this area, particularly regarding the programme’s use in clinical settings.

Objective: The purpose of this study was to determine the impact of a mindfulness-based intervention in the Arab community, as well as to compare it to standard cognitive behavioural therapy.

Method and Findings: The FFMQ was compared across three groups in a prospective cohort study that evaluated the impact of well-being on mild traumatic brain injury (mTBI) outpatients (N=20), Syrian refugees with PTSD (N=19), and healthy participants (N=17). Results showed that the act and non-judge scores decreased in the mTBI group after both interventions (CBT and MBI), while other scores increased. CBT had a stronger impact than MBI. No clear pattern of change was observed in the PTSD group after either intervention. Although both interventions resulted in higher scores in the healthy controls group, there is no statistically significant difference in FFMQ response overall mean between the MBI and CBT groups for participants (with mTBI, refugees, and healthy controls).

Conclusion: The Arabic version of the FFMQ has acceptable psychometric quality and can be used to assess clinical population awareness.

Overview

The Five Facets Mindfulness Questionnaire (FFMQ) is widely used in the research outlined in this thesis. However, there is no Arabic version of the original FFMQ available for the study of mindfulness in a clinical setting, except for an Arabic short form of the FFMQ (FFMQ-SF) (Al-Tammar, 2019). The development of this questionnaire was critical as it was one of the earliest studies to examine the effectiveness of mindfulness in addressing real-life challenges (Baer et al. 2004). Hence, this research first translates the FFMQ into Arabic. The questionnaire was administered to a group of participants who experienced stress, anxiety, and some symptoms of depression (Al Ozairi et al., 2023) before it was used with other participants. Subsequently, the performance of each group will be presented individually, starting with healthy individuals, followed by refugees, and finally patients, before comparing the performance of all participants in the study before and after the therapeutic intervention.

9.1 Design

This study is an intervention study that utilises a mixed factorial pre-test and post-test design to compare the efficacy of the mindfulness-based intervention (MBI) and cognitive behavioural therapy (CBT) in enhancing well-being among individuals with mild traumatic brain injury (mTBI), Syrian refugees with PTSD who experience attention impairment and low well-being, and a healthy control group. Participants completed the FFMQ as a baseline before undergoing either MBI or CBT sessions, which lasted for two weeks and consisted of four sessions per week. The FFMQ was repeated post-intervention, and the intervention agenda and guidelines can be found in Appendix L.

9.2 Ethics

9.2.1 Ethical approval

This is the fifth study that was conducted on all of the participants; therefore, the same ethics, consent form, and confidentiality that were applied in section 5.2 were also applied here.

9.2.2 Main Variable:

To determine the effect of the intervention on improving the well-being of the patient group compared to the healthy group by using FFMQ.

9.2.3 Participants:

Fifty-six young adults participated (21-45), as shown in the following table. Participants in the experimental group had a mindfulness-based intervention from Ms Mubarak, while the psychologist Mr Almutairi delivered a cognitive behavioural therapy course to the control group.

Table 9.1

Demographic Characteristics Description

Demographic	PSTD_ Refugees		Healthy		mTBI	
	MBI (*n*=10)	CBT (*n*=10)	MBI (*n*=7)	CBT (*n*=10)	MBI (*n*=9)	CBT (*n*=10)
Gender						
Male		10 (100%)		7 (70%)	4 (44.4%)	4 (40.0%)
Female	10 (100%)		7 (100%)	3 (30%)	5 (55.6%)	6 (60.0%)
Educational Level						
High school	2 (20.0%)	2 (20.0%)			4 (44.4%)	3 (30.0%)
Diploma	1 (10.0%)	1 (10.0%)	1 (14.3%)			
Undergraduate	7 (70.0%)	7 (70.0%)	5 (71.4%)	7 (70.0%)	3 (33.3%)	4 (40.0%)
High diploma				2 (20.0%)		
Postgraduate			1 (14.3%)	1 (10.0%)	2 (22.3%)	3 (30.0%)
Handedness						
Right	9 (90%)	10 (100%)	7 (100%)	9 (90%)	9 (100%)	10 (100%)
Left	1 (10%)			1 (10%)		
Age (year)						
Range (Min., Max.)	(29, 45)	(21, 45)	(20, 39)	(26, 42)	(22, 40)	(23, 36)
(mean ±*SD*)	(39.4±5.9)	(30.8±7.4)	(30.5±6.2)	(35.9±5.4)	(31.8±6.8)	(29.4±4.8)

9.2.4 Recruitment

9.2.4.1 PTSD refugees and Healthy group

The recruitment methods, as in section 5.3, were also used here.

9.2.4.2 mTBI outpatients

The same recruitment methods as in sections 6.1.1 to 6.2.4 were also used here.

9.3 Method

The method, data collection, inclusion, exclusion, and procedures that were used in sections 5.3, 5.4, and 6.3 of Chapter 6 were also employed here, except for the FFMQ, which will be covered in the following section.

9.3.1 Measure:

Five Facet Mindfulness Questionnaire (FFMQ)

In clinical settings, mindfulness-based therapies are growing in popularity as a means to alleviate clinical distress and enhance functioning (Hayes & Feldman, 2004; Baer et al., 2004; Chadwick et al., 2008; Walach et al., 2006). Baer et al. (2006) published a paper on the structure of mindfulness, in which they combined elements from different mindfulness questionnaires and conducted an exploratory factor analysis. Although these questionnaires are psychometrically sound (Buchheld et al., 2001; KIMS; Baer et al., 2004; MAAS; Brown & Ryan, 2003; Davis et al., 2009; Feldman et al., 2007; Chadwick et al., 2008), they vary in terms of generalisation, content, and structure, reflecting a lack of consensus that Baer et al. attempted to address with the FFMQ. Thus, this study chose the FFMQ as it measures the multi-dimensional construct of mindfulness skills (observing, describing, acting with awareness, non-judgment of inner experience, and non-reactivity to inner experience), which was integrated from five separate mindfulness questionnaires (i.e., FMI: Freiburg Mindfulness Inventory; KIMS: Kentucky Inventory of Mindfulness Skills; MAAS: Mindfulness Attention Awareness Scale).

The Five Facets Mindfulness Questionnaire (FFMQ) FFMQ contains 39 items which assess five aspects of mindfulness: observe (eight items), describe (eight items), act aware (eight items), nonjudgement (eight items), and non-reaction (seven items). Participants were asked to rate how truthful certain statements were to them on a scale of one to ten. The items were graded on a five-point Likert scale ranging from one (never or very rarely true) to five (always or almost always true). Facet scores were calculated by adding the individual item scores. Higher scores indicate more mindfulness. Facet scores vary from eight to 40 (except for the non-react facet, which spans from seven to 35).

This study aimed to examine the psychometric qualities of the FFMQ in a clinical population. The questionnaire was selected for its validity and its ability to measure awareness and enjoyment of the present moment (Baer et al., 2006). Moreover, it assesses the multi-faceted construct of mindfulness skills, incorporating elements from five different mindfulness questionnaires, including the Freiburg Mindfulness Inventory (FMI), the Kentucky Inventory of Mindfulness Skills (KIMS), and the Mindfulness Attention Awareness Scale (MAAS). A reliable and validated questionnaire would be extremely useful for future clinical research to understand the impact and processes of mindfulness in the Arab population.

9.3.2 Procedures

The FFMQ was previously tested on small samples of individuals with normal and mild traumatic brain injury, and it was found to have adequate psychometric properties (unpublished data). The questionnaire was also administered to a group of participants who reported symptoms of stress, anxiety, and depression (Al Ozairi et al., 2023). The questionnaire was implemented through the Google Form application to ensure confidentiality and data protection, and participants were provided with the researcher's phone number and email address to communicate when facing any unclear questions. Only the researcher had access to the data collected from the questionnaire and was able to download the participants' responses or read the questionnaire aloud if required.

At the start of the study, participants were asked to complete the online FFMQ, which took no more than fifteen minutes, before attending the courses. At the end of this two-week period, they were asked again by Ms Mubarak to complete the FFMQ. The questionnaire was read to those of the participants who had difficulty understanding the items. Note that the process took place in three phases, where the questionnaire and the intervention course were first applied to the healthy group, then to the refugees, and finally to the patient group separately. The FFMQ might cause tiredness; thus, participants were given regular pauses during the evaluation to avoid the possibility of impairment if required. In addition to the quantitative data, the participants were provided with a reflection form (see Appendices F and G) to allow them to express their thoughts on whether the intervention was effective or not. It is essential that future clinical research should include qualitative approaches and consider the perspectives of patients.

9.4 Reliability

The type of scale analysis used to measure reliability in this research is Cronbach's Alpha, developed by Lee Cronbach in 1951, where a value of 0.700 or higher is considered in order to determine whether the FFMQ questionnaire is consistent (Tavkol et al., 2011). Therefore, a value of Cronbach's Alpha ≥ 0.700 indicates that there is an internal consistency between questionnaire items. Test-retest reliability, on the other hand, evaluates the measure's temporal stability over time and compares the results of one round of questionnaire administration with the results of a subsequent round testing the same participants (Drost, 2011). The correlation between the two scores indicates the stability of the measures' performance. Table 9.2 shows that the overall Cronbach's Alpha for the FFMQ questionnaire is 0.873 indicating an acceptable level of internal consistency.

Table 9.2

Reliability Statistics for Research’s questionnaires (FFMQ39)

Questionnaire	Cronbach's Alpha	*N* of Items	Sample Size	Groups
FFMQ-39	.873	39	56	Healthy, PSTD, and mTBI

9.5 Validity

Construct validity is useful when evaluating questionnaires that are focused on concepts that cannot be directly measured, such as mindfulness (Rust & Golombok, 2009). Therefore, to check the construct validity for the FFMQ39 questionnaire within this research, the Pearson product moment correlation was applied, where according to the table of R-product moment and considering the total sample size within all research groups, which equals (*n*=56), and significance level of 0.05, the critical value of r is (0.250). Hence, making a decision about construct validity for the FFMQ39 questionnaire can be made by comparing each correlation coefficient result in Table 9.3 with the critical value (0.250), and if the resulted correlation coefficients are greater than the critical value, then the questionnaire is valid.

It is important to note that the correlation coefficients were calculated between each variable score and the total score for the FFMQ39 prior to the intervention in all research groups. Table 9.3 shows that all Pearson correlation coefficients for all variables are significant and ≥0.250, with p-values < 0.001. For instance, the act with awareness variable has a correlation coefficient of r = .463, p < .001, indicating evidence of construct validity for the questionnaires used in this research.

Table 9.3 Pearson Correlation Coefficients between FFMQ-39 total Score and Five Factors (n=56) for all Research Groups

Variable	**Correlation Coefficient** ***r***	**P-value**
Observed	.709**	<.001
Describe	.755**	<.001
Act with awareness	.463**	<.001
Nonjudge	.807**	<.001
Non react	.718**	<.001

9.6 Data Analysis

The power analysis for all measurement tools used in this study was computed using partial-eta squared (η_p^2). Such statistics could be obtained in the IBM-SPSS environment by implementing generalised linear models and then selecting the repeated-measures option to define a factor of two levels. Furthermore, the results in Table 9. 4 show that the observed (post-hoc) power levels for the research's assessments, namely observe, describe, act with awareness, non-judge, and non-react within *mTBI* (*n*=19) participants group, are large except in the case of the *describe* assessment where the reported partial-eta squared denoted by η_p^2 =.06.

Table 9.4

Test of Within-Subjects effects within mTBI Group (n=19)

Source		Type III Sum of Squares	D f	Mean Square	F	Sig.	Partial Eta Squared	Observed Power*
Observe	Sphericity Assumed	132.66	1	132.66	7.44	0.01	0.29	0.73
	Greenhouse-Geisser	132.66	1	132.66	7.44	0.01	0.29	0.73
Describe	Sphericity Assumed	9.50	1	9.50	1.24	0.28	0.06	0.18
	Greenhouse-Geisser	9.50	1	9.50	1.24	0.28	0.06	0.18
Act with awareness	Sphericity Assumed	342.00	1	342.00	34.78	0.00	0.66	1.00
	Greenhouse-Geisser	342.00	1	342.00	4.78	0.00	0.66	1.00
Non judge	Sphericity Assumed	222.74	1	222.74	20.32	0.00	0.53	0.99
	Greenhouse-Geisser	222.74	1	222.74	20.32	0.00	0.53	0.99
Non react	Sphericity Assumed	144.11	1	144.11	23.39	0.00	0.57	1.00
	Greenhouse-Geisser	144.11	1	144.11	23.39	0.00	0.57	1.00

*Computed using alpha= .05

Spearman's correlation coefficients calculated between age (in years) and participants' scores in the FFMQ for three study groups (mTBI, PSTD refugees, and healthy) within two methods (MBI and CBT) at a significance level of (.05). The results showed that age (in years) was significantly and moderately negatively correlated with the scores of mTBI patients in nonjudgment within the MBI method (n=9) after the intervention, with a correlation coefficient of rs = -.672 and a p-value of .047 < .05. There was no significant correlation with the scores of other groups.

Table 9.5

Spearman's Correlation Coefficients between Age (in Years) and Research Measurements Methods for mTBI Group within MBI (n=9) and CBT (n=10) After the Intervention

Measurement	*Research's Group*			
	mTBI within (MBI)		*mTBI within (CBT)*	
	Correlation Coefficient	*p*-value	Correlation Coefficient	*p*-value
Observed_R	0.145	0.709	-.031	.931
Describe_R	0.25	0.516	-.084	.818
Act_ with _awareness_R	-0.376	0.319	.310	.383
Nonjudge_R	**-.672***	**0.047**	.183	.612
Nonreact_R	-0.004	0.991	.517	.126

It is important to mention that the interpretation of the correlation is made based on the rule of thumb[5].

Correlation Coefficient *(r_s)*	**Interpretation**
±0.01 to ± 0.30	Negligible
±0.31 to ±0.50	Low
±0.51 to ±0.70	Moderate
±0.70 to ± 0.90	High
±0.91 to ±1.00	Very high

9.7 Results

The mean scores for each group in the FFMQ were summarised, which uses a five-point scale (1 = never or very rarely true, 2 = rarely true, 3 = sometimes true, 4 = often true, 5 = very often or always true). The FFMQ consists of 39 items that are divided into five dimensions: *Observe* items (1, 6, 11, 15, 20, 26, 31, 36), *Describe* items (2, 7, 12R, 16R, 22R, 27, 32, 37), *Act with Awareness* items (5R, 8R, 13R, 18R, 23R, 28R, 34R, 38R), *Non-judge* items (3R, 10R, 14R, 17R, 25R, 30R, 35R, 39R), and *Non-react* items (4, 9, 19, 21, 24, 29, 33). First, the results of each group are presented and then the three groups collectively. Descriptive statistics such as mean scores and standard deviations were calculated. Furthermore, Paired Sample T-tests were used to compare the differences in FFMQ mean scores before and after each intervention in each group.

To visualise the scores, histograms were plotted for each group before and after the interventions (MBI and CBT). Mann-Whitney Rank tests were applied to compare the mean ranks of the five FFMQ components (Observe, Describe, Act with Awareness, Non-judge, and Non-react) between the MBI (n=9) and CBT (n=10) groups for the three study groups. Two-sample independent T-tests were applied to compare the overall mean scores in the FFMQ between the MBI and CBT groups. This type of parametric test was used when the normality assumption was assumed to be valid, and there was a need to determine if there was a difference in the overall mean scores between the two independent groups.

9.7.1 Analysis of Five-Facet Mindfulness Questionnaire for mTBI Group

Table 9.5 presents the mean scores and standard deviations for all combinations of patients with mTBI. Paired T-tests were used to compare the mean scores for each of the five components of the FFMQ. As shown in Table 9.6, there is a significant reduction in the act with awareness component of the FFMQ assessment in the MBI group (P=.006). Meanwhile, there are significant increases in scores for all components of the FFMQ in the CBT group. Regarding the interpretation of p-values in this analysis, if each component assessed in the FFMQ is considered independent, a conventional 0.05 cut-off can be used to indicate statistically significant differences. However, if the components are linked, a correction for multiple comparisons should be considered, such as the conservative Bonferroni correction, which would result in a cut-off of 0.01. It is important to note that the full results of the Paired T-tests for all groups can be found in Appendix L at the end of this report.

Table 9.6

Descriptive Statistics of Comparing FFMQ items for Patients with mTBI between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	Intervention				Comparisons
	Pre to		Post to		Within Groups [a]
	M	*SD*	*M*	*SD*	P- value
MBI (n=9)					
Observe	27.4	7.8	28.1	4.3	1.000
Describe	22.4	3.4	23.7	3.2	.952
Act with Awareness	24.0	6.5	17.0	3.3	**.006**
Non-judge	24.7	6.3	20.8	5.9	.085
Non-react	21.0	3.2	23.4	3.4	.105
CBT (n=10)					
Observe	21.1	3.4	28.2	1.8	**<.001**
Describe	20.7	2.4	22.5	2.1	**.014**

Act with Awareness	27.2	4.6	21.0	2.5	**.002**
Non-judge	27.4	4.3	21.6	2.7	**.001**
Non-react	17.2	1.9	22.9	2.0	**<.001**

Figures 9.1 and 9.2 demonstrate that, after the intervention, mean scores of *act* with *awareness* and *non-judge* are higher in the CBT group after the intervention compared to the MBI group for patients with mTBI. Conversely, the mean scores of *describe* and *non-react* are higher after the intervention in the MBI group compared to the CBT group for patients with mTBI. It should be noted that for observing, the mean response score for patients with mTBI is equal after both interventions for both the MBI and CBT groups.

