MMPI-2 PROFILES: FIBROMYALGIA PATIENTS COMPARED TO EPILEPTIC AND NON-EPILEPTIC SEIZURE PATIENTS

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We compared MMPI-2 profiles of Gulf War veterans with fibromyalgia (FM) to epileptic seizure (ES) patients, psychogenic non-epileptic seizure (PNES) patients, and Gulf War veteran healthy controls. Both PNES and FM are medically unexplained conditions. In previous MMPI-2 research PNES patients were shown to have significantly higher Hs and Hy clinical scales than ES patients. In the present research the FM group had significantly higher Hs and Hy scale scores than both the ES group and the healthy control group. There was no significant difference between the FM and PNES Hs scale scores; however, the FM Hy scale score was significantly lower than the PNES Hy scale score. Present findings indicate a high level of psychological distress in the FM group.

Keywords: Fibromyalgia; Veterans; MMPI-2.

INTRODUCTION

Fibromyalgia (FM) is characterized by an array of physical and psychological symptoms, including: chronic widespread musculoskeletal pain, un-refreshed sleep, chronic fatigue, morning stiffness, and affective disturbances (Bennet, 1997; Wood et al., 2007). Many FM patients also experience headaches, irritable bowel syndrome, irritable bladder, pelvic pain, restless leg syndrome, cognitive problems (often called “fibro fog”), and sensitivity to noise and temperature. Many patients with fibromyalgia are referred for neuropsychological evaluations and the common complaint of cognitive symptoms among fibromyalgia patients has led to extensive neuropsychological and neurological research of this condition.

The American College of Rheumatology (ACR) defines fibromyalgia as widespread pain (axial pain plus pain in four quadrants) and high sensitivity to pressure at musculo-tendinous junctions, called tender points. To meet diagnostic criteria an individual must report (1) widespread pain and (2) pain in at least 11 of the 18 specified tender points when sufficient pressure (4 kg) is applied (Wolfe et al., 1990). FM is common in both economically developing countries.
such as Mexico, and economic leaders such as the US, suggesting that the condition is not bound by either economic constraint or privilege (White & Harth, 2001). The condition is pervasive, with six million people in the US meeting diagnostic criteria (Wallace & Hallegua, 2001). It has been estimated that 10 billion dollars are spent annually in the US on health care and litigation costs for fibromyalgia patients (Wallace & Hallegua, 2001).

The etiology of fibromyalgia remains unclear and is still heavily debated. As with several other unexplained conditions, including chronic fatigue syndrome and multiple chemical sensitivity (Binder, 2005; Binder & Campbell, 2004), fibromyalgia is a constellation of predominantly physical symptoms with no clear or singular medical explanation. Several articles have reported various pathophysiological abnormalities in fibromyalgia participants, including: an altered EEG pattern (Smythe & Moldofsky, 1977), low levels of serotonin by-products in spinal fluid and high spinal fluid levels of substance P (Vaeroy, Helle, Forre, Kass, & Terenius, 1988), dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis (Dessein, Shipton, Stanwixs, & Joffe, 2000), and dopamine release in the basal ganglia during painful stimulation (Wood et al., 2007).

Brain-imaging studies have indicated several neurological differences between fibromyalgia patients and healthy controls. Studies using single photon emission computed tomography (SPECT) have identified FM patients as having lower regional cerebral blood flow (rCBF), and therefore lower neural activity, than healthy controls in the right and left thalamus and caudate nucleus (Kwiatek et al., 2000; Mountz et al., 1995). Notably, these patterns have also been documented in psychiatric populations (Hakala et al., 2002; Lange, Wang, DeLuca, & Natelson, 1998).

Gracely, Petzke, Wolf, and Clauw (2002) compared the functional magnetic resonance imaging (fMRI) of FM patients and healthy controls. They found that equal subjective reports of perceived pain across the two groups produced similar changes in neural activity across the two groups. But when the objective pressure stimulus was equal across the two groups, the FM patients displayed 13 highly activated brain regions, while the healthy controls only displayed 1 highly activated brain region. Fibromyalgia has also been associated with mild neuropsychological deficits (Hart, Martelli, & Zasler, 2000), but the cause of these deficits has not been identified. Another study shows that when participants with evidence of poor effort were eliminated, there were no differences between fibromyalgia patients and controls (Suhr, 2003).