Figure 9.1

Comparing Mean Scores of Five Facet Questionnaire Items for Patients with mTBI between MBI group (n=9) and CBT group (n=10) in Pre intervention Phase

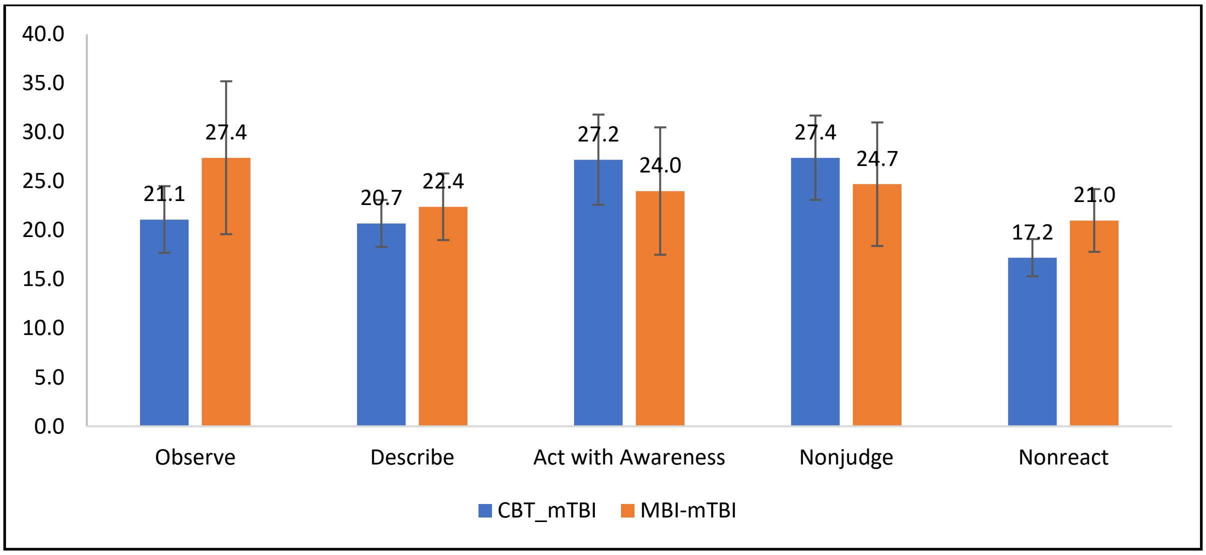
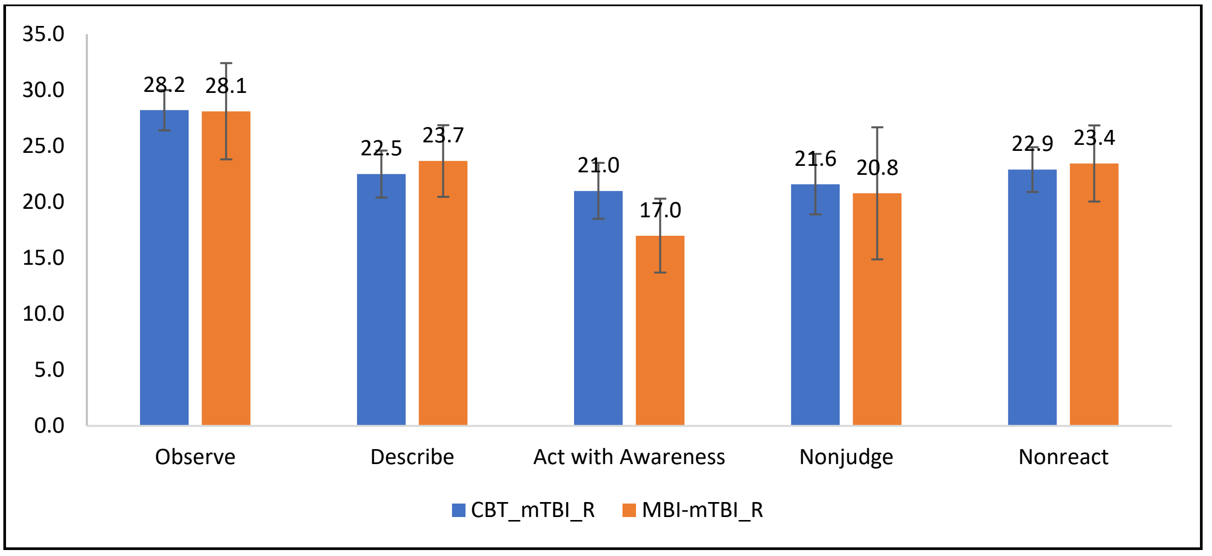


Figure 9.2

Comparing Mean Scores of Five Facet Questionnaire Items for Patients with mTBI between MBI group (n=9) and CBT group (n=10) in Post intervention Phase



The Mann-Whitney Rank test was applied to compare patients with mTBI responses' mean ranks in all FFQ components (observe, describe, act with awareness, non-judge, and non-react) between MBI and CBT. Such type of non-parametric test is applied when there is a need to check if there is a difference in the overall distribution across two independent groups given that the normality distribution assumption is not assumed to be valid. The null hypothesis states that there is no statistically significant difference in response mean ranks of FFMQ items for patients with mTBI between MBI and CBT groups in the pre-intervention and post-intervention phases. Such type of non-parametric tests is applied when the normality distribution assumption is not valid. There was a significant difference between mean scores *observed* in pre-intervention between the MBI and CBT groups, with a mean difference of (M=7.0) and a P-value of .022, which was higher for the MBI group. There were significant differences in the mean scores of *act with awareness* in both pre- and post-intervention phases for patients in MBI and CBT groups, with mean differences of (M=4.4) and (M=4.0), respectively, and P-values of .027<.05 for each. There was also a significant difference in *non-react* scores in pre-intervention between the MBI and CBT groups, with a mean difference of (M=4.4) and a P-value of .004<.05, which was higher for the MBI group. The full results can be found in the Test Statistics Table in Appendix L.

9.7.2 Analysis of Five-Facet Mindfulness Questionnaire for PSTD Refugees Group

Table 9.7 presents the mean scores and standard deviations for all combinations of groups of PTSD refugees. Paired t-tests were utilised to compare the mean scores for each of the five components of the FFMQ. The results shown in Table 9.7 indicate that there were no significant differences in the scores for the five components of FFMQ between the MBI and CBT groups before and after the intervention, with P-values greater than .05. It is important to note that the full results of the paired t-tests for all groups can be found in Appendix L at the end of this report.

Table 9.7

Descriptive Statistics of Comparing FFMQ items for PSTD Refugees between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	**Intervention**				**Comparisons**
	Pre to		**Post to**		**Within Groups [a]**
	M	***SD***	***M***	***SD***	***P*- value**
MBI (*n*=9)					
Observe	30.1	8.2	24.7	2.0	.088
Describe	27.1	6.1	23.0	3.9	.087
Act with Awareness	19.3	6.9	20.4	4.8	.730
Non-judge	28.3	6.9	24.1	3.5	.132
Non-react	24.9	5.9	20.3	3.8	.052

CBT (*n*=10)					
Observe	30.9	4.8	30.2	6.0	.506
Describe	24.7	3.6	25.2	3.9	.637
Act with Awareness	21.2	7.5	18.4	7.6	.292
Non-judge	26.3	4.7	25.6	4.0	.506
Non-react	23.1	5.5	21.2	3.7	.302

Figures 9.3 and 9.4 show that all the scores for the FFMQ components are higher, except for the *act with awareness* component in the pre-intervention phase for the MBI group, compared to the post-intervention phase, but the difference is not statistically significant. For instance, the mean score and standard deviation for the *observe* component in the MBI group of PTSD refugees before the intervention is (M=30.1, SD= 8.2), while after the intervention, it is (M=24.7, SD= 2.0). In the CBT group, the mean scores for all FFMQ components are higher in the pre-intervention phase compared to the post-intervention phase, except for the *describe* component. For example, the mean score and standard deviation for the *act with awareness* component in the CBT group before the intervention are (M=21.2, SD= 7.5), and after the intervention, they are (M=18.4, SD= 7.6).

There is a change in the mean scores for the *describe* and *act with awareness* components before and after the interventions in both the MBI and CBT groups. In the pre-intervention phase, the mean score of the *describe* component was higher in the MBI group (M=27.1) compared to the CBT group (M=24.7). Also, in the pre-intervention phase, the mean score of the *act with awareness* component was higher in the CBT group (M=21.2) than in the MBI group (M=19.3). However, post-intervention, the mean score of the *describe* component is higher in the CBT group (M=25.2) than in the MBI group (M=23.0). Moreover, the mean score of the *act with awareness* component is higher in the MBI group (M=20.4) than in the CBT group (M=18.4). These differences are not statistically significant.

Figure 9.3

Comparing Mean Scores of Five Facet Questionnaire Items for PSTD Refugees Patients between MBI group (n=9) and CBT group (n=10) within Pre intervention Phase

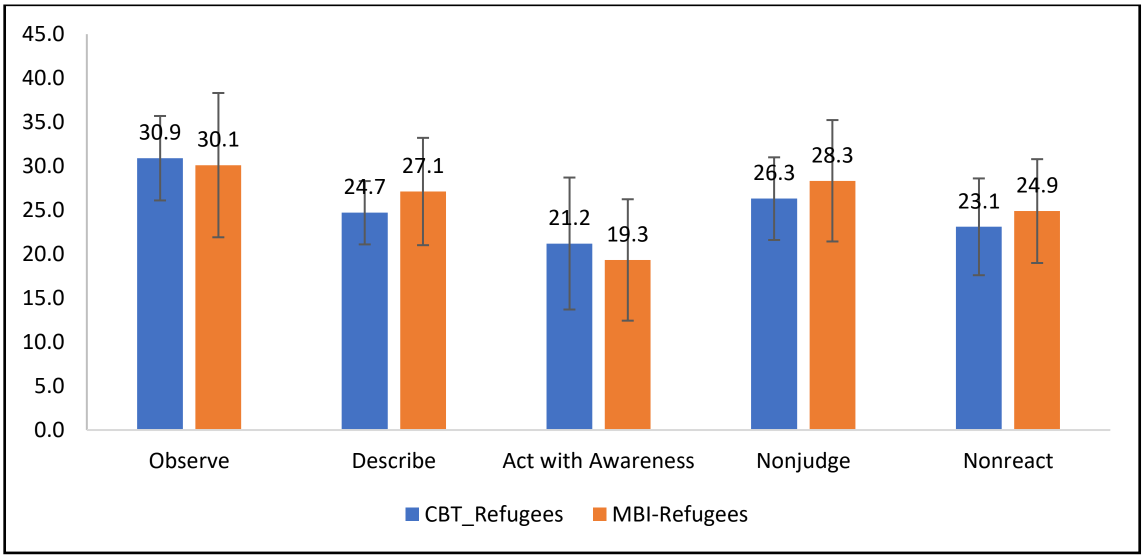
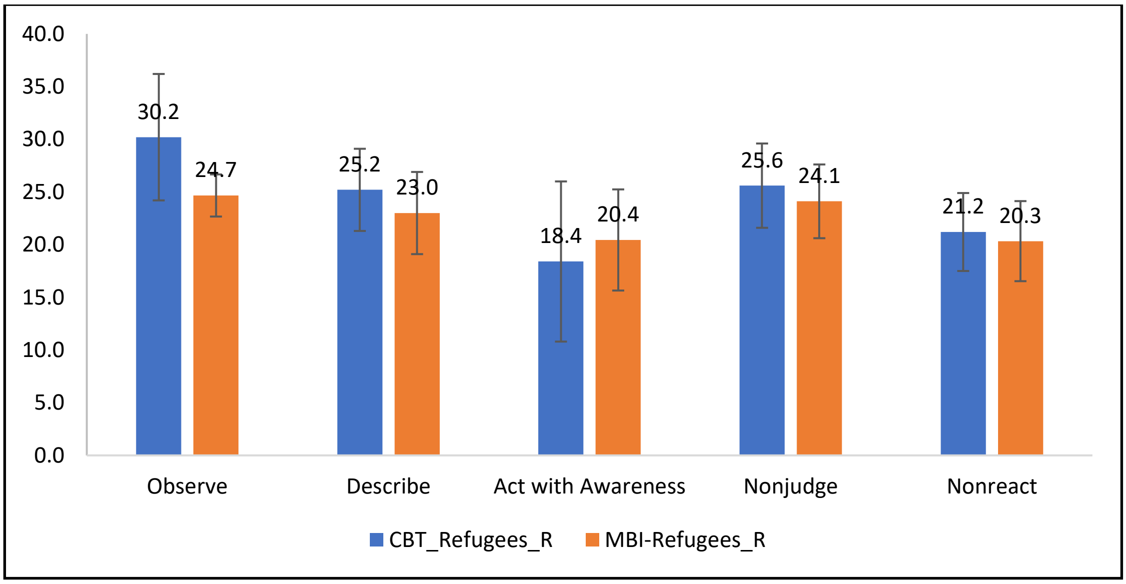


Figure 9.4

Comparing Mean Scores of Five Facet Questionnaire Items for PSTD Refugees Patients between MBI group (n=9) and CBT group (n=10) within Post intervention Phase



The Mann-Whitney Rank test was applied to compare mean ranks in all FFMQ components (observe, describe, act with awareness, non-judge, and non-react) between MBI (*n*=9) and CBT (*n*=10). The null hypothesis shows that there is no statistically significant difference in response means in ranks of FFMQ items between MBI and CBT groups in the pre-intervention and post-intervention phases. However, there is a significant difference between the mean scores *observed* in post-intervention between MBI and CBT groups, with a mean difference of 5.5 and *P*-value =.022, which is higher for the CBT group. Full results can be found in the Test Statistics Table in Appendix L.

9.7.3 Analysis of Five-Facet Mindfulness Questionnaire in the Heathy Group

Table 9.8 lists mean scores and standard deviations for all combinations of *healthy* participants. Paired T-tests were applied to compare mean scores in each group. It is clear from Table 9.3 that there is an increase in mean scores for the *describe* component of FFMQ assessment in the MBI group before and after the intervention: mean difference *M*=2.7 (*p*=.037). There are no significant differences in scores for the five components of FFMQ assessment in the CBT group before and after the intervention with *P*- values >.05. All scores are, however, higher post-intervention. It is important to mention that the full result for paired T-tests for all groups can be found at the end of this report in Appendix L.

Table 9.8

Descriptive Statistics of Comparing FFMQ items for Healthy Participants between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	Intervention				Comparisons
	Pre to		Post to		Within Groups [a]
	M	SD	M	SD	P- value
MBI (n=7)					
Observe	30.1	6.5	32.7	4.5	.100
Describe	22.6	3.5	25.3	2.7	**.037**
Act with Awareness	18.1	5.8	18.1	7.8	1.000
Non-judge	25.0	4.1	24.7	8.8	.910
Non-react	20.9	5.8	22.7	3.4	.428
CBT (n=10)					
Observe	25.0	5.1	27.1	4.7	.117
Describe	22.4	4.6	24.2	4.1	.094
Act with Awareness	21.0	8.4	22.8	5.2	.529
Non-judge	23.9	7.9	23.7	2.9	.775
Non-react	19.3	4.3	20.7	3.2	.143

Figure 9.5 shows that mean scores for all FFMQ components are equal or higher except for *non-judge* after intervention in the MBI group (*n*=7) compared to the pre-intervention phase. Figure 9.6 shows that mean scores for all FFMQ components are higher after the intervention in the CBT group (*n*=10) compared to the pre-intervention phase. For example, the mean score and standard deviation for *non-react* within the CBT group for healthy participants before the intervention are (*M*=19.3, *SD*= 4.3) compared to (*M*=20.7, *SD*= 3.2) for CBT after the intervention. In addition, the mean scores of *observing, describing, non-judge* and *non-react* are higher before and after intervention phases in the MBI group compared to the CBT group. On the other hand, the mean score of *the act with*

awareness is higher in the before and after intervention phases in the CBT group compared to the MBI group.

Figure 9.5

Comparing Mean Scores of Five Facet Questionnaire Items for Healthy Participants between MBI group (n=7) and CBT group (n=10) within Pre intervention Phase

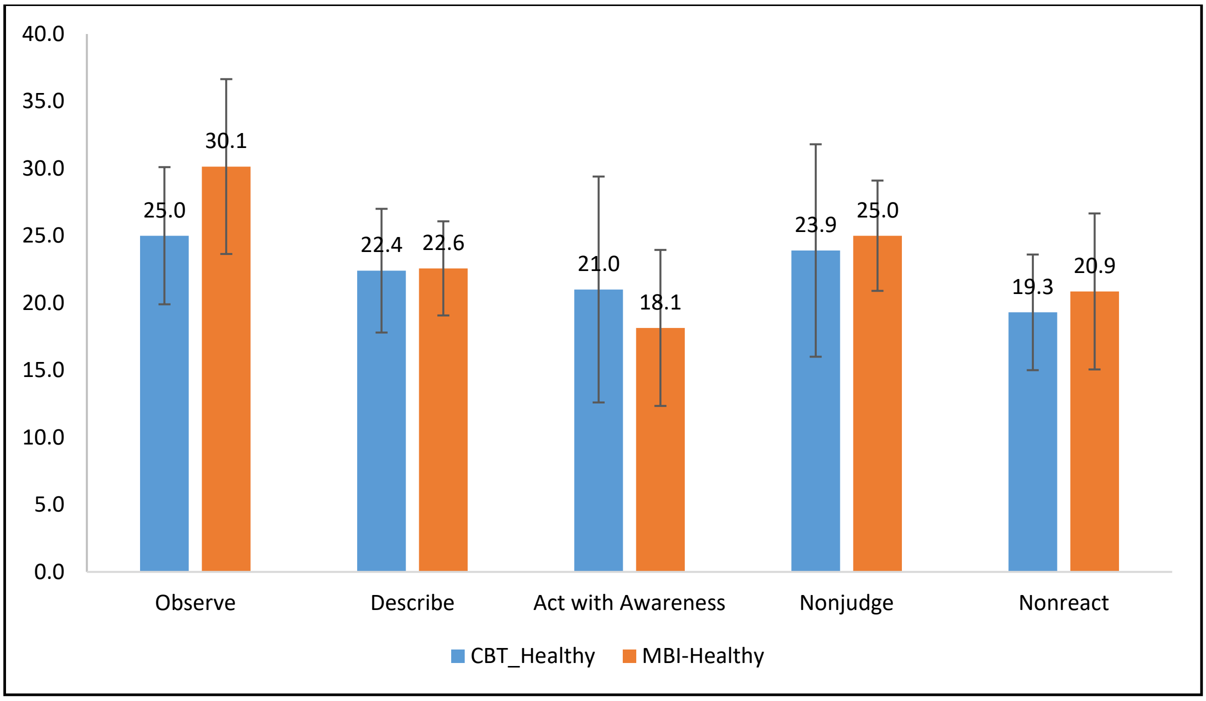
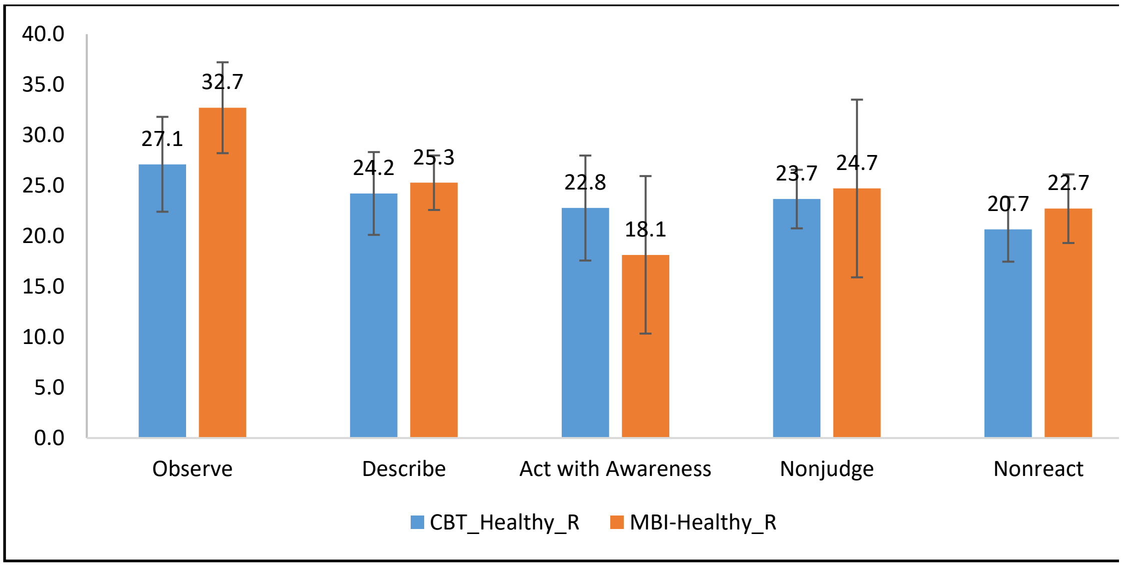


Figure 9.6

Comparing Mean Scores of Five Facet Questionnaire Items for Healthy Participants between MBI group (n=7) and CBT group (n=10) within Post intervention Phase



A Mann-Whitney Rank test was applied to compare mean ranks in all FFMQ components (observe, describe, act with awareness, non-judge, and non-react) between MBI (*n*=7) and CBT (*n*=10). The null hypothesis demonstrates that there is no statistically significant difference in response mean ranks of FFMQ items between MBI and CBT groups in both pre-intervention and post-intervention phases. However, there is a significant difference between mean scores *observed* in post-intervention in MBI than in CBT groups, with a mean difference of 5.6 (*P*-value =.019). Full results can be found in the Test Statistics Table in Appendix L.