Other literature suggests a psychological component to fibromyalgia (Garcia, Simön, Durán, Canceller, & Aneiros, 2006; Hassett, Cone, Patella, & Sigal, 2000; Merskey, 2006; Payne et al., 1982; Reich, Johnson, Zautra, & Davis, 2006; Vidal-Zas, 2001). One study found that fibromyalgia patients had a significantly higher lifetime prevalence of mood and anxiety disorders when compared to rheumatoid arthritis patients, a disease of undisputed pathophysiological origin that is also characterized by joint pain (Walker et al., 1997b). In that study 90% of fibromyalgia patients had a prior psychological diagnosis, while less than half of the rheumatoid arthritis patients had prior psychological diagnoses. Another study comparing fibromyalgia and rheumatoid arthritis found that fibromyalgia patients have higher lifetime rates of adult and childhood trauma and victimization than do
rheumatoid arthritis patients (Walker et al., 1997a). In other research 48% of patients referred to a pain center for fibromyalgia also met diagnostic criteria for major depressive disorder (Okifuji, Turk, & Sherman, 2000). Several other findings indicate that fibromyalgia and fibromyalgia severity are associated with a history of psychological trauma and abuse (Aaron et al., 1997; Amir et al., 1997; Nielson & Merskey, 2001).

Minnesota Multiphasic Personality Inventory profiles (MMPI and MMPI-2) of fibromyalgia patients have also been explored. One study found that 88% of a fibromyalgia sample had depressive or psychosomatic profiles consistent with other chronic pain profiles documented in previous research (Ellertsen, Væroy, Endresen, & Forre, 1991). Another study compared fibromyalgia patients, Lyme encephalopathy patients and depressed patients using a battery of psychological and neuropsychological tests, including the MMPI (Kaplan, Meadows, Vincent, Logigian, & Steere, 1992). Findings revealed that fibromyalgia patients scored significantly higher than the other two groups on the \( Hs \) scale.

The Swedish version of the MMPI was used to compare personality features of women with fibromyalgia to women with regional back pain (Trygg, Lundberg, Rosenlund, Timpka, & Gerdle, 2002). In this sample the fibromyalgia group had significantly higher \( Hs, D, \) and \( Hy \) scores than the regional back pain group. The FM group also had four clinical scales with mean T scores over 69 (\( Hs, D, Hy, \) and \( Sc \)), whereas the regional back pain group had no mean T elevations over 69.

Complicating matters, research indicates that MMPI profiles might be heterogeneous across various fibromyalgia populations. Findings from a recent MMPI-2 study indicate that 32% of a fibromyalgia patients adhered to a typical chronic pain profile, while 68% adhered to a typical psychological maladjustment profile (Blasco et al., 2006). Apparently, some fibromyalgia cases include a stronger psychological component than others.

The MMPI and MMPI-2 profiles of other medically unexplained conditions, including psychogenic non-epileptic seizures (PNES), Gulf War unexplained illnesses, and multiple chemical sensitivity, have also been studied (Derry & McLachlan, 1996; Dodrill, Wilkus, & Batzel 1993; Binder et al., 2000; Binder, Salinsky, & Smith, 1994; Binder, Storzbach, & Salinsky, 2006; Storzbach et al., 2000b). Individuals with psychogenic non-epileptic seizures (PNES) have significantly higher elevations in MMPI-2 scales \( Hs \) and \( Hy \) than epileptic seizure patients (ES), indicating a pattern of somatization in the PNES group (Binder et al., 2000; Storzbach, Binder, Salinsky, Campbell, & Mueller 2000a). Particularly high \( Hs \) and \( Hy \) scale scores, as seen in the PNES population, are commonly associated with conversion and somatoform diagnoses (Graham, 1993). This finding is consistent with the conceptualization of PNES as a subgroup of patients with non-epileptic seizures in whom there is (1) no physiological abnormality that can explain the episodes and (2) a probable psychological origin to the episodes (Binder & Salinsky, 2007).