9.7.4 Comparison between mTBI patients, PTSD refugees and Healthy controls in MBI groups

It can be seen from Figures 9.7 and 9.8 that healthy participants in the MBI group have the highest *observed* mean response scores before and after intervention with (*M*before= 30.1, and *M*after =32.7) compared to participants with mTBI (*M*before= 28.1, and *M*after=28.1) and PSTD refugees (*M*before = 29.7, and *M*after =24.9). PSTD refugees in the MBI group have the highest *non-judge* mean response scores before the intervention with (*M*before= 27.0) compared to participants with mTBI (*M*before= 24.6) and healthy participants (*M*before = 25.0). Participants with mTBI in the MBI group have the highest *non-react* mean response scores after intervention (*M*after= 23.4) compared to healthy participants (*M*after= 22.7) and PSTD refugees (*M*after = 20.4).

Figure 9.7

Comparison in Components of the Five Facet Mindfulness Questionnaire (FFMQ) Response Mean Scores between (mTBI, Refugees, Healthy) Participants within MBI group in the pre-Intervention Phase

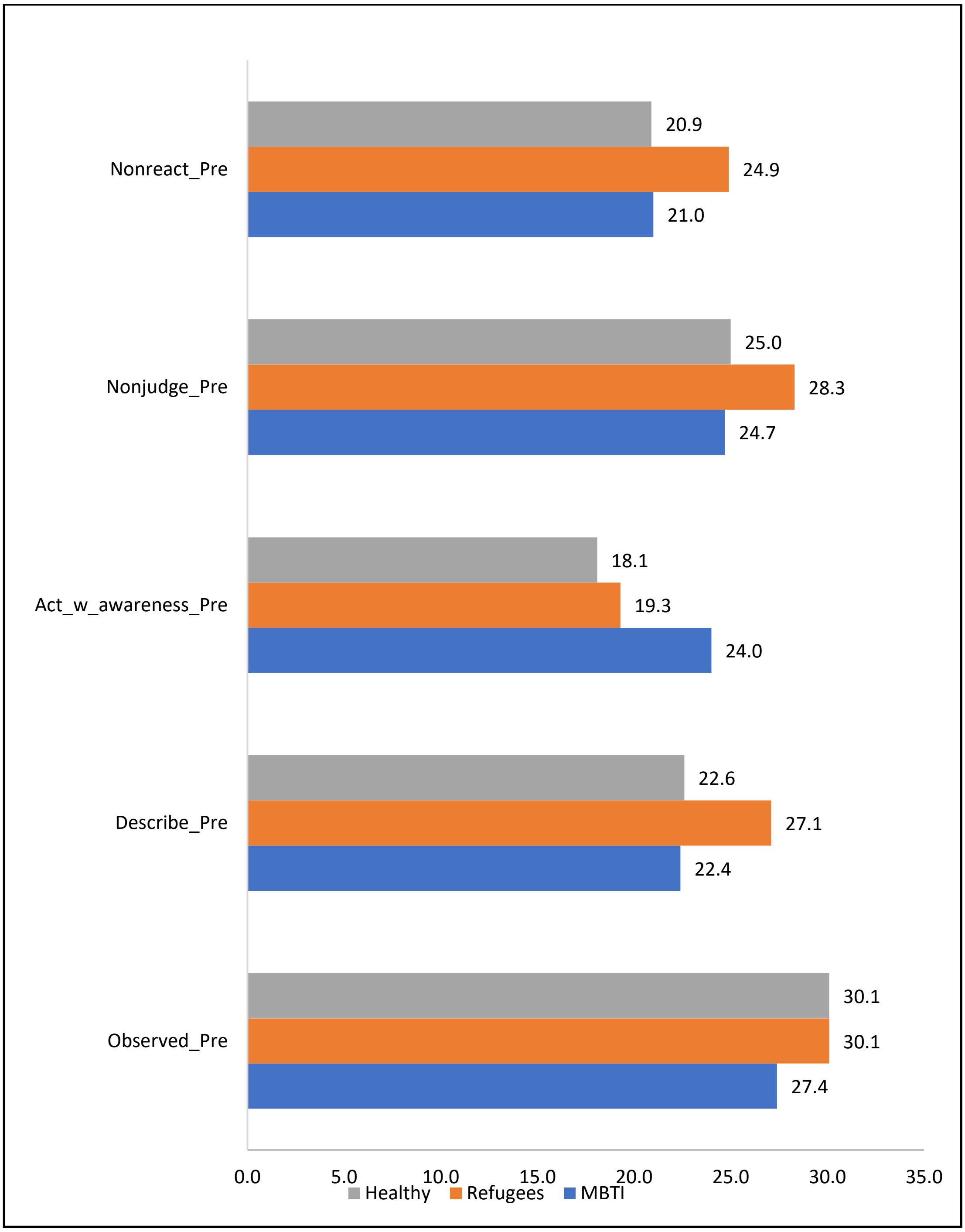
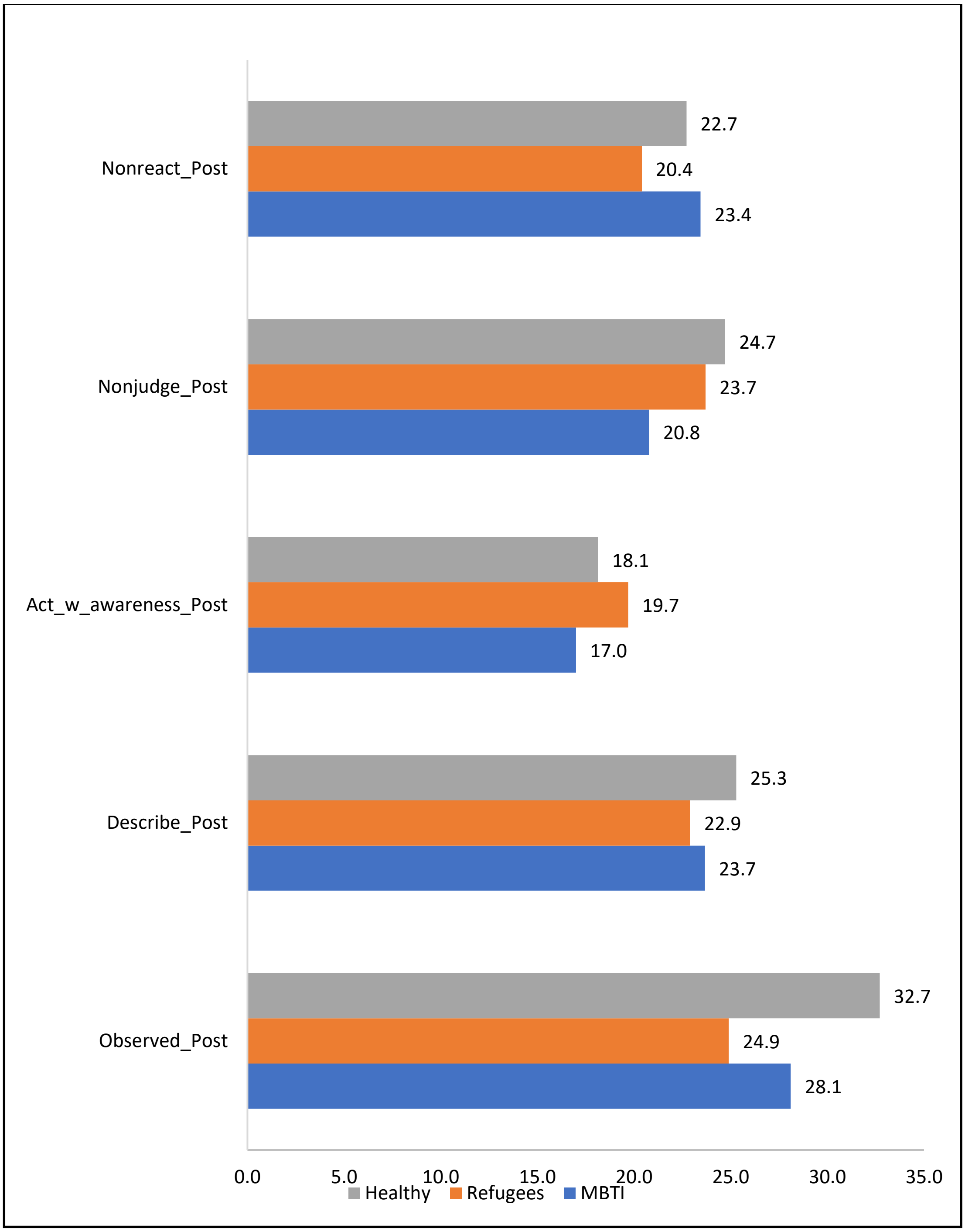


Figure 9. 8 *Comparison in Components of the Five Facet Mindfulness Questionnaire (FFMQ) Response Mean Scores between (mTBI, Refugees, Healthy) Participants within MBI group in the post Intervention Phase*



9.7.5 Comparison between mTBI patients, PTSD refugees and Healthy controls in CBT groups

Figures 9.9 and 9.10 show that PSTD refugees have the highest *observed* mean response scores before and after intervention with (*M*before= 30.9, and *M*after =30.2) compared to participants with mTBI (*M*before= 21.1, and *M*after=28.2) and healthy participants (*M*before = 24.9, and *M*after =27.1). Healthy participants have the highest *act with awareness* mean scores during after intervention phase (*M*after= 24.0) compared to participants with mTBI (*M*after= 21.0) and PSTD refugees (*M*after = 18.4). Participants with mTBI have the highest *non-judge* mean response scores before the intervention phase with (*M*before= 27.4) compared to healthy participants (*M*before= 24.9) and PSTD refugees (*M*before = 26.3).

Figure 9. 9 *Comparison in Components of the Five Facet Questionnaire (FFMQ) Response Mean Scores between (mTBI, Refugees, Healthy) Participants within CBT group in the pre- Intervention Phase*

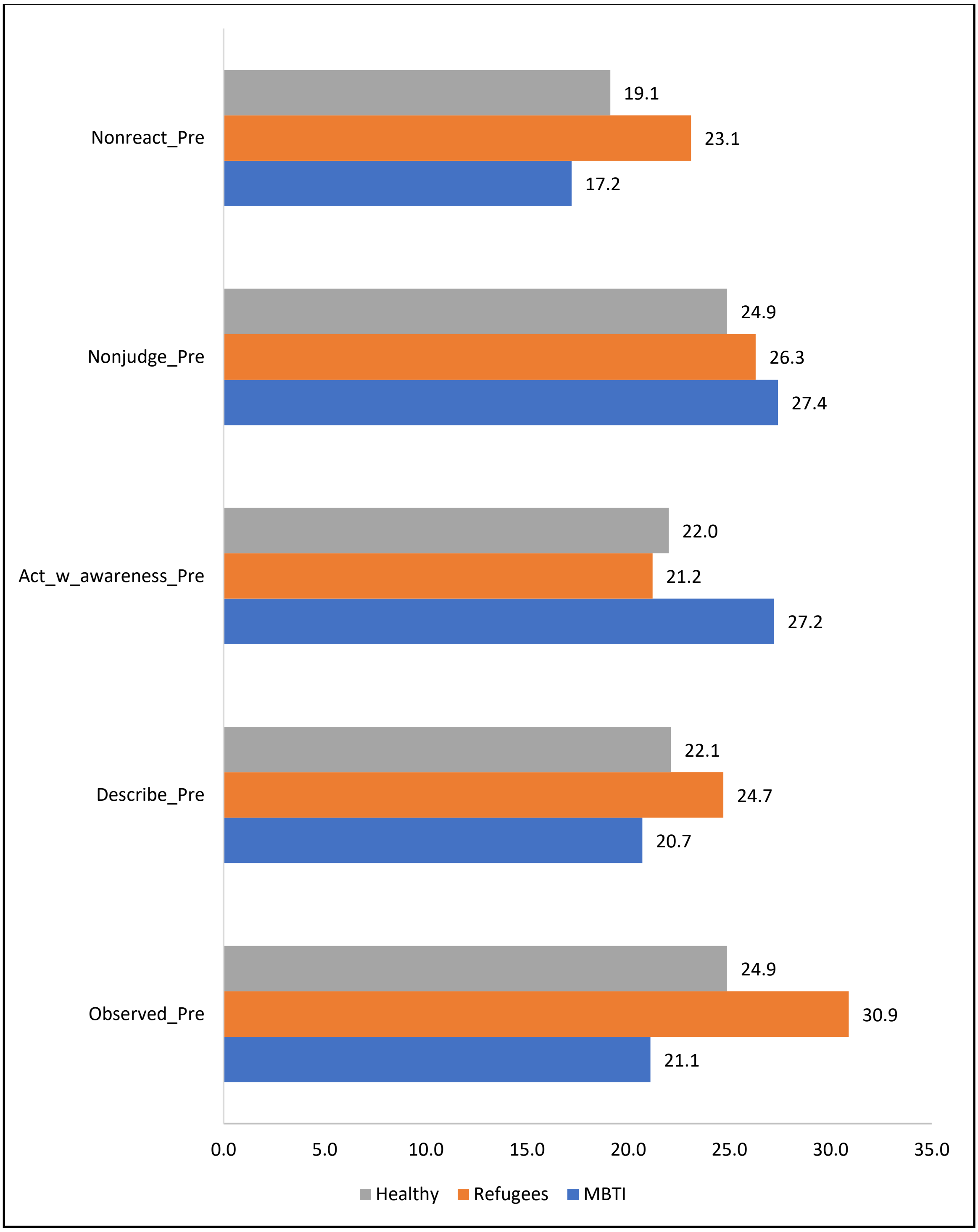


Figure 9. 10 *Comparison in Components of the Five Facet Questionnaire (FFMQ) Response Mean Scores between (mTBI, Refugees, Healthy) Participants within CBT group in the post Intervention Phase*

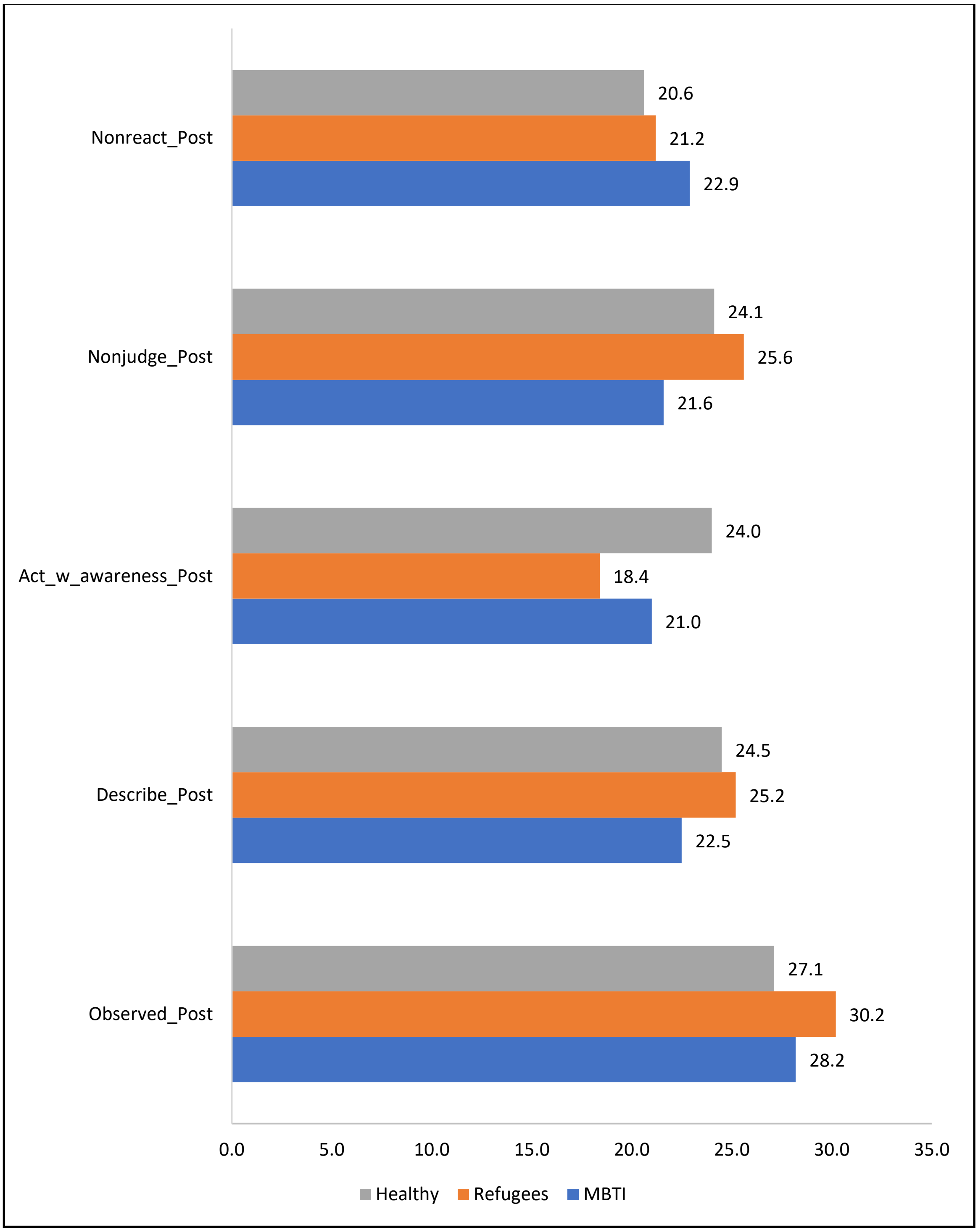

Nonreact_Post
Nonjudge_Post
Act_w_awareness_Post
Describe_Post
Observed_Post
20.6
21.2
22.9
24.1
25.6
21.6
24.0
18.4
21.0
24.5
25.2
22.5
27.1
30.2
28.2
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
Healthy
Refugees
MBTI

Table 9.9 Descriptive Statistics of Comparing FFMQ items for Patients within Study Groups between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	**Intervention**				**Comparisons**
	Pre to		**Post to**		**Within Groups [a]**
	M	**SD**	**M**	**SD**	**P- value**
mTBI					
MBI (n=9)	120.5	17.9	113.0	11.9	**.041**
CBT (n=10)	113.6	11.3	116.2	4.9	.298
PSTD Refugees					
MBI (n=10)	126.7	26.8	111.6	11.1	.092
CBT (n=10)	126.2	16.8	120.6	8.6	.293
Healthy					
MBI (n=7)	116.7	17.3	123.6	14.8	.167
CBT (n=9)	108.6	22.4	118.4	9.8	.088

Next, Figures 9.11 and 9.12 show that the mean scores of *the act with awareness* and *non-judge* components are higher after intervention in the CBT group compared to the MBI group for patients with mTBI. On the other hand, mean scores of *describing* and *non-react* are higher after intervention in the MBI group compared to the CBT group for patients with mTBI. It is important to mention that, for *observing the component of FFMQ*, the mean response score for patients with mTBI is equal after the intervention for MBI and CBT.