When comparing MMPI-2 profiles of PNES patients to the MMPI-2 profiles of other unexplained illness populations, there have been variable findings. Patients with multiple chemical sensitivity, who were engaged in litigation, were shown to have a similar MMPI-2 profile as the PNES group, with particularly high \( Hs \) and \( Hy \) scale scores (Binder et al., 2006). Gulf War veterans with unexplained
illness also showed diagnostic elevations of clinical scales $H_s$ and $D$; however, these scale elevations were significantly lower than PNES patients (Storzbach et al., 2000b).

The present study compares the MMPI-2 profiles of Gulf War veterans diagnosed with fibromyalgia (FM) to: psychogenic non-epileptic seizure patients (PNES), epileptic seizure patients (ES), and a group of healthy veteran controls. The PNES group was included to provide a comparison to individuals with a medically unexplained illness with probable psychological origin. The ES group was included to provide comparison to individuals with a well-defined physical illness. Lastly, the healthy veteran control group was included to provide a comparison to veteran individuals with no sign of illness. The MMPI-2 was selected because it has been shown to be sensitive to the personality differences between those with somatic illnesses and those with well-defined physical illnesses (Ardiç & Toraman, 2002; Binder & Campbell, 2004; Binder & Salinsky, 2007; Binder et al., 2000; Dodrill et al., 1993; Graham, 1993; Storzbach et al. 2000b; Trygg et al., 2002). Comparison of these four clinical groups will help to determine the extent to which fibromyalgia is psychologically rooted, in the same way that MMPI-2 research on multiple chemical sensitivities cases in the process of litigation suggested a psychological origin for the complaints (Binder et al., 2006).

Previous fibromyalgia research indicates that fibromyalgia is a medically unexplained illness with a strong psychological component; in particular, fibromyalgia may include strong somatic preoccupation over medically unexplained symptoms. This particular psychological pattern has already been demonstrated in another medically unexplained condition called psychogenic non-epileptic seizures. If fibromyalgia does, in fact, share this psychological pattern, fibromyalgia patients and psychogenic non-epileptic seizure patients should share the same MMPI-2 profile reflecting this pattern.

We predicted that: (1) the FM group would display significantly higher $H_s$ and $H_y$ scales than the medically explained ES group and the healthy veteran control group, and (2) the FM group would have similar elevations on $H_s$ and $H_y$ scales to the medically unexplained PNES group.

**METHOD**

**Participants**

There were 196 participants in this study, including 49 Gulf War veterans diagnosed with fibromyalgia (FM), 49 psychogenic non-epileptic seizure patients (PNES), 49 epileptic seizure patients (ES), and 49 Gulf War healthy veteran controls. FM and healthy veteran control participants came from a psychologically heterogeneous sample of Gulf War veterans with unexplained illnesses that was collected in 1995–1997 at the Portland VA Medical Center/Portland Environmental Hazards Research Center (Binder et al., 2000; Storzbach et al., 2000b). Seizure participants (both PNES and ES participants) came from an archival database of seizure patients seen through the epilepsy program of the Oregon Health & Sciences University from approximately 1990 to 1996.
The original Gulf War sample was initiated via a questionnaire that was sent to 2022 randomly selected individuals from a list of military veterans residing in Oregon and Washington who were deployed to the Persian Gulf between September 1, 1990 and August 31, 1991. The questionnaire covered a wide array of symptoms and varied exposure to hazards. A total of 1119 veterans responded to the questionnaire. Respondents were ineligible to participate in the unexplained illness research if they met one or more of several criteria, including: refusal of further contact, being a Vietnam veteran, symptoms predating the Gulf War, living more than 100 miles from the test site, and presence of exclusionary diagnoses. The 32 exclusionary diagnoses included malignancy, schizophrenia, hepatitis, HIV, malaria, diabetes, and other diseases.

Potential cases and controls were invited to participate in the 6- to 8-hour clinical evaluation, which included a physical examination with emphasis on neurological and musculoskeletal systems, health histories specific to the symptoms reported by the participant, blood and urine analyses, and computerized neurobehavioral and psychological tests (Kovera et al., 1996; Storzbach et al., 2000b). Following medical examinations, a clinical case determination committee with representation from the disciplines of neurology, rheumatology, internal medicine, neuropsychology, and epidemiology reviewed all potential cases and controls. Further exclusions were made based on symptom onset, symptom persistence over time, and presence of exclusionary criteria not previously discovered.

The 98 participants (FM and healthy veteran control participants) selected for this research from the Gulf War unexplained illness database (443 veterans total) had also completed clinical evaluations and review by the clinical case determination committee necessary for eligibility in the Gulf War unexplained illness research. The healthy veteran controls did not meet any of the exclusionary criteria stipulated in the larger Gulf War sample and did not present with any unexplained medical symptoms. The FM participants also did not meet any of the exclusionary criteria stipulated in the larger sample. FM participants were diagnosed by a rheumatologist, co-author Andre´ Barkhuizen, M.D. Individuals diagnosed as having fibromyalgia met all of the diagnostic criteria of the condition, as specified by the American College of Rheumatology. This included widespread pain (axial plus 4 quadrant pain on a pain diagram) plus pain in at least 11 of the 18 specified tender points when 4 kg of pressure was applied. Additionally, none of these patients had other rheumatic disorders evident on clinical evaluation or laboratory screening.

Seizure participants (49 PNES and 49 ES participants) were selected from the archival database of seizure patients seen through the epilepsy program of the Oregon Health & Sciences University. Seizure patients were diagnosed by an epileptologist, co-author Martin Salinsky, M.D., using the gold-standard objective test method of EEG videotelemetry monitoring. Patients with possible frontal lobe seizures were excluded based on the semiology of the episodes, as such seizures can be electrographically silent (Quesney, 1987). Epileptic seizure patients (ES) were diagnosed using standard criteria, with definite electrographic evidence of seizures. Psychogenic non-epileptic seizure patients (PNES) met the following standard criteria: (a) minimum of two spells captured on EEG and videotape, (b) spells were judged to be typical of habitual episodes, (c) EEG remained normal (unchanged
from baseline) throughout the episodes, (d) EEG did not show interictal epileptiform activity, (e) clinical appearance of the episode was atypical of ES, (f) positive evidence of the appearance of altered consciousness and/or bilateral motor activity during the episodes. Criterion (e) was included to reduce the possibility of misclassifying patients with partial seizures of frontal lobe origin as having PNES (Binder et al., 2000).

As shown in Table 1, the four clinical groups did not differ in age ($F = 0.032$, $p = .992$) or education ($F = 0.818$, $p = .486$); however, the groups were not equivalent in proportions of males and females. The proportions of males in the four groups were: ES 53%, PNES 34.7%, FM 63.3%, and Healthy controls 83.7%.

### Assessment measures

Gulf War veterans who participated in this study, specifically the FM and healthy control participants, completed the first 370 items of the MMPI-2 as part of a computer-based battery of psychological and neuropsychological measures (Campbell et al., 1999; Kovera et al., 1996). Seizure patients who participated in this study, specifically the ES and PNES participants, completed the full 567-item version of the MMPI-2 as part of a neuropsychology battery (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989; Graham, 1993).

The abbreviated administration given to the FM and healthy control groups contained all of the data necessary to apply traditional correlates for MMPI clinical and validity scales. However, it did not include all of the necessary items to interpret validity scales—such as TRIN and VRIN—or several other supplementary and content scales that are specific to the MMPI-2. As such, we have only provided analyses of the traditional clinical and validity scale scores across the four clinical groups.