Figure 9.11 Comparing Overall Mean Scores of Five Facet Questionnaire in MBI group for Patients with mTBI (n=9), Refugees (n=10), and Healthy Controls (n=7) between Pre- to Post intervention

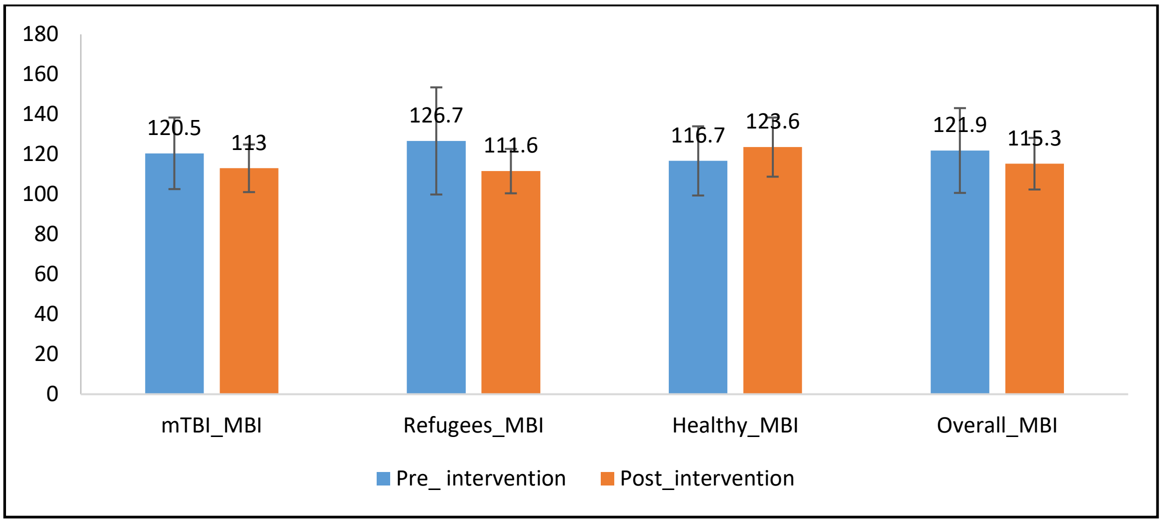
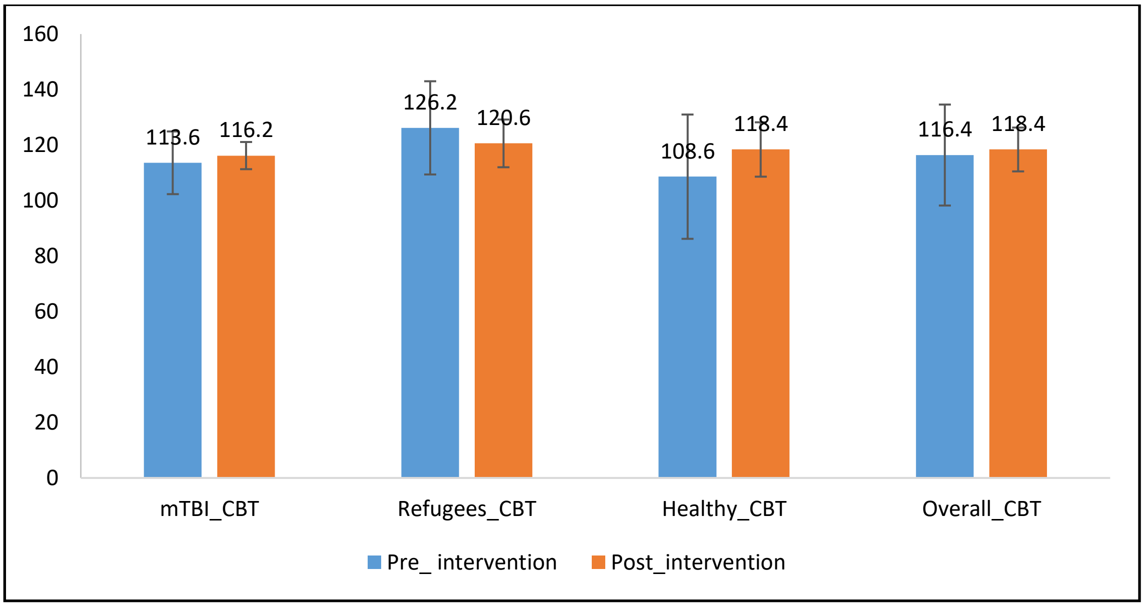


Figure 9. 12 *Comparing Overall Mean Scores of Five Facet Questionnaire in CBT group for Patients with mTBI (n=9), Refugees (n=10), and Healthy Controls (n=7) between Pre- to Post intervention*



9.7.6 Comparing Overall FFMQ Mean Scores for Patients within Study Groups between MBI and CBT groups during two periods of intervention (Pre, Post)

Two independent sample T-tests were applied in order to compare the overall mean scores of FFMQ between the MBI and CBT groups. Such types of parametric tests are applied when there is a need to check if there is a difference in the overall mean scores across two independent groups, given that the normality distribution assumption is assumed to be valid. The null hypothesis shows that there is no statistically significant difference in the overall FFMQ mean score for all participants (with mTBI, refugees, and healthy) in MBI and CBT groups pre- and post-intervention. There is no significant difference in the overall mean scores of FFMQ *pre-intervention* between the MBI (n=26) and CBT (n=30) groups with P-value =.373. In addition, there were no significant differences in the overall mean scores of FFMQ *post-intervention* between the MBI (n=26) and CBT (n=29) groups with P-value =.283

Table 9.10 Descriptive Statistics Comparing Overall FFMQ Mean Scores for participants in Study Groups between MBI and CBT groups during two periods of intervention (Pre, Post)

Group/ Assessment Type	**Descriptive**		**Test Statistic**	**Comparisons Between Groups**
	M	**SD**	**t**	***P*- value**
Overall_FFMQ_Pre				
MBI (n=26)	121.9	21.2	.898	.373
CBT (n=30)	117.1	18.4		
Overall_FFMQ_Post				
MBI (n=26)	115.3	12.9	-1.085	.283
CBT (n=29)	118.4	7.9		

Discussion:

According to mTBI patients, both interventions (MBI and CBT) improve most facets of FFMQ after receiving both interventions, which decreased act and non-judge scores, while other scores increased. There was no significant difference in response mean rankings of FFMQ items for mTBI patients between MBI and CBT groups in the post-intervention stage; however, CBT had a more robust effect. No consistent pattern was observed in PTSD refugees before and after the intervention. Although there was no significant difference in response mean rankings of FFMQ items for patients with PTSD in the MBI and CBT groups in both the pre-intervention and post-intervention period, the results revealed a significant difference in mean post-intervention scores in the CBT groups. In the pre-intervention and post-intervention phases, there is no statistically significant difference in response mean rankings of FFMQ items in the MBI and CBT groups. However, there is a greater increase in scores in the MBI group, yet when comparing the results of the performance of the three groups, the overall scores in the FFMQ showed a slight improvement for patients within the MBI group. In both the pre- and post-intervention phases, there is no statistically significant difference in response overall mean of FFMQ for participants (with mTBI, refugees, and healthy controls) between the MBI and CBT groups.

This study suggests that mindfulness-based intervention (MBI) can improve awareness as well as attention in persons who have attention deficits. Although there was no significant difference between the three groups except in the observe R item, where the PTSD refugees in the CBT group were the highest, the results indicate a difference in the average mean scores. When compared to participants with mTBI and PSTD refugees, healthy participants in the MBI group have the highest observed mean scores before and after the intervention. Furthermore, when compared to healthy participants and PSTD refugees, people with mTBI in the MBI group have the highest *non-react* mean response scores for the after-intervention phase. However, Figure 9.10 reveals that, when compared to patents with mTBI and healthy participants in the CBT group, PSTD refugees have slightly higher *observed* mean response scores both before and after the intervention. This indicates that the clinical neuropsychology evaluation process will enable early identification of the cognitive domains impacted by PTSD. Hence enhancing the quality of life and reducing the progression of the clinical post-traumatic disorder (Charlson et al., 2012). The results also indicate the impact of the mindfulness program in improving the cognitive performance of mTBI patients (Boccia, Piccardi, & Guariglia, 2015; Fox et al., 2014; Link et al., 2016; van der Horn et al., 2017). These findings demonstrate the efficacy and significance of the FFMQ in improving individual well-being (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) in the clinical population (Baer, 2003; Baer et al., 2006; Neff, 2003). The next chapter will provide a further general discussion.

This indicates that the clinical neuropsychology evaluation process will enable early identification of the cognitive domains impacted by PTSD. Hence enhancing the quality of life and reducing the progression of the clinical post-traumatic disorder (Charlson et al., 2012). The results also indicate the impact of the mindfulness program in improving the cognitive performance of mTBI patients (Link et al., 2016; van der Horn et al., 2017; Boccia, Piccardi, & Guariglia, 2015; Fox et al., 2014). These findings demonstrate the FFMQ's efficacy and significance in improving individual well-being (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) in the clinical population (Baer, 2003; Baer et al., 2006; Mindfulness-Based Interventions; Neff, 2003). The next chapter will provide further general discussion.

Chapter 10: General Discussion

10. Overview

The study of cognitive impairment is becoming a pressing issue in public health, making it necessary to advance clinical neuropsychological evaluations and effective rehabilitation methods, especially for individuals with mild traumatic brain injury and refugees with PTSD. Given the lack of rehabilitation services and clinical research in the Arab community and Kuwait in particular, this thesis, conducted under the supervision of Bangor University's School of Medical and Health Sciences and in collaboration with the Research Centre of the Ministry of Health in Kuwait and the Public Authority for Disabled People in Kuwait, aims to address this issue. As previously stated in the introduction chapter, this thesis is divided into two sections: measures of neuropsychology and therapeutic intervention.

This chapter will discuss the research findings and the studies conducted to validate the hypotheses and objectives, such as the role of the neurocognitive scales and effective mindfulness-based intervention in enhancing the quality of life and cognitive function in attention tests. The Five Facet Mindfulness Questionnaire was used to evaluate the mindfulness-based intervention in a group of mTBI outpatients and PTSD refugees, and all tests were administered to both groups, and a healthy control group. This general discussion will start with a review of the aims of this thesis, followed by a summary of the findings from each neuropsychological assessment and then the rehabilitation course. It will also consider the theoretical, practical, and future research implications of these findings. Finally, any limitations of the methods used in this thesis will be acknowledged, and a comprehensive conclusion will be reached.

10.1 Review of Aims

The first objective of this thesis was to improve the Arabic version of neurocognitive assessments. The second objective was to see if Mindfulness-Based Intervention could improve the attention of people who have attention deficits. Third, this study sought to compare the effects of two types of interventions (MBI vs CBT) in improving attention and stress management in people with attention deficits and to investigate the experiences of both mTBI and PTSD patients in order to assess the efficacy of these interventions. In the final two objectives, the impact of the intervention on the patient's ability to manage stress reactions and report positive life improvements following a highly traumatic and stressful occurrence was measured by using the Five Facet Mindfulness Questionnaire (FFMQ).

10.2 Main Findings

10.2.1 Aim One: Investigate Neuropsychological Assessments for patients with attention deficits

The first objective was met by comparing the baseline measures of two groups: those who received two weeks of MBI and CBT for PTSD (n = 20) and those with mTBI who received MBI (n = 19), to the neuropsychological results of a healthy group who received the same MBI and CBT for two weeks (n = 17). The results showed an improvement in attention and concentration, as well as an enhancement of executive functioning and emotion. The neuropsychological scores also improved, showing faster processing times and fewer errors. However, some of the results were noteworthy and deserving of further discussion.

10.2.1.1 Stroop Task in PTSD group. Both groups (PTSD and healthy groups) performed better in the main test of interference effects of the Stroop task after the intervention. The healthy control group performed better on the Stroop task both before and after the intervention than the PTSD group, PTSD sufferers have longer reaction times and produce more errors than the healthy group, and this may indicate the impact of psychological trauma on performance (Buckley, Blanchard, & Neill, 2000; Brewin et al., 2007; McNally et al., 1990). During the initial interviews with PTSD refugees, it was observed that some refugees experienced distraction, panic attacks, and shortness of breath; however, this is an observation that has not yet been evaluated; therefore, it is necessary to study this in the upcoming research. As mentioned earlier in section 1.7.3.1, survivors with severe PTSD symptoms have lower IQs, poor immediate recall, and poor attention (Thase et al., 2014). Reduced attention, according to Brands et al. (2002), plays a role in shaping memories of a traumatic incident which may explain to patients a longer response time was noted in those with PTSD compared to healthy subjects. The findings also indicate the need for further attention to PTSD refugees, underlining the impact of stress and trauma on their cognitive capacities, particularly the attention network system (Brandes et al., 2002; Koenen et al., 2001; Vasterling et al., 2002; Roca et al., 2006).

10.2.1.2 Stroop Task (Vocal vs Manual Response). Nineteen mTBI patients completed the Stroop task with both vocal and manual responses. Results showed improved performance in both vocal and manual tasks after intervention in both MBI and CBT groups. Although the MBI group had a higher manual Stroop score than the CBT group, this difference was not statistically significant before or after the intervention. In conclusion, both manual and verbal responses to the Stroop task were found to be acceptable, with manual performance being superior. This contradicts previous studies that suggest manual response does not affect the patient’s response (Brown & Besner, 2001; Sharma & McKenna, 1998). The researcher believes that interference may be due to differential access to processing systems (phonological, lexico-semantic, or response level). However, the findings support the idea that manual responses have a higher facilitation effect than vocal responses in some cases (Redding & Gerjets, 1977). Recent research suggests that vocal and manual responses require different tasks (naming versus classification), leading to qualitatively different Stroop effects (Kinoshita et al., 2017).

From the researcher's perspective, both manual and verbal response methods are appropriate for mTBI patients, depending on the research question being addressed. Since the method involves a tool that helps to answer the questions that arise in the mind of the researcher, two methods were employed in order to determine the most appropriate method for patients with mild brain injuries, especially as it is the first study of its kind conducted in Kuwait. The findings show that the computerised Stroop task is a suitable assessment to assess attention, processing speed, executive function, and other cognitive flexibility (Kane & Engle, 2003). In addition, the computerised Stroop task and a pilot study by Al-Ghatani et al. (2010) showed that an Arabic translation is suitable for the Stroop test.

10.2.1.3 Trail Making Test (TMT – Arabic Version). The TMT was translated following the methodology used by Stanczak et al. (2001) with a clear and qualitative design that was reviewed by Dr Al Ozairi (see Appendix I). To the researcher's knowledge, this study is the first research conducted in Arabic that uses TMT to explore the relationship between brain injury and cognitive performance. Stanczak et al. focused on the impact of age, gender, and the type of education in healthy participants and in those with head injuries; in addition, they present a rationale for the finding of significant differences in ETMT performance between the US and Sudanese populations (Stanczak et al., 2001). They compared the findings of 105 Sudanese (healthy and brain damaged individuals) on an Arabic version of the Expanded Trail Making Exam (ETMT; D. E. Stanczak et al., 2001) with 550 healthy and brain-damaged U.S. patients on the Standard English version of the test.

However, there are some unresolved questions, such as the relevance of the scale in assessing attention in Arab countries, which is a topic for further research.

The findings of this study provide an explanation of which cognitive abilities are required to complete the connections version of the TMT (A-B). The findings also confirm that there is a link between injury type and response (Christidi et al., 2013; Kopp et al., 2015), as there was a significant difference between the three groups (PTSD refugees, mTBI outpatients, and healthy group). PTSD refugees had the highest score during testing, indicating that they took longer to connect the numbers, followed by mTBI outpatients and then the healthy group. This shows that psychological trauma has an impact on cognitive ability and concentration (Beckham et al., 1998), as well as working memory (Sánchez-Cubillo et al., 2009). The findings contradict Salthouse's belief, which is that there are no correlations between working memory and connections to trail-making performance (Salthouse, 2011). Distraction and difficulty in remembering instructions were observed, especially in the first sessions, where the therapist was required to repeat the information more than once. The Arabic version of TMT appears to be an effective tool for evaluating attention, concentration, and processing speed, as well as general cognitive capacity. Part A seems to be a good indicator of working memory, while Part B, which requires several cognitive operations to complete, is more sensitive to executive functioning. More research is needed on TMT in clinical populations in the Middle East.

10.2.1.4 Processing Speed Index – (WAIS-IV) Arabic Version. Although the performance of all three groups on the PSI improved after receiving the intervention, the results indicated that there was a significant difference between the three groups on the PSI (Symbol Search and Coding). The mTBI group showed the highest score in Symbol Search R and Coding R, followed by the PTSD refugee group, and finally, the healthy group. These results support previous research that mild brain injuries may affect visual-perceptual speed, visual-motor coordination, visual scanning, and visual working memory, decision-making and lead to poor attention (Mallin et al., 2008). The findings confirmed the high sensitivity and specificity of the PSI index in distinguishing between patients with severe TBI and those without. The WAIS-IV was also found to be valuable in evaluating patients with TBI, as per Carlozzi et al. (2015).

10.2.1.5 Theoretical Implications. Human Attention Network Theory (Posner & Petersen, 1990) and its connection to the Neural Mechanism (Fan et al., 2007) were addressed in Chapter 2. The researcher used a variety of neuropsychological tests to better understand the functions of alerting, orienting, and executive control (see Chapters 5-8). Where most studies concentrated on one or two aspects of attention, two studies, on the other hand, determine the effectiveness of using three elements of networks theory in a task; Robertson used the everyday test for attention (ETA) with ecological attentional measures like map searching, listening to lottery numbers, and looking up phone numbers (Robertson et al., 1996). Fan et al. (2002) developed the attentional network task (ANT), which is one of the most commonly used activities for determining the efficiency of the three networks in a single experiment. Therefore, employing several tests to assess different aspects of attention is more effective in determining the interplay of brain regions before and after the intervention.

A functional magnetic resonance imaging (fMRI) study was also conducted on mTBI patients during the manual Stroop test to gain a deeper understanding of the interactions between different brain regions. However, due to the COVID-19 pandemic, the data has not yet been analysed. The findings highlight the importance of neuropsychological assessments translated into Arabic in demonstrating the interactions between the components of attention in cognitive tests. Moreover, the use of multiple tests to measure attentional processes was found to be beneficial (Robertson et al., 1996).

10.2.1.6 Future Directions. This research was presented in Kuwait, which prompted the Ministry of Health and Kuwait University to collaborate in support of neuropsychological and brain imaging research.

10.2.1.7 Clinical Implications. Many issues of the utility of neuropsychological evaluations were discussed in Chapter 2. The role of measures, the client's perception of his or her difficulties, and identifying functional lesions as contributing factors to the investigation of the problem, as well as the development of effective rehabilitation, were all examined. The role of neuropsychological assessment in evaluating outcomes was also discussed. This research answered the questions that arose in the mind of the researcher regarding the appropriateness and effectiveness of certain scales when translated into Arabic, such as the Stroop task. Other studies confirmed long-held assumptions and provided supporting evidence of the functions of these anatomical systems (Corbetta & Shulman, 2002; Driver et al., 2004; Fan et al., 2005; Fan et al., 2003; Fan, Raz, & Posner, 2003; Hopfinger et al., 2000; Posner & Fan, 2007; Raz, 2004; Raz & Buhle, 2006). Furthermore, the researcher's work in translating several standards into Arabic piqued the interest of Kuwait University's Departments of Psychiatry and Psychology in establishing a neuropsychology specialist. Additionally, they have employed some of the assessments that have been translated by the researcher in the Psychology department at Kuwait University and are working to provide these services in health centres.

10.3 Aim Two: Investigate the Arabic Version of the Five Facet Mindfulness Questionnaire

The results indicated the effectiveness of the FFMQ in measuring the extent of awareness and well-being of the three groups (mTBI outpatients, PTSD refugees, and healthy groups). It was noted that the performance of all participants improved after receiving the MBI course, with a significant difference between them on the Observe R item. The healthy group received the highest score in the FFMQ except for awareness R and non-judgement R, where the group of mTBI outpatients received the highest score. However, the PTSD refugees group had the lowest score in the FFMQ. These findings explain how stress and trauma affect an individual’s experience of well-being and awareness (Patel & Granville-Chapman, 2010). Other studies show that being a woman, older, and living in insecure housing predicts greater anxiety, PTSD, and depression severity (Song et al., 2018). Several consequences are involved when a patient suffers from PTSD, especially if he or she is also a refugee, as refugees with PTSD may confront significant challenges during and after their migration (Kirmayer et al., 2011), and this migration has a high chance of causing serious and long-term mental health problems (Palic & Elklit, 2011).

The results also support previous research into the effectiveness of the FFMQ in assessing awareness and well-being (Baer et al., 2006). While most of the previous studies focused on psychological outcomes, the results of this research enriched scientific research into the relationship between mental health and cognitive abilities, especially attention and memory, where more research is still needed. In addition, ways to provide suitable treatment that will help improve the individual’s cognitive and psychological abilities must be sought. As is well known, there are many studies on the effectiveness of CBT in clinical populations (Clark & Beck, 2010; Hodgson et al., 2005; Sign, 2013). However, little research has been conducted on the therapy’s influence on improving attention and cognitive function. The following section will present an analysis of the results of the comparison of Cognitive-Behavioural Therapy and Mindfulness-Based Interventions. Furthermore, it will also show the differences between the two therapeutic interventions in improving participants' performance in the three groups in neuropsychological assessments and the differences between the two interventions in FFMQ results.

10.3.1 Analysis and Comparisons between Mindfulness-based Intervention and Cognitive Behavioural Therapy.

The results of the PTSD refugees study showed that both therapies appear to be appropriate for the rehabilitation of people with attention impairment, as the performance of both groups improved after receiving the intervention, with no significant differences in neuropsychological evaluation (Coding R, Symbol Search R, TMT R) except the Stroop R task. Stroop R (after intervention) found a strong Stroop within-subjects main effect (MBI and CBT). For patients with mTBI, correct responses for vocal Stroop assessments are greater in the CBT group than in the MBI group. The MBI group, on the other hand, has a higher manual Stroop mean score than the CBT group, and there was no statistical difference between the two interventions. The findings suggest that both therapeutic interventions can improve performance, and neuropsychological assessment scores improved after both interventions as the time to complete TMT A, and TMT B decreased and scores symbol search and coding improved.

The results highlight the importance of neuropsychological rehabilitation for individuals with attention impairment (Arciniegas et al., 2010), as well as the influence of MBI on improving the mental health and cognitive function of clinical populations (Carmody & Baer, 2008; Evans et al., 2018; Hofmann et al., 2010), as well as an improvement of cognitive function (Gothe & McAuley, 2015). The positive findings of the impact of mindfulness on the brains of participants need additional research since the subject is still young, and existing studies need further evaluation and replication. Investigators should consider performing studies to obtain rigorous data that can support mindfulness in the treatment of clinical conditions, leading to increased well-being and a healthy life and may have a role in psychological rehabilitation.

10.3.2 Theoretical Implications.

In Chapter 3, the three elements (intention, attention, and attitude) of the Mindfulness Model that was designed by Shapiro et al. (2006) were explained. According to the explanation by Kabat Zinn (1982), “the intention plays a role in drawing attention to the moment by moment whenever the trainee’s mind wanders”. The intention affects the person’s attention and attitude, and frequent training in daily exercises raises the awareness of the individual and mental health (Shapiro et al., 2006). According to previous studies, this state can be achieved by allowing unfavourable events to pass by while increasing present attention levels (Shapiro & Schwartz, 1999). A metacognitive action mechanism involves becoming aware of one’s thought processes and recognising the patterns that underpin them. Mindfulness is favourably related to a more significant metacognitive mechanism of actions, and empirical research suggests that metacognitive monitoring and control may be partially unconscious (Baron-Cohen et al., 1995, 1999, 2001; Dorjee, 2017; Happé, 1994; Hill, 2004; Losh et al., 2012; Perner et al., 1989; Safran & Segal, 1990). However, mindfulness might be the highest level of metacognition as it always requires being a conscious activity (Jankowski & Holas, 2014).

The relationship between the mindfulness model and the human attention network theory (alerting, orienting, and executive control) is currently limited, especially in clinical populations. As a result, the findings of this study add to prior scientific research and demonstrate the effectiveness of the MBI with patients who suffer from attention impairment, such as mTBI outpatients and refugees with PTSD. The connections between the mindfulness model and attention theory have been discussed, and it was demonstrated that MBI improves patients' performance on neuropsychological scales. Based on the findings, further scientific research is planned to expand the MBI's clinical reach and include other patient samples, such as Parkinson's disease and Multiple Sclerosis, in order to gain a better understanding of these treatment methods.

10.3.3 Cultural Implications of Practising Mindfulness

It is important to consider cultural constructs in one's interpretation of mindfulness. For example, the Arabic version of mindfulness has been separated from its Buddhist roots and focuses on the sciences and neurocognitive parts of this approach. Scholars have highlighted the influence of culture on society and individual contexts, as discussed in the literature on borrowing from cross-cultural policies and concerns (Daniels et al., 2009; Farah, S. & Steiner-Khamsi, 2014; Hajdu & Hajdu, 2016). Since mental health is a sensitive topic for some, and there are currently very few mindfulness studies in Arab society, an awareness campaign was run using various media channels: television, radio, Instagram, and Twitter, informing the community and patients of the importance of mental health and encouraging healthy and mTBI patients to participate in this study. The healthy group was more motivated to participate than the patient groups, as some patients were still concerned about psychological stigma; their perceptions of mindfulness were clearly limited and less sophisticated due to their limited experience and understanding of the phenomena. Therefore, the researcher provided them with all the information they needed in order to better understand the research.

It was also noted that city residents are more interested in the idea of intervention than those living in other areas. This contradicts the researcher's observations of a group of Syrian refugees with PTSD who live in a care centre on the borders and are looking for any assistance that will help them escape the constraints and position they find themselves in. As a result, the participants' perspectives on mindfulness were very mixed. Since this difference in cultural understanding has a direct impact on participants' performance, future research must consider this in order to provide participants with a more comprehensive perspective of the mindfulness phenomenon, as this will directly influence the programme's effectiveness.

10.3.4 Clinical Implications and Future Directions

In section 3.6 of the literature review, various aspects of the mindfulness experience were investigated, including its impact on brain structure and function and how it affects clinical populations as a contributing element to rehabilitation. Practising mindfulness is thought to develop attention processes and improve logical memory, making it a promising intervention for those with attention impairments and psychological issues. Although participants generally showed interest in mindfulness programs, the researcher had to educate and encourage patients in the mTBI group to participate. The same programs were applied to healthy individuals and Syrian refugees with PTSD. The initial data collected led to the adoption of a mindfulness program by the Kuwait Center for Scientific Research, and the researcher and a colleague trained 70 doctors and nurses working in the Ministry of Health. Additionally, the researcher was invited to join Doctors Without Borders/Médecins Sans Frontières (MSF) to provide psychological support and rehabilitation.

10.4. Conclusion

This research aimed to investigate the relationship between brain function, structure, and behaviour in individuals with mild traumatic brain injury (mTBI) and refugees with post-traumatic stress disorder (PTSD). The study was driven by the premise that attentional impairments may arise from brain network dysfunction following mTBI. Additionally, as the researcher, I was motivated to examine the impact of PTSD, a condition that has significant but understudied effects on cognitive performance. The results demonstrated attentional impairment in both mTBI and PTSD populations. The results show that interventions aimed at improving attention appear to be promising for improving neuropsychological performance more broadly and support the hypothesis that cognitive performance improves after practising attention exercises (MBI).

The results provide a new approach for studying mTBI as a model of attention and the effect that might be of Mindfulness on Attention Network Theory (ANT), which could improve our understanding of attention impairment when compared to the healthy brain. Mindfulness-Based Interventions show improvement for a variety of physical (Toivonen et al., 2017) and neuropsychiatric disorders (Chiesa et al., 2011); however, a better understanding of the neuropsychological 'mechanisms of action' in mindfulness-based interventions are still needed to improve treatment protocols for clinical populations (see Hölzel et al., 2011, Rubia, 2009). In addition, the results showed the impact of PTSD on cognition, and in particular, attention, and that MBI can be an effective intervention. This work emphasises the necessity of empowering the role of neuropsychology in hospitals, translating standards and the importance of cross-cultural research cooperation.

10.5. Limitations

This research faced multiple challenges, some of which were related to measures, health issues, software programs, sample size and cultural influences, as explained below.

10.5.1. Neuropsychological Work in Kuwait

Various difficulties were faced whilst designing and implementing the programme in the Kuwaiti environment, including issues dealing with the Ministry of Health, as there is still no neuropsychology specialisation in universities or hospitals in this field. Therefore, this research is considered the first study in the field of neuropsychology in Kuwait.

10.5.2. Neuropsychological Measures

The researcher faced challenges due to the scarcity of Arabic versions of valid neuropsychological scales such as the Stroop Task. This required the researcher to translate the scale and apply it to a sample of healthy participants before applying it to the main sample.

10.5.3. Ministry of Health and the Research Administration Restrictions

The global health crisis of COVID-19 affected data collection. The Research Department in the Ministry of Health in Kuwait stopped the use of some devices and centres, such as magnetic resonance imaging, which was used only for emergency health cases. As a result, the researcher was unable to complete the fMRI experiment as planned.

10.5.4. Cultural Influences

Fear of stigma made it difficult to recruit some mTBI patients. In particular, this affected young women, as they feared the risk that participation would negatively affect their chances of getting married. In addition, the unwillingness of some men to be trained and examined by a woman was one of the challenges I faced with the Syrian refugees.

10.5.5. Effects of COVID-19 on Recruitment

COVID-19 infections, restrictions due to COVID-19 and a general concern about the pandemic all adversely affected recruitment.

10.6. Strengths of the Research

A strength of this thesis was the successful translation of neuropsychological measures and their effective application to clinical populations. Another strength was the development of culturally-tailored interventions, particularly a mindfulness-based intervention, for the Arab community. As a researcher, I was pleased to have had the opportunity to conduct this study and provide support for the underrepresented group of Syrian refugees. This research emphasised the need for establishing neuropsychology services in Kuwaiti hospitals and universities.

10.7. Future Research

There has been limited investigation into the relationship between the attention system, behavioural outcomes, and mild traumatic brain injury in refugees with PTSD. To the best of the researcher's knowledge, there has been no prior study examining the connection between attention and mindfulness in Arab society. Given the exploratory nature of this study, it is recommended that future research should reproduce the findings with a larger and more diverse sample. Additionally, in this study, the male refugees refused to participate in training led by a woman, leading to the control group (CBT) consisting of only men and the experimental group (MBI) consisting of only women. Future studies should include both male and female participants to account for any potential gender disparities. It is also good for the future study to include refugees in different countries, to know the impact of the culture on them, and try to get more participants. Furthermore, as social cognition is a complex construct, incorporating additional social cognitive tasks would help determine if the impairments observed in this study are specific to the methods used or generalisable across tasks. In addition to paying attention to the patient's complaint and conducting periodic interviews to assess the situation on a long-term basis. The thesis highlights the need for further psychological experimentation and imaging studies to validate the findings. Neuropsychological evaluations and neuroimaging provide a solid foundation for investigating brain activity, predicting and explaining behaviour, and advancing psychology's demand for quantification.

10.8. Publications

The results of the study on the impact of a Mindfulness-Based Intervention (MBI) on Improving Attention in Refugees with PTSD were presented at the First Neuroscience for Wales Virtual Conference on 8th June 2020. The findings of the study on the effect of MBI on Attention Improvement in Mild Traumatic Brain Injury (mTBI) patients were presented at the European Neuroscience Conference for Doctoral Students (ENCODS) held on 4th - 6th June 2021, with a poster presentation titled "Mindfulness-Based Intervention in Mild Traumatic Brain Injury." The abstract on the Assessment of Attention Impairment in Individuals with Post-Traumatic Stress Disorder (PTSD) through Neuropsychology Assessments and Rehabilitation Training has also been accepted for poster presentation at the NAN 41st Annual Conference in 2021. The study of the effectiveness of virtual Mindfulness-Based Interventions on Perceived Anxiety and Depression of Physicians during the COVID-

19 Pandemic: A pre-post experimental study has been published by Frontiers in Psychiatry (Alozairi et al., 2023).

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Appendix A

Ethical Approval

- 2018-16359 Mild Traumatic Brain Injury and Mindfulness based Cognitive Therapy intervention proposal has been reviewed by the Healthcare Sciences (Post-reg) Ethics and Research Committee and the committee confirmed ethical and governance approval for the above research on the basis described in the application form, protocol and supporting documentation - School of Medical and Health Sciences - Bangor University - 2018.
- The Standing Committee for the Coordination of Medical and Health Research has reviewed 2019 / 11894 the use of Mindfulness Based Intervention with mild Traumatic Brain Injury proposal, and recommended in their meeting held on Tuesday 3/12/2019, to approve the conduct of the submitted research by Oroub Hisham Mubarak.
- ATAA Humanitarian Relief Association- Turkey has been approved research proposal on the effect of Mindfulness based Intervention on Syrians' with PTSD - 2019.

Appendix B

Consent form

COLEG IECHYD A GWYDDORAU YMDDYGIAD
COLLEGE OF HEALTH & BEHAVIOURAL SCIENCES

YSGOL GWYDDORAU MEDDYGOL
SCHOOL OF MEDICAL SCIENCES

PRIFYSGOL BANGOR UNIVERSITY

The Use of Mindfulness-Based Cognitive Therapy (MBCT) in Intervening Mild Traumatic Brain Injury.

Kindly respond to the following questions by ticking (✓) on the appropriate choice.	Yes	No
1. **I have been given adequate information about the study after reading the Information Sheet provided.**		
2. **I have received satisfactory responses to all my questions concerning my participation in the study and I know that I can ask questions during the study.** 3. **I understand that taking part in this research will include assessment tools such as short interview and attention scales.**		
4. **The requirements of the study are clear and I agree to participate.**		
5. **I understand that I have the freedom to stop my participation in the research at any point in time during the research without providing reasons for this. Also, I understand that I can decline to respond to some of the questions from the researcher without future consequences.**		
6. **I understand the confidentiality conditions provided by the researcher in the Information Sheet and I agree to provide the information.**		
7. **After reading the conditions presented in the Information Sheet, I wish to take part in the research process voluntarily.**		

8. **I approve the researcher to use the collected information to accomplish the aims of this research and use in future research as long as the information cannot be traced back to me (anonymous).**		
9. **I have agreed that you inform my general practitioner (GP) about my participation in the study.**		

Signature of the participant: ______________________

Date: ____

Name of the participant: _________________________

Your contact details:

____

____

Name of the researcher: __Oroub Mubarak_____________

Signature of the researcher: _________________________

Contact details of the researcher: ____________________

Email: psp941@bangor.ac.uk

Tel: 07786543035

Appendix C

Information Sheet- Bangor University

COLEG IECHYD A GWYDDORAU YMDDYGIAD
COLLEGE OF HEALTH & BEHAVIOURAL SCIENCES

YSGOL GWYDDORAU MEDDYGOL
SCHOOL OF MEDICAL SCIENCES

PRIFYSGOL
BANGOR
UNIVERSITY

Permission to take part in a Neuropsychology Study for adults (21 year and above)

Study Title: The Use of Mindfulness-Based Cognitive Therapy in Mild Brain Injury

The following explains why we are conducting this research and how your contribution

will help. We wish to give you enough information so that you can make an informed decision of whether to participate in the study or not. Please read the information below carefully and if you have any questions or need clarifications, you can contact the researcher directly.

The Purpose of the Study

The study is based on the idea that mindfulness-based cognitive therapy (MBCT) can

improve attention problems that commonly follow a traumatic head injury. We will compare

Mindfulness based Cognitive Therapy (MBCT) with standard Cognitive Behavioral Therapy (CBT).The study will also examine how magnetic resonance imaging (MRI) and diffusion tensor imaging (DTI) techniques can help in the prediction of long-term psychological outcomes after head injury.

The Research Organizers

The research is being conducted by Oroub Mubarak, a trained clinical psychologist and a

Ph.D. student at Bangor University School of Medical Sciences, under the supervision of Dr Martyn Bracewell, Senior Lecturer and Consultant Neurologist, Dr Rudi Coetzer, Consultant Clinical Neuropsychologist and Dr Abdullah Al-Ozairi, Assistant Professor in Faculty of Medicine, Kuwait University. The research has been reviewed and approved by the School of Medical Sciences Research Ethics Committee- Bangor University.