### RESULTS

As shown in Table 2 and Figure 1, the groups differed in mean MMPI-2 profiles. The healthy veteran control group and the ES group had no clinical scales with mean T-scores of 65 or greater, indicating that both groups can be viewed as having non-diagnostic profiles (Graham, 1993). Both the PNES and the FM
**Table 2** Means and standard deviations for Minnesota Multiphasic Personality Inventory (MMPI-2) validity and clinical scale scores

<table>
<thead>
<tr>
<th>MMPI-2 scales</th>
<th>ES patients</th>
<th>PNES patients</th>
<th>FM patients</th>
<th>Healthy controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEANS</td>
<td>SD</td>
<td>MEANS</td>
<td>SD</td>
<td>MEANS</td>
</tr>
<tr>
<td>L</td>
<td>58.04d</td>
<td>54.31</td>
<td>10.40</td>
<td>53.45d</td>
</tr>
<tr>
<td>F</td>
<td>58.55d</td>
<td>63.16d</td>
<td>18.54</td>
<td>62.24d</td>
</tr>
<tr>
<td>K</td>
<td>51.69c,d</td>
<td>47.92d</td>
<td>10.82</td>
<td>45.04a,d,c,d</td>
</tr>
<tr>
<td>Hs</td>
<td>62.30b,c,d</td>
<td>74.16a,cd</td>
<td>12.76</td>
<td>75.37a,b,c,d</td>
</tr>
<tr>
<td>D</td>
<td>62.86c,d</td>
<td>65.9d</td>
<td>11.56</td>
<td>68.57a,b,c,d</td>
</tr>
<tr>
<td>Hy</td>
<td>61.27b,c,d</td>
<td>76.16a,b,c,d</td>
<td>13.52</td>
<td>69.3ga,b,c,d</td>
</tr>
<tr>
<td>Pd</td>
<td>56.61d</td>
<td>57.55d</td>
<td>12.70</td>
<td>58.08d</td>
</tr>
<tr>
<td>Mf</td>
<td>52.2d</td>
<td>49.94</td>
<td>10.33</td>
<td>51.35d</td>
</tr>
<tr>
<td>Pa</td>
<td>53.96b,c,d</td>
<td>60.33a,b,c,d</td>
<td>16.95</td>
<td>61.27a,b,c,d</td>
</tr>
<tr>
<td>Pr</td>
<td>60.61d</td>
<td>63.53d</td>
<td>13.19</td>
<td>64.39d</td>
</tr>
<tr>
<td>Sg</td>
<td>64.35b,d</td>
<td>69.55a,b,c,d</td>
<td>15.26</td>
<td>68.86d</td>
</tr>
<tr>
<td>Ma</td>
<td>57.35d</td>
<td>59.82a,b,c,d</td>
<td>11.63</td>
<td>53.78b,c,d</td>
</tr>
<tr>
<td>Si</td>
<td>53.08c</td>
<td>52.53c</td>
<td>11.54</td>
<td>58.61a,b,c,d</td>
</tr>
</tbody>
</table>

Means and standard deviations for Minnesota Multiphasic Personality Inventory (MMPI-2) validity and clinical scale scores of epileptic seizure patients (ES), psychogenic non-epileptic seizure patients (PNES), fibromyalgia patients (FM), and healthy controls. Means with subscripts are significantly different from one or more groups at $p < .05$. aSignificantly different from ES. bSignificantly different from PNES. cSignificantly different from FM. dSignificantly different from healthy controls.

**Figure 1** MMPI-2 profiles of epileptic seizure patients (ES), psychogenic non-epileptic seizure patients (PNES), fibromyalgia patients (FM), and healthy controls.
groups displayed mean T-score elevations greater than or equal to 65 on several of the clinical scales, indicating diagnostic profiles in both groups. Specifically, both groups had mean T-score elevations greater than or equal to 65 on the following clinical scales: Hs, D, Hy, and Sc.

MMPI-2 clinical and validity scales were compared with analysis of variance and modified least significant difference post hoc tests ($p < .05$). The FM, ES, and PNES groups all had significantly higher mean scale scores than the healthy veteran control group on clinical scales Hs, D, Hy, Pd, Pa, Pt, Sc, and Ma. The largest difference between the three illness groups was found between the PNES and ES groups on scale Hy, where the PNES group mean was 14.94 points higher than the ES group mean ($p < .001$). The groups also differed on validity scales. The FM, ES and PNES groups all had significantly higher elevations on validity scale F than the healthy veteran control group.