Why have you be asked to take part?

You have been invited to a be a part of this study because you have a mild traumatic head injury.

Whether You Should Participate in the Study

Taking part in our study is voluntary. We will respect your decision and you will not be

required to provide the reasons for declining. However, if you choose to participate in the

research, you will need you to provide your consent. You have the right to withdraw from the

study at any time without explaining your decision.

What does the study involve?

At the start of the study, you will be asked to complete attentional scales (pen and paper tasks), Stroop test and short practice of Mindful breathing, which will take no more than hour. Then you will have an MRI, which also collect data using DTI to look at the connections of part of the brain that we believe is involved in attention.

You will be randomly assigned to receive either MBCT or standard CBT. You will meet with Ms. Mubarak four days a week for a one-hour session for a total of two weeks. The researcher has been trained to teach Mindfulness courses from Mindfulness Centre in Bangor University. While, Participants in the control group will meet with Mr Almutairi four days a week for a one-hour session for a total of two weeks.

At the end of this two weeks period, you will be asked again to complete attentional scales (pen and paper tasks). In addition, you will be asked to complete Stroop test, all will be taken around one hour.

Possible Benefits and Risks of Participating in the Study

Your participation will be instrumental in helping us understand whether MBCT can improve attention while reducing the levels of stress resultant from traumatic brain injury. The results will help in improving rehabilitation services in the future. You will receive for each of the two testing sessions. We do not anticipate any risks associated with the study.

Confidentiality of the Information You Provide and the results

The research team from Bangor University will ensure that all the information you

provide remains confidential. Your data will be anonymized and stored on secure University

computers. It will not be possible to identify you in any work resulting from this research.

What happens if I agree to be in this research?

If you agree to join, you will be asked to do the following

- You will be asked to sign the consent.
- You will be asked to attend full course
- You will be asked to answer attentional scales
- You will be asked to have MRI.

What will happen if you would like to withdraw from the study?

If you choose to withdraw from the study, all your data and information collected

About you to date will be destroyed.

How the Study Findings will be used?

The study results will enlighten us on how mindfulness improves the life experiences especially attention, among people with mild traumatic brain injury. The results will be either

presented in a conference or published in an academic journal. The information that will be used in the presentation/or publication of the results will remain anonymous

Knowing your Performance in the Study

Please contact the researcher via the e-mail if you would like to be informed of your results concerning the DTI, MRI, interview and attentional scales

The Organization and Funding of the Research

The study is organized and conducted by Ms Mubarak under the supervision of Dr Bracwell; Dr Coetzer, and Dr Abdullah Al-Ozairi. The Kuwait Government is the primary funder of the research.

The Reviewer of the Study

For the purpose of protecting you and your interests as the participant, an in dependent group of people that constitute the Research Ethics Committee reviewed the study. The School of Medical Science Ethics Committee at Bangor University also reviewed and signed approval of the research.

Further information and contact

For more information about the study, please feel free to contact Dr Martyn Bracewell (tel. 01248 382628; email: m.bracewell@bangor.ac.uk) Abdullah Al-Ozairi (tel. 96962000; email: a.alozairi@HSC.EDU.KW) and Oroub Mubarak (tel. 07786543035; email: psp941@bangor.c.uk).

By signing this document, I testify to have read the information in the participant information sheet and agree to take part in this research

Printed name ……………………………………………………………

Signature …………………………………………………………………..

Date ……………………………………………………………………….

Thank you very much for taking your time to read the information presented in this sheet.

Informed Consent- Kuwait University

Kuwait University

HEALTH SCIENCES CENTRE Ethical Committee

Informed Consent (Controls - Adult)

Faculty: Faculty of Medicine
Department: Mental health

Hospital: Ibn Sina
Department: Radiology

Title of the Project:

The Use of Mindfulness-Based Cognitive Therapy in Mild Brain Injury

What is the purpose of the Study?

- The study is based on the idea that mindfulness-based cognitive therapy (MBCT) can improve attention problems that commonly follow a traumatic head injury.
- We will compare Mindfulness based Cognitive Therapy (MBCT) with standard Cognitive Behavioral Therapy (CBT).

Why have I been invited to participate?

You have been invited to a be a part of this study because you have a mild traumatic head injury

What procedures will be performed on me?

- At the start of the study, you will be asked to complete attentional scales (pen and paper tasks), which will take no more than 30 minutes. Then you will be asked to answer Stroop task via fMRI, study also is looking to collect data using DTI to look at the connections of part of the brain that we believe is involved in attention, it will take around one hour.
- You will be randomly assigned to receive either MBCT or standard CBT. The sessions will be for one hour during eight days. The researcher has been trained

to teach Mindfulness courses from Mindfulness Centre in Bangor University. While, Participants in the control group will meet with Mr. Almutairi four days a week for a one-hour session for a total eight days.

- At the end of this two weeks period, you will be asked again to complete attentional scales (pen and paper tasks). In addition, you will be asked to complete Stroop task via fMRI, all will be taken around one hour and a half.

What are the benefits of taking part in this study?

Your participation will be instrumental in helping us understand whether MBCT can improve attention while reducing the levels of stress resultant from traumatic brain injury. The results will help in improving rehabilitation services in the future.

What are the risks of taking part in this study?

We do not anticipate any risks associated with the study.

What will happen to the information provided by myself? (Confidentiality)

All the information you provide remains confidential. Your data will be anonymized and stored on secure University computers. It will not be possible to identify you in any work resulting from this research.

Who do I contact if I want further information?
Investigator name: .... Tel.: ....

Invitation to participate ***(PI shall update this part according to his/her project)*** **:**
Please note that you have the right to accept or to reject to participate in this study. In case you accepted, you are free to withdraw at any time without affecting your medical treatment (for patient) or professional performance (for employee) or your academic record (for student).

Date:
Note for PI: (Kindly specify if your subjects are "Patients" or "Participants")
Agree **Patient/Participant Name:** .... **Signature:** ....
Don't Agree **Patient/Participant Name:** .... **Signature:** ....
PI Name: .... **Contact:** .... **Signature:** ....

Appendix D

Debriefing Information

PRIFYSGOL
BANGOR
UNIVERSITY

Title of the research project:

Intervening in Mild Traumatic Brain Injury using Mindfulness Based Cognitive Therapy.

<u>Debriefing Information for Patients and Their Family</u>

Purpose and Background:

Research has revealed that mindfulness-based cognitive therapy can be used in the rehabilitation of Mild Traumatic Brain Injury. As such, the main purpose this particular research is to determine whether effective utilization of DT/MRI methodology can be used to analyses brains interaction functionality in order to predict other forms of illness. Moreover, the researcher is seeking to apply Mindfulness-based cognitive therapy to rehabilitate people suffering from the mTBI and also examine the results in terms of their concentration, attention and daily experiences. Evidently, traumatic brain injury poses a major public health problem and is further associated with high rates of disability and mortalities (Krzeczkowski, Robb, & Good, 2017). If this disorder if not treated, it can lead to long-term psychiatric disorders such as PSTD, anxiety, and depression and thus it is prudent to use Mindfulness-based Cognitive Therapy to improve the brains activity, concentration, and attention of patients with the condition.

However, despite the growing interest in the contemporary health care systems regarding the effectiveness of DT and MRI technique in helping people suffering from health issues such as brain injury, limited facts are known pertaining the utilization of DT/MRI method in predicting diverse brain activities and long-term outcomes (Krzeczkowski, Robb, & Good, 2017). Owing to the fact that Mindfulness-based Cognitive Therapy can have a significant effect to the concentration, attention and brains activity of a patient, this study will endeavor to inform how DT/MRI technique is useful in the exploration of brain's activity. Furthermore, the study will publish the important role played by MBCT in increasing the attention of people diagnosed with brain injuries.

In summation, we thank the patients and family members who participated in the study.

Questions:

If you have any questions about why this research is important or would like more information about clinical neuropsychology in general, please contact the researcher:

Ms. Oroub Mubarak:
psp941bangor.ac.uk

References

Krzeczkowski, J. E., Robb, S. A., & Good, D. E. (2017). Trait Mindfulness Is Associated with Lower Post-Injury Psychological Symptoms Following a Mild Head Injury. *Mindfulness,* 8(6), 1594-1602.

Appendix E

MBI for small group of mTBI outpatients

Stroop test

Several Paired Sample t-tests were performed to assess if there are significant differences in the Stroop test before and after the intervention for the Mild traumatic brain injury group. Out of the six pairs of variables compared, only Stroop main test congruent was statistically significant (t (4) = 4.27, p = 0.013) with average score decreasing from 1012.6 (SD = 124.48) before intervention to 872.6 (SD = 90.09) after intervention as Table 6a reveals.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Stroop test control congruent	1056.60	5	142.325	63.650
	Stroop test control R - congruent	1025.40	5	68.639	30.696
Pair 2	Stroop test control incongruent	1091.20	5	142.978	63.942
	Stroop test control R - incongruent	942.20	5	173.588	77.631
Pair 3	Stroop test practice congruent	1221.60	5	283.428	126.753
	Stroop Test Practice R - congruent	1004.40	5	352.604	157.689
Pair 4	Stroop test practice incongruent	1170.00	5	145.614	65.121
	Stroop Test Practice R - incongruent	1046.40	5	113.500	50.759
Pair 5	Stroop Main Test - congruent	1012.60	5	124.482	55.670
	Stroop Main Test R - congruent	872.60	5	90.093	40.291
Pair 6	Stroop Main Test - incongruent	1108.60	5	293.944	131.456
	Stroop Main Test R - incongruent	917.00	5	57.840	25.867

Table 6a. Descriptive statistics for the paired sample t-test

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Stroop test control congruent - Stroop test control R - congruent	31.200	147.654	66.033	-152.137	214.537	.472	4	.661
Pair 2	Stroop test control incongruent - Stroop test control R - incongruent	149.000	191.447	85.618	-88.713	386.713	1.740	4	.157
Pair 3	Stroop test practice congruent - Stroop Test Practice R - congruent	217.200	330.502	147.805	-193.173	627.573	1.470	4	.216
Pair 4	Stroop test practice incongruent - Stroop Test Practice R - incongruent	123.600	114.076	51.016	-18.044	265.244	2.423	4	.073
Pair 5	Stroop Main Test - congruent - Stroop Main Test R - congruent	140.000	73.171	32.723	49.146	230.854	4.278	4	.013
Pair 6	Stroop Main Test - incongruent - Stroop Main Test R - incongruent	191.600	270.592	121.012	-144.384	527.584	1.583	4	.189

Table 6b. Statistical testing for paired sample t-tests.

Symbol search, coding, trial making

Several Paired Sample t-tests were performed to assess if there are significant differences in the Symbol search, coding, trial making before and after the intervention for the Mild traumatic brain injury group. Out of the four pairs of variables compared, Table 7b shows only Symbol search was statistically significant (t (4) = -4.05, p = 0.016) with average score increasing from 23.2 (SD = 6.64) before intervention to 29.2 (SD = 8.22) after intervention as Table 7a reveals.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Symbol search	23.20000	5	6.648308	2.973214
	Symbol searchR	29.2000	5	8.22800	3.67967
Pair 2	Coding	45.20	5	12.029	5.380
	CodingR	52.00	5	8.775	3.924
Pair 3	trail1 numbers	43.60	5	13.957	6.242
	trail 1R	42.80	5	7.396	3.308
Pair 4	trail2 number and letters	99.20	5	22.554	10.087
	trail2R	92.40	5	20.367	9.108

Table 7a. Descriptive statistics for the paired sample t-test

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Symbol search - Symbol searchR	-6.000000	3.316625	1.483240	-10.118134	-1.881866	-4.045	4	.016
Pair 2	Coding - CodingR	-6.800	6.943	3.105	-15.420	1.820	-2.190	4	.094
Pair 3	trail1 numbers - trail 1R	.800	9.149	4.091	-10.560	12.160	.196	4	.855
Pair 4	trail2 number and letters - trail2R	6.800	17.196	7.690	-14.552	28.152	.884	4	.427

Table 7b. Statistical testing for paired sample t-tests.

Mindfulness questionnaire

Several Paired Sample t-tests were performed to assess if there are significant differences in the Five facets mindfulness questionnaire before and after the intervention for the Mild traumatic brain injury group. Out of the five pairs of variables compared, Table 8b shows none of them is statistically significant.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Observe	28.2000	5	5.35724	2.39583
	ObserveR	31.6000	5	4.15933	1.86011
Pair 2	Describe	26.0000	5	11.13553	4.97996
	DescribeR	26.6000	5	8.56154	3.82884
Pair 3	Awareness	29.6000	5	5.12835	2.29347
	AwarenessR	31.4000	5	6.54217	2.92575
Pair 4	Nonjudge	23.4000	5	7.89303	3.52987
	NonjudgeR	27.0000	5	10.04988	4.49444
Pair 5	Nonreact	21.6000	5	3.50714	1.56844
	NonreactR	24.2000	5	1.92354	.86023

Table 8a. Descriptive statistics for the paired sample t-test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Observe - ObserveR	-3.40000	5.27257	2.35797	-9.94676	3.14676	-1.442	4	.223
Pair 2	Describe - DescribeR	-.60000	6.73053	3.00998	-8.95705	7.75705	-.199	4	.852
Pair 3	Awareness - AwarenessR	-1.80000	5.16720	2.31084	-8.21593	4.61593	-.779	4	.480
Pair 4	Nonjudge - NonjudgeR	-3.60000	12.72006	5.68859	-19.39404	12.19404	-.633	4	.561
Pair 5	Nonreact - NonreactR	-2.60000	3.84708	1.72047	-7.37678	2.17678	-1.511	4	.205

Table 8b. Statistical testing for paired sample t-tests.

Appendix F

The Reflection form

Personal Reflection

Please describe by words your personal reflection on the program

Name

What did you learn? Describe how this program "Mindful living" contributed to the improvement of your wellbeing and health

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…….

Describe here ways in which your own behaviour will change as a result of reflection on this program

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

……

Have any other issues come out of the experience?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…….

Appendix G

MRI Safety Checklist

MRI Safety Checklist

Ibn Sina Specialized Hospital - Radiology Department

Patient Details:

Patient Name: ....

Patient ID: ....

MRI Safety Screening:

- MRI machine uses a very strong magnet field. Therefore any metallic objects or electronic devices such as: hearing aids, glasses, magnetic cards, watches, phones, jewelers, hair pins are strictly prohibited to take inside scanner room. **Do NOT bring anything into the MRI room with you.**
- Please answer with (Yes / No) to the following questions :

No	Yes	Do you have?
		Do you have Cardiac pacemaker, defibrillator ?
		Do you have Cochlear implant ?
		Do you have Recent surgical intervention ? mention what and when ?
		Do you have brain aneurysmal clip ?
		Do you have prosthetic cardiac valves ?
		Do you have Implant device , infusion pump ?
		Do you have Dental brace and dentures ?
		Do you have Tattoo / permanent makeup ?

Signature of Patient or his/her representative

Signature of the Referring Physician

Appendix H

Trail Making Test (TMT- A/B)

ترجمه وتكييف إلى اللغة العربية: أ. عروب هشام مبارك المولى

<u>التعليمات:</u>

الجزء الأول:

<u>المثال الأول :</u>

هناك مجموعة أرقام داخل دوائر في هذه الصفحة. من فضلك خذ قلم الرصاص وارسم خطا من الرقم (1) الى الرقم الذي بعده وما يليه بنفس الطريقة.

أبدأ من الرقم (1) (يشير الفاحص الى الرقم 1) ثم الى الرقم (2) (يشير الفاحص الى الرقم 2) ثم الى الرقم (3) (يشير الفاحص الى الرقم 3) . وأكمل بنفس هذه الطريقة.

من فضل حاول أن يكون القلم ثابتاً في المسار وأنت تنتقل من الرقم إلى الذي بعده. إذا ممكن أعمل بسرعة من غير أخطاء.

في حالة الفشل:

يقول الفاحص: كنت في الرقم 2، ما هو الرقم الذي يأتي بعده؟ انتظر إلى أن يجيب المفحوص ثم قل : من فضلك ابدأ من هنا واكمل المسار.

....

إذا جاوب المفحوص المثال الأول بشكل صحيح

أعد التعليمات في الأعلى وابدأ بقياس الزمن من بعد كلمة ابدأ

أقف حساب الزمن عندما يكمل الحل، أو عندما ينتهي الوقت عند 150 ثانية ما يعادل 2.5

....

الجزء الثاني

<u>المثال الثاني:</u>

هناك مجموعة أرقام وحروف في دوائر في هذه الصفحة. من فضلك خذ القلم وارسم خطا بالترتيب ما بين الأرقام والحروف.

ابدأ من الرقم (1) (يشير الفاحص الى الرقم 1) بعدها انتقل الى أول حرف هجائي حرف أ (يشير الفاحص الى الحرف أ) ثم من بعدها انتقل الى الرقم (2) (يشير الفاحص الى الرقم 2) ثم تنتقل منه الى الحرف ب (يشير الفاحص الى الحرف ب) وهكذا بنفس هذه الطريقة.

من فضلك حاول أن يكون القلم ثابتاً في المسار وأنت تنتقل من الرقم او الحرف إلى ما بعده. إذا ممكن اعمل بسرعة من غير أخطاء.

في حالة الفشل:

يقول الفاحص: كنت في الرقم 2، ما هو الحرف الذي يأتي بعده؟ انتظر إلى أن يجيب المفحوص ثم قل : من فضلك ابدأ من هنا واكمل المسار.

إذا جاوب المفحوص المثال الأول بشكل صحيح

أعد التعليمات في الأعلى وابدأ بقياس الزمن من بعد كلمة ابدأ

أقف حساب الزمن عندما يكمل الحل، أو عندما ينتهي الوقت عند 150 ثانية ما يعادل 2.5

Appendix I

Patient Health Questionnaire-9 (PHQ-9)

	Over the last 2 weeks, on how many days have you been bothered by any of the following problems?	Not at all	Several Days	More than half the days	Nearly every day
1	Little interest or pleasure in doing things	0	1	2	3
2	Feeling down, depressed or hopeless	0	1	2	3
3	Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4	Feeling tired or having little energy	0	1	2	3
5	Poor appetite or over eating	0	1	2	3
6	Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
7	Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8	Moving or speaking so slowly that other people could have noticed, or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9	Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

PHQ9 – Total Score

Appendix J

General Anxiety Disorder-7 (GAD-7)

GAD-7 Anxiety

Over the last two weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Column totals _____ + _____ + _____ + _____ =

Total score _______

If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Source: Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD-PHQ). The PHQ was developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke, and colleagues. For research information, contact Dr. Spitzer at ris8@columbia.edu. PRIME-MD® is a trademark of Pfizer Inc. Copyright© 1999 Pfizer Inc. All rights reserved. Reproduced with permission

Scoring GAD-7 Anxiety Severity

This is calculated by assigning scores of 0, 1, 2, and 3 to the response categories, respectively, of “not at all,” “several days,” “more than half the days,” and “nearly every day.”
GAD-7 total score for the seven items ranges from 0 to 21.