As shown in Table 2, the FM group showed significantly higher mean scores than the healthy veteran control group on all 10 of the MMPI-2 clinical scales. The most significant differences between FM and healthy control scale elevations, using Cohen’s $d$ effect size, were seen on scales Hs ($d = 3.65$, $p < .001$), D ($d = 1.98$, $p < .001$), Hy ($d = 3.73$, $p < .001$), Pt ($d = 2.05$, $p < .001$), and Sc ($d = 2.40$, $p < .001$). FM patients also had significantly higher mean scores than ES patients on scales Hs, D, Hy, Pa, and Si. The most significant of these differences, using Cohen’s $d$ effect size, were seen on scales Hs ($d = 1.18$, $p < .001$) and Hy ($d = .75$, $p = .001$). FM patients were also significantly higher than PNES patients on Scale Si; however they were significantly lower than PNES patients on scales Hy and Ma. FM patients did not have a significantly different mean elevation than PNES patients on Scale Hs.

Despite a difference in Hy scale scores between the FM and PNES groups, both groups displayed a mean MMPI-2 profile code-type of 132/312. The 132/312 code-type, sometimes referred to as “conversion V,” is associated with physical symptoms with no known medical origin and somatoform pain disorder (Graham, 1993). This finding suggests that the individuals in the FM and PNES groups present with medically unexplained symptoms. Nevertheless, it is noted that given the lower elevation on Scale Hy, the individuals in the FM group show less distress about physical symptoms than the PNES group. In contrast, the level of somatic concerns, indicated by the Hy scale, is significantly higher in the FM group than in the ES and healthy control groups (Graham, 1993).

Symptom Validity Scale scores (FBS scores; Lees-Haley, 1992; Lees-Haley, English, & Glenn, 1991) were also inspected for all four groups. Actual FBS raw scores for all groups were not available because FM and healthy veteran control participants completed only the first 370 MMPI-2 items. Instead, FBS scores were estimated (FBS-E) using linear regression from the clinical and validity scales, thereby equating for the reduced number of MMPI-2 FBS items administered in the 370-item version (Larrabee, 1998, 2003; Nelson, Parsons, Grote, Smith, & Sisung, 2006). Using cutoff scores (Greiffenstein, Baker, Axelrod, Peck & Gervais, 2004; Larrabee, 2003; Lees-Haley, 1992; Lees-Haley et al., 1991) of 24 and above for males and 26 and above for females: 2 (4%) ES patients, 17 (34.7%) PNES patients, 15 (30.6%) FM patients, and 0 healthy control patients had FBS scores that were
Table 3 ANOVA for Symptom Validity Scale scores (FBS)

<table>
<thead>
<tr>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>3856.96</td>
<td>3</td>
<td>1285.65</td>
<td>65.46</td>
</tr>
<tr>
<td>Within groups</td>
<td>3771.02</td>
<td>192</td>
<td>19.64</td>
<td></td>
</tr>
</tbody>
</table>

ANOVA for Symptom Validity Scale scores (FBS) of epileptic seizure patients (ES), psychogenic non-epileptic seizure patients (PNES), fibromyalgia patients (FM), and healthy controls.

Table 4 Post-hoc T-tests comparing Symptom Validity Scale scores (FBS)