0–4: minimal anxiety

5–9: mild anxiety

10–14: moderate anxiety

15–21: severe anxiety

Appendix K

Five Facets Mindfulness Questionnaire (FFMQ)

Five Facet Mindfulness Questionnaire

Description:

This instrument is based on a factor analytic study of five independently developed mindfulness questionnaires. The analysis yielded five factors that appear to represent elements of mindfulness as it is currently conceptualized. The five facets are observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. More information is available in:

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

1	2	3	4	5
never or very rarely true	rarely true	sometimes true	often true	very often or always true

_____ 1. When I'm walking, I deliberately notice the sensations of my body moving.

_____ 2. I'm good at finding words to describe my feelings.

_____ 3. I criticize myself for having irrational or inappropriate emotions.

_____ 4. I perceive my feelings and emotions without having to react to them.

_____ 5. When I do things, my mind wanders off and I'm easily distracted.

Appendix L

Table 1 shows the agenda and the follow-up for each session.

Session's topic	Agenda	Homework
Session 1 Automatic pilot	-Establish the orientation of the class. -Ask participants to introduce themselves to the group. - Raisin exercise. - Feedback and discussion of raisin exercise. - Body scan exercise for 25 minutes and discussion of the body scan exercise feedback. **-Discuss homework for 1st session.** - End session with short breath for 2-3 minutes on the breath.	**Using homework check list to record:** - Body scan feedback **Mindfulness for routine activity:** Choose one routine activity in your daily life and make deliberate effort to bring moment to moment awareness to activity each time you do it **Eat at least one meal "mindfully"** -The nine dots exercise Option: Writing gratitude list.
Session 2 Dealing with barriers	-Start with body scan practice for 25 minutes -Practice review. -Homework review. -Thoughts and feeling exercise (walking down on the street). -Pleasant events calendar. -10-15 sitting meditation. **-Discuss homework for 2nd session.**	**Using homework form to record:** - Practice 10-15 minutes mindfulness of breathing **Pleasant events calendar:** Become aware of your thoughts, feeling, and body sensations around one pleasant event each day **Mindfulness for routine activity:** Choose one routine activity in your daily life and make deliberate effort to bring moment to moment awareness to activity each time you do it **Eat at least one meal "mindfully"** Option: Writing gratitude list
Session 3 Mindfulness of the breath	-Start with practice (five minutes "seeing or hearing" exercise). -20 minutes sitting meditation. -Practice review. -Homework review.	**Using homework form to record:** - Practice 10-15 minutes mindfulness of breathing **Unpleasant events calendar:**

	-3 minutes breathing space and review. -Mindful walking and review. -Unpleasant events calendar. **Discuss homework for 3rd session.**	Become aware of your thoughts, feeling, and body sensations around one unpleasant event each day. -Practice 3- minute breathing space - Mindfulness for routine activity -Eat at least one meal "mindfully" -Mindfulwalking/Mindful movement Option: Writing gratitude list
Session 4 Staying present	-Start with practice (five minutes "seeing or hearing" exercise). -20 minutes sitting meditation. -Practice review. -Homework review. -3 minutes breathing space and review. - read "Wilde geese" poem. -Discuss the GAD-9 and PHQ9, FFMQ results -3 minutes breathing space coping and review. **Discuss homework for 4th session** -Hand out copies of Full Catastrophe Living to the class for	**Using homework form to record:** - Practice 15-20 minutes sitting meditation Become aware of your thoughts, feeling, and body sensations -Practice 3 minutes breathing space - Mindfulness for routine activity -Practice 3 minutes breathing space-Coping (whenever you notice unpleasant thoughts or feeling) -Eat at least one meal "mindfully" Option: Writing gratitude list
Session 5 Allowing/ letting be	-Start with practice 20 minutes sitting meditation/ introducing a difficulty within the practice -Practice review -Homework review -3 minutes breathing space and review -Read "the guest house" poem -3 minutes breathing space-coping and review -unpleasant events calendar **Discuss homework for 5th session**	**-Using homework form to record:** - Practice 20-30 minutes sitting meditation Become aware of your thoughts, feeling, and body sensations -Practice 3 minutes breathing space- regular - Mindfulness for routine activity -Practice 3 minutes breathing space-Coping (whenever you notice unpleasant thoughts or feeling) -Eat at least one meal "mindfully"

		Option: Writing gratitude list.
Session 6 Thoughts are not facts	-Start with practice 20 minutes sitting meditation/ introducing a difficulty within the practice -Practice review **-Homework review** -Mention preparation for end of the course -Moods and thoughts exercise -3 minutes breathing space and review **Discuss homework for 6th session**	**Using homework form to record:** -Practice 20-30 minutes sitting meditation Become aware of your thoughts, feeling, and body sensations -Practice 3- minute breathing space- regular -Mindfulness for routine activity -Practice 3- minute breathing space-Coping (whenever you notice unpleasant thoughts or feeling) -Improve your lifestyle by using plan you did it in the session -Eat at least one meal "mindfully " Option: Writing gratitude list.
Session 7 How can I best take care of myself?	-Start with practice 20 minutes sitting meditation/ introducing a difficulty within the practice -Practice review **-Homework review** -Generate list of pleasure and mastery activities -Plan how best to schedule such activities -3 minutes breathing space and review **Discuss homework for 7th session**	**Using homework form to record:** - Practice 20-30 sitting meditation Become aware of your thoughts, feeling, and body sensations -Practice 3- minute breathing space- regular - Mindfulness for routine activity -Practice 3- minute breathing space-Coping (whenever you notice unpleasant thoughts or feeling) -Improve your lifestyle by using plan you did it in the session.

		-Eat at least one meal "mindfully" Option: Writing gratitude list
Session 8 Using what has been learned with future moods and stress	-Start with body scan practice. -Practice review. -Homework review. -Practice 20 minutes sitting meditation and review. -Review whole course and discuss with participants what has been learned.	- Course feedback and discussion

CBT Session's Agenda

Session	Agenda
Session 1	Establish relationship. Identify participants' presenting problem. Introduce Cognitive Behavioral Therapy. Introduce the Cognitive-Behavioral Model. Describe Problem in Context of Model. Set Goals. Receive Feedback from participants
Session 2	Check Mood. Introduce Behavioral Activation, and Explore Potential Activities to Improve Mood. Set Homework: Mood and Activity Tracking. Receive Feedback from participants
Session 3	Check Mood. Review Mood and Activity Tracking. Use Tracking Sheet to Plan Where and What Behavioral Activation Will Be Employed. Troubleshoot Completing Activity. Assign Homework: 1 Behavioral-Activation Exercise. Receive Feedback from participants
Session 4	Check Mood. Review Behavioral Activation, Introduce Three-Column Thought Record and Idea of "Hot Thought". Practice Three Column With Event From Past Week. Homework: 1 behavioral activation 1three-column thought record Receive Feedback from participants
Session 5	Check Mood.

	Discuss Progress of Therapy and Termination. Review Homework. Introduce Cognitive Distortions. Complete Three-Column in Session, and Have Identify Hot Thought. Introduce Concept of Challenging Hot Thought. Homework: 1 behavioral activation 1three-column thought record Receive Feedback from participants
Session 6	Check Mood. Review Homework. Introduce Challenging Thoughts and Seven-Column Thought Record. Complete Seven-Column in Session. Introduce Concept of Challenging Hot Thought. Homework: 1 behavioral activation 1three-column thought record Receive Feedback from participants
Session 7	Check Mood. Review Homework. Complete Seven-Column in Session (With participants Writing and Talking Through as they Completes It) Homework: 1 behavioral activation 1seven-column thought record Receive Feedback from participants
Session 8	Check Mood. Review Homework. Review Progress of Treatment. Complete Relapse Prevention. Schedule Self-Management Homework: Self-Management exercise

Appendix M

Full results of Statistical Testing using IBM-SPSS v.21.0)

Stroop Paired Samples Test CBT-mTBI

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Stroop speech after intervention-correct responses - Stroop speech pre intervention-correct responses	6.200	5.789	1.831	2.059	10.341	3.387	9	.008

Pair 2	Stroop Hand after intervention-correct responses - Stroop Hand pre intervention-correct responses	4.000	2.494	.789	2.216	5.784	5.071	9	.001

Stroop Paired Samples Test MBI-mTBI

		Paired Differences							
		ean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			f	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Stroop speech after intervention-correct responses - Stroop speech pre intervention-correct responses	.889	5.465	1.822	1.688	10.089	.233		.012
Pair 2	Stroop Hand after intervention-correct responses - Stroop Hand pre intervention-correct responses	.222	2.682	.894	.160	4.284	.485		.038

(Symbol, Coding, Trial1 and Trial2) Paired Samples Test CBT-PSTD refugees

		Paired Differences					t
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
					Lower	Upper	
Pair 1	Pre_symbol search-correct response - post_symbol search_correct response	-10.300	6.832	2.161	-15.187	-5.413	-4.767
Pair 2	pre_coding_correct response - post_coding_correct response	-15.800	27.402	8.665	-35.402	3.802	-1.823
Pair 3	pre_trial1_in seconds - post_trial1_in seconds	14.300	17.626	5.574	1.691	26.909	2.566
Pair 4	pre_trial2_in seconds - post_trial2_in seconds	9.200	25.560	8.083	-9.084	27.484	1.138

(Symbol, Coding, Trial1 and Trial2) Paired Samples Test CBT-PSTD refugees

		Paired Differences					t	d
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	Pre_symbol search-correct response - post_symbol search_correct response	-2.000	2.708	.856	-3.937	-.063	-2.335	
Pair 2	pre_coding_correct response - post_coding_correct response	-2.800	8.066	2.551	-8.570	2.970	-1.098	
Pair 3	pre_trial1_in seconds - post_trial1_in seconds	11.500	16.841	5.326	-.547	23.547	2.159	
Pair 4	pre_trial2_in seconds - post_trial2_in seconds	25.800	19.927	6.301	11.545	40.055	4.094	

Symbol, Coding, Trial1 and Trial2) Paired Samples Test MBI-PSTD refugees

	Paired Differences					t	d
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
Pair 1 Pre_symbol search-correct response - post_symbol search_correct response	-1.500	5.930	1.875	-5.742	2.742	-.800	9
Pair 2 pre_coding_correct response - post_coding_correct response	-6.400	7.074	2.237	-11.461	-1.339	-2.861	9
Pair 3 pre_trial1_in seconds - post_trial1_in seconds	9.400	13.898	4.395	-.542	19.342	2.139	9
Pair 4 pre_trial2_in seconds - post_trial2_in seconds	15.700	19.972	6.316	1.413	29.987	2.486	9

(PHQ and GAD) Paired Samples Test CBT-mTBI

		Paired Differences					t	df	(2-ta
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PHQ9_MTBI_after intervention_Total_score - PHQ9_MTBI_Pre intervention_Total_score	-3.000	3.333	1.054	-5.385	-.615	-2.846	9	
Pair 2	GAD7_MTBI_after intervention_Total_score - GAD7_MTBI_Pre intervention_Total_score	-2.800	2.530	.800	-4.610	-.990	-3.500	9	

(PHQ and GAD) Paired Samples Test MBI-mTBI

	Paired Differences					t	df	(2-ta
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			

Pair 1	PHQ9_MTBI_after intervention_Total_score - PHQ9_MTBI_Pre intervention_Total_score	-2.111	5.533	1.844	-6.364	2.142	-1.145	8
Pair 2	GAD7_MTBI_after intervention_Total_score - GAD7_MTBI_Pre intervention_Total_score	-1.500	7.407	2.619	-7.692	4.692	-.573	7

FFMQ Paired Samples Test CBT-mTBI

		Paired Differences					**t**	**df**
		Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**			
					Lower	**Upper**		
Pair 1	Observed - Observed_R	-7.100	2.644	.836	-8.991	-5.209	-8.493	9
Pair 2	Describe - Describe_R	-1.800	1.874	.593	-3.140	-.460	-3.038	9
Pair 3	Act_w_awareness - Act_w_awareness_R	6.200	4.417	1.397	3.040	9.360	4.439	9

Pair 4 Nonjudge - Nonjudge_R	5.800	3.490	1.104	3.304	8.296	5.256	9
Pair 5 Nonreact - Nonreact_R	-5.700	2.908	.920	-7.780	-3.620	-6.199	9

FFMQ Paired Samples Test MBI-PSTD refugees

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair Observed - Observed_R	-2.571	3.505	1.325	-5.813	.670	-1.941	6	.100
Pair Describe - Describe_R	-2.714	2.690	1.017	-5.202	-.226	-2.669	6	.037
Pair Act_w_awareness - Act_w_awareness_R	.000	3.559	1.345	-3.292	3.292	.000	6	1.00
Pair Nonjudge - Nonjudge_R	.286	6.422	2.427	-5.653	6.225	.118	6	.910
Pair Nonreact - Nonreact_R	-1.857	5.786	2.187	-7.208	3.494	-.849	6	.428

FFMQ Paired Samples Test CBT-PSTD refugees

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Observed - Observed_R	-2.889	4.936	1.645	-6.683	.905	-1.756	8	.117
Pair 2 Describe - Describe_R	-2.556	4.035	1.345	-5.657	.546	-1.900	8	.094
Pair 3 Act_w_awareness - Act_w_awareness_R	-2.000	9.110	3.037	-9.003	5.003	-.659	8	.529
Pair 4 Nonjudge - Nonjudge_R	-.778	7.902	2.634	-6.852	5.296	-.295	8	.775
Pair 5 Nonreact - Nonreact_R	-1.667	3.082	1.027	-4.036	.703	-1.622	8	.143

FFMQ Paired Samples Test MBI-PSTD Refugees

	Paired Differences				t	df	(2-
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			

				Lower	Upper			
Pair 1 Observed - Observed_R	5.444	8.398	2.799	-1.011	11.900	1.945	8	
Pair 2 Describe - Describe_R	4.111	6.333	2.111	-.757	8.979	1.947	8	
Pair 3 Act_w_awareness - Act_w_awareness_R	-1.111	9.320	3.107	-8.275	6.053	-.358	8	
Pair 4 Nonjudge - Nonjudge_R	4.222	7.563	2.521	-1.591	10.035	1.675	8	
Pair 5 Nonreact - Nonreact_R	4.556	5.981	1.994	-.042	9.153	2.285	8	

FFMQ Paired Samples Test CBT-PSTD Refugees

	Paired Differences					t	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
Pair 1 Observed - Observed_R	.700	3.199	1.012	-1.588	2.988	.692	
Pair 2 Describe - Describe_R	-.500	3.240	1.025	-2.818	1.818	-.488	
Pair 3 Act_w_awareness - Act_w_awareness_R	2.800	7.913	2.502	-2.861	8.461	1.119	

Pair 4	Nonjudge - Nonjudge_R	.700	3.199	1.012	-1.588	2.988	.692
Pair 5	Nonreact - Nonreact_R	1.900	5.486	1.735	-2.025	5.825	1.095

(PHQ and GAD) Independent Samples Test CBT and MBI within mTBI

		Levene's Test for Equality of Variances		t-test for Equality of				
		F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**E Diff**
PHQ9_MTBI_Pre intervention_Total_score	Equal variances assumed	3.227	.090	-.330	17	.746	-.922	
	Equal variances not assumed			-.320	12.218	.754	-.922	
PHQ9_MTBI_after intervention_Total_score	Equal variances assumed	8.703	.009	-.016	17	.987	-.033	
	Equal variances not assumed			-.016	9.526	.988	-.033	

GAD7_MTBI_Pre intervention_Total_score	Equal variances assumed	2.841	.110	-1.747	17	.099	-4.800
	Equal variances not assumed			-1.705	13.171	.112	-4.800
GAD7_MTBI_after intervention_Total_score	Equal variances assumed	1.007	.331	-2.766	16	.014	-4.875
	Equal variances not assumed			-2.601	10.480	.026	-4.875

(FFQ) Test Statistics CBT and MBI within mTBI Patients

	Observed	Observed_R	Describe	Describe_R	Act_w_awareness	Act_w_awareness_R	Nonjudge	Nonjudge_R	Nonreact	Nonreact_R
Mann-Whitney U	17.000	39.500	23.500	32.000	18.000	18.500	26.000	40.500	10.500	40.500
Asymp. Sig. (2-tailed)	.022	.649	.078	.282	.027	.027	.117	.712	.004	.710

(FFMQ) Test Statistics[a] CBT and MBI PSTD refugees' participants

	Observed	Observed_R	Describe	Describe_R	Act_w_awareness	Act_w_awareness_R	Nonjudge	Nonjudge_R	Nonreact	Nonreact_R
Mann-Whitney U	17.000	9.500	34.000	28.500	28.500	21.000	35.000	30.500	35.000	24.000

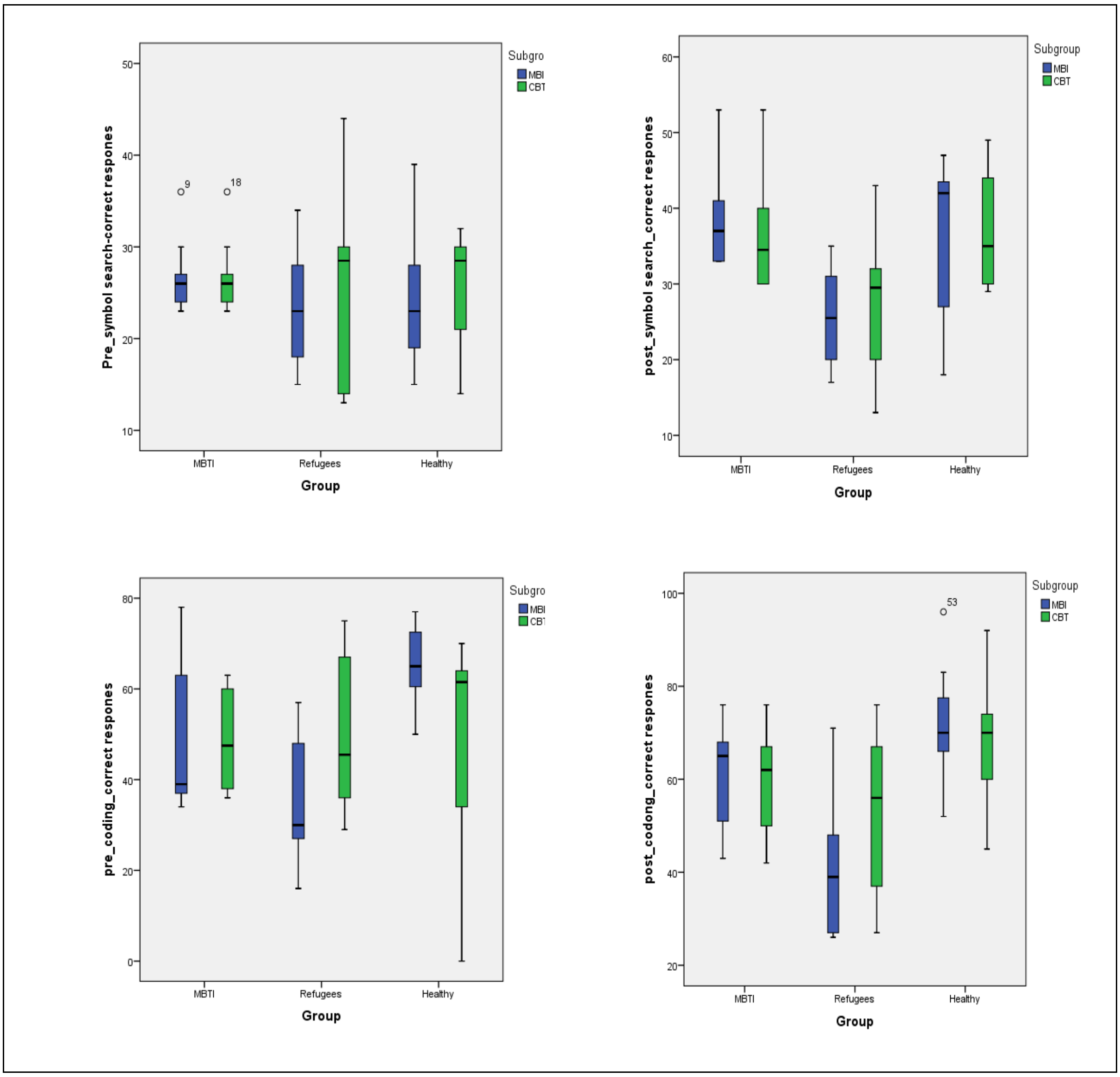
Asymp. Sig. (2-tailed)	.078	.019	.921	.748	.525	.261	1.000	.916	1.000	.413

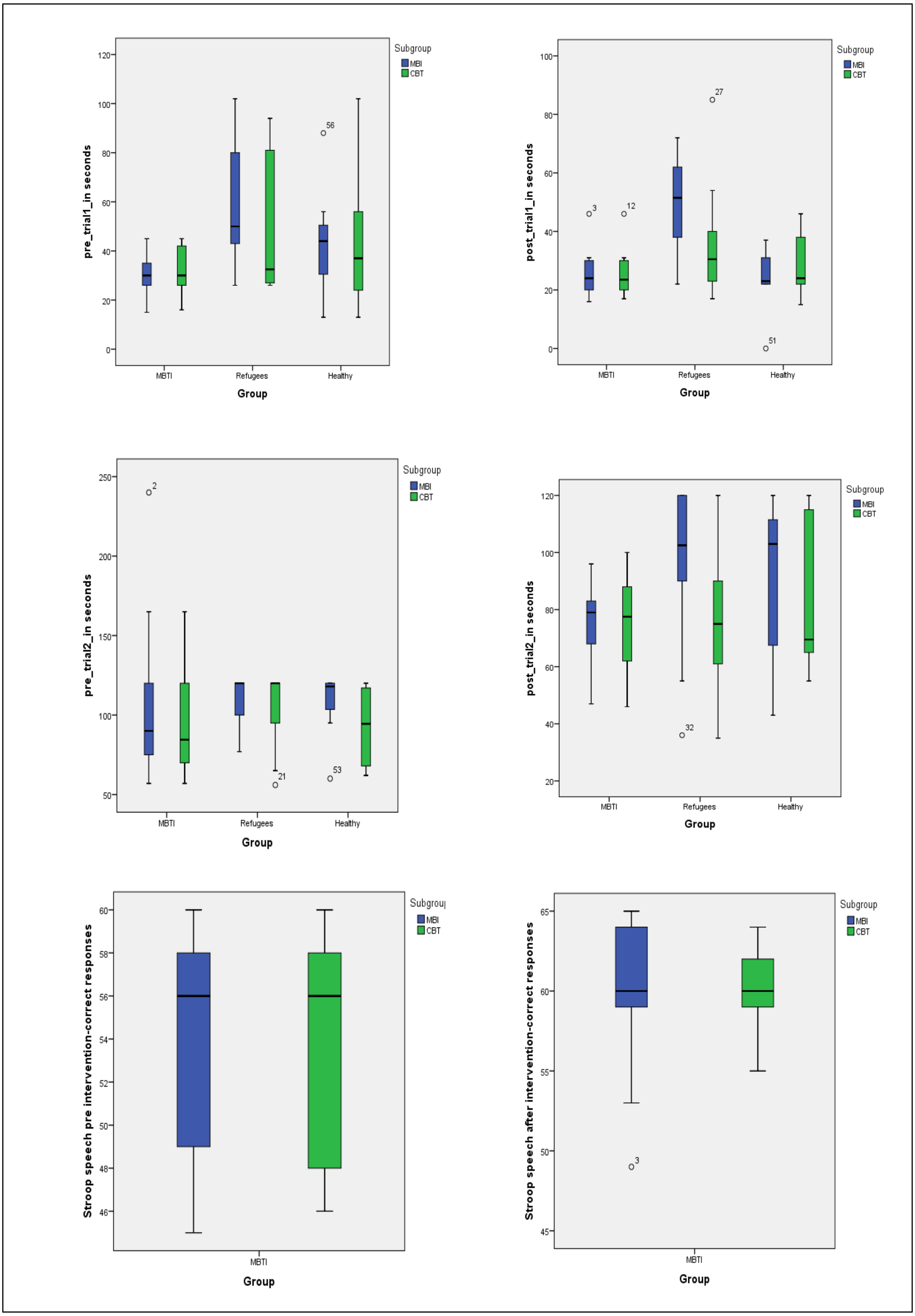
(FFMQ) Test Statistics[a] CBT and MBI PSTD Refugees Patients

	Observed	Observed_R	Describe	Describe_R	Act_w_awareness	Act_w_awareness_R	Nonjudge	Nonjudge_R	Nonreact	Nonreact_R
Mann-Whitney U	43.500	17.000	25.000	26.500	38.500	32.500	34.500	28.500	35.000	42.500
Asymp. Sig. (2-tailed)	.902	.022	.099	.128	.594	.306	.390	.175	.411	.836

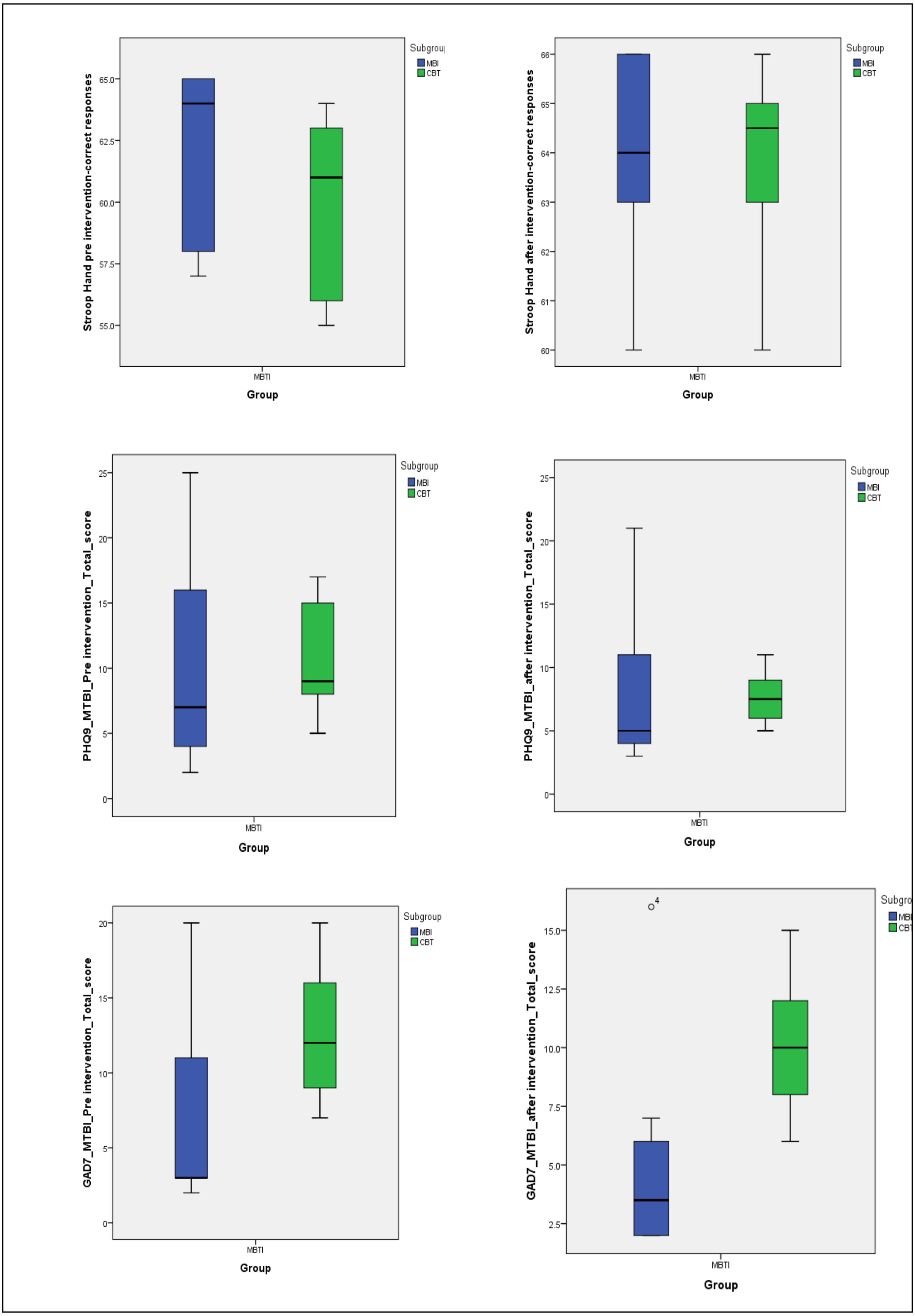
Appendix N

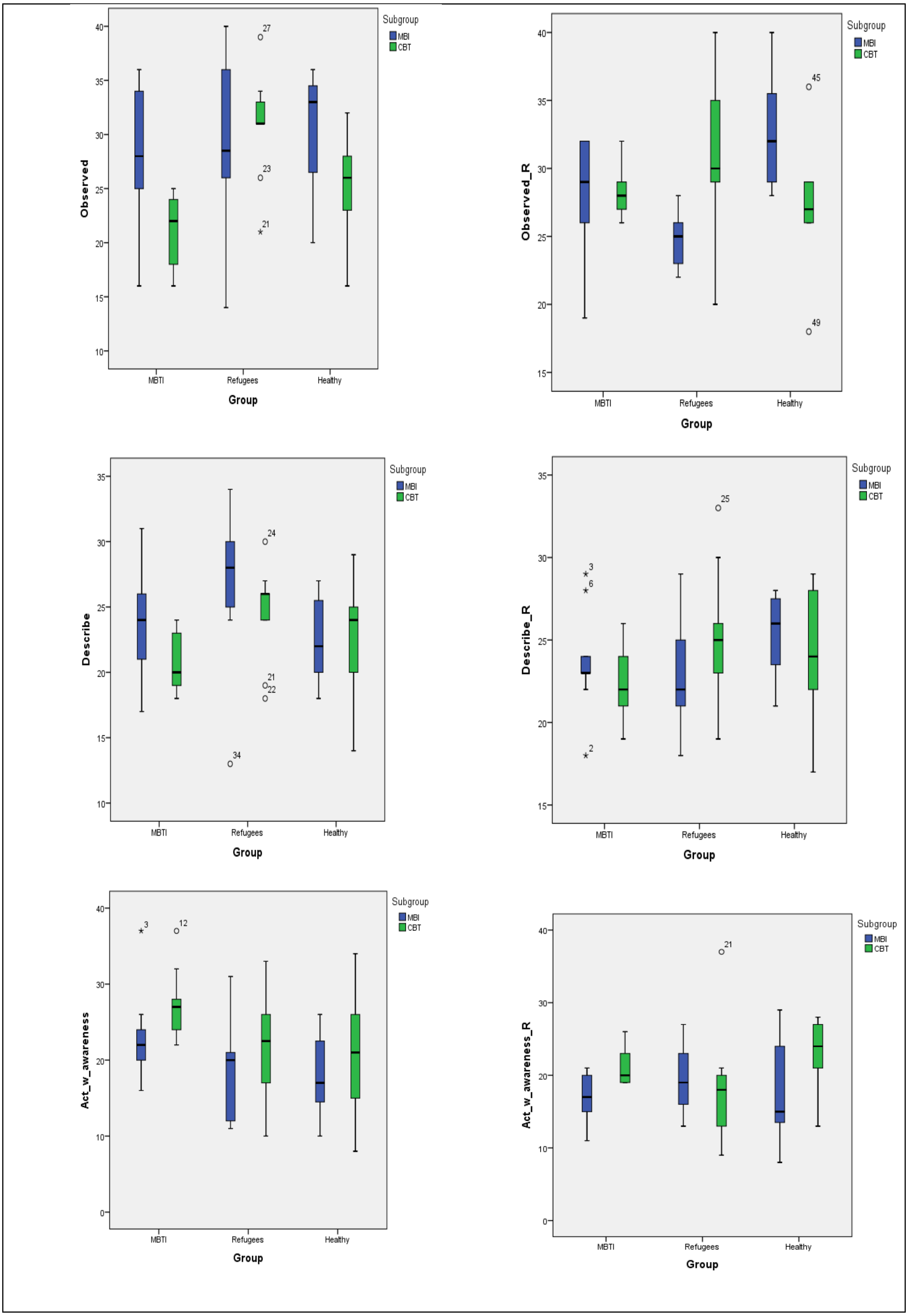
Table 1 Boxplots for Research Groups (Healthy, PSTD, and mTBI) Data for (MBI and CBT) Treatments within All Applied Measurements' Treatments

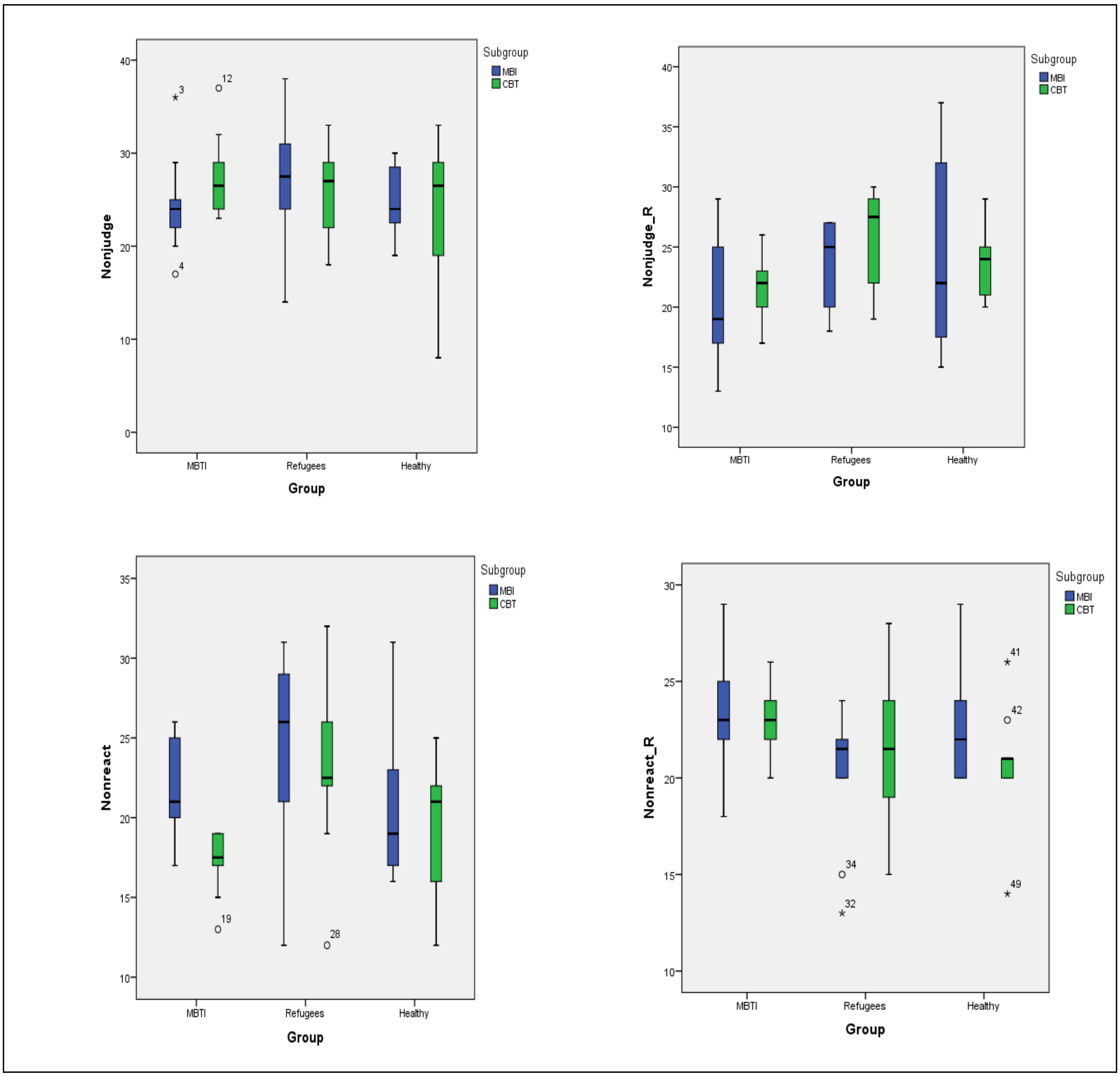




Subgroup
MBI
CBT
pre_trial1_in seconds
0
20
40
60
80
100
120
56
MBTI
Refugees
Healthy
Group
post_trial1_in seconds
0
20
40
60
80
100
3
12
27
51
pre_trial2_in seconds
50
100
150
200
250
2
21
53
post_trial2_in seconds
20
40
60
80
100
120
32
Stroop speech pre intervention-correct responses
46
48
50
52
54
56
58
60
Stroop speech after intervention-correct responses
45
50
55
60
65


Stroop Hand pre intervention-correct responses
Stroop Hand after intervention-correct responses
PHQ9_MTBI_Pre intervention_Total_score
PHQ9_MTBI_after intervention_Total_score
GAD7_MTBI_Pre intervention_Total_score
GAD7_MTBI_after intervention_Total_score
Subgroup
MBI
CBT
MBTI
Group


Observed
Observed_R
Describe
Describe_R
Act_w_awareness
Act_w_awareness_R
Group
MBTI
Refugees
Healthy
Subgroup
MBI
CBT


Nonjudge
Group
MBTI
Refugees
Healthy
Subgroup
MBI
CBT
Nonjudge_R
Nonreact
Nonreact_R