<table>
<thead>
<tr>
<th>Group</th>
<th>Group</th>
<th>Mean difference</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES</td>
<td>PNES</td>
<td>−5.26</td>
<td>0.90</td>
<td>.000</td>
</tr>
<tr>
<td>FM</td>
<td>−4.60</td>
<td>0.90</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Healthy controls</td>
<td>5.83</td>
<td>0.90</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>PNES</td>
<td>ES</td>
<td>5.26</td>
<td>0.90</td>
<td>.000</td>
</tr>
<tr>
<td>FM</td>
<td>0.65</td>
<td>0.90</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Healthy controls</td>
<td>11.08</td>
<td>0.90</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>FM</td>
<td>ES</td>
<td>4.60</td>
<td>0.90</td>
<td>.000</td>
</tr>
<tr>
<td>PNES</td>
<td>−0.65</td>
<td>0.90</td>
<td>1.000</td>
<td></td>
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<tr>
<td>Healthy controls</td>
<td>10.43</td>
<td>0.90</td>
<td>.000</td>
<td></td>
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<tr>
<td>Healthy controls</td>
<td>ES</td>
<td>−5.83</td>
<td>0.90</td>
<td>.000</td>
</tr>
<tr>
<td>PNES</td>
<td>−11.08</td>
<td>0.90</td>
<td>.000</td>
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<tr>
<td>FM</td>
<td>−10.43</td>
<td>0.90</td>
<td>.000</td>
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</tbody>
</table>

Post-hoc T-tests comparing Symptom Validity Scale scores (FBS) of epileptic seizure patients (ES), psychogenic non-epileptic seizure patients (PNES), fibromyalgia patients (FM), and healthy controls. A negative mean difference indicates that the group in the first column was lower than the group in the second column.

Figure 2 Mean FBS scores of epileptic seizure patients (ES), psychogenic non-epileptic seizure patients (PNES), fibromyalgia patients (FM), and healthy controls.
above these cutoffs. FBS scores above 28 indicate very significant concerns about validity (Greiffenstein, Fox, & Lees-Haley, 2007). No (0%) ES patients, 5 (10%) PNES patients, 5 (10%) FM patients, and no (0%) healthy controls had FBS scores above 28.

As shown in Table 3, the groups differed in mean FBS scores. Mean FBS scores were as follows: FM group (21.58), PNES group (22.23), ES group (16.97), and the healthy control group (11.15). FBS scores were compared with analysis of variance and Bonferroni post hoc tests ($p < .05$). Table 4 illustrates that the FM group had a significantly higher mean FBS score than the ES and healthy control groups, but there was no significant difference in mean FBS scores when comparing the FM group to the PNES group. Figure 2 illustrates the comparison between mean FBS scores in these four groups.

**DISCUSSION**

We predicted that: (1) the FM group would be significantly higher in scales $Hs$ and $Hy$ than the medically explained ES group and the healthy veteran control group, and (2) the FM group would have similar elevations on clinical scales $Hs$ and $Hy$ to the medically unexplained PNES group. Overall, our findings support this expectation. The FM group displayed significantly higher mean scores on several clinical scales when compared to the ES and healthy control groups. The most significant of these differences in scale scores were on scales $Hs$ and $Hy$. As predicted, the FM group and the PNES group displayed statistically similar elevations on clinical scale $Hs$. Contrary to our expectations, the FM group was significantly lower than PNES group on mean scale scores for $Hy$. Despite this difference both the FM and PNES group display the same MMPI-2 code-type of 132/312, indicating that both groups present with medically unexplained symptoms and high distress about their physical symptoms, albeit with the FM group showing less somatic concern than the PNES group.

It remains unclear why the FM group displayed lower $Hy$ scores than the PNES group. One theory is that these findings are consistent with the less dramatic clinical presentation of fibromyalgia patients when compared to psychogenic nonepileptic seizure patients. Another theory is that $Hy$ presentation in the FM group was somehow shaped by the fact that all fibromyalgia participants were Gulf War veterans. Previous MMPI and MMPI-2 research for fibromyalgia patients have mixed results in terms of $Hy$ scores. While the majority of these findings indicate clinically significant elevations on the $Hy$ scale for fibromyalgia patients, these elevations still vary greatly. One study found mean scale scores for a fibromyalgia sample to be 62±9.8 (females) 64±10.4 (males), which is consistent with the present findings (Ardiç & Toraman, 2002). Other research indicates much higher mean $Hy$ scores for fibromyalgia samples, with mean scores ranging from 72.2 to 114.3 (Blasco et al., 2006; Gerson & Fox, 2003; Trygg et al., 2002; Vaerøy et al., 1988).

The present study was not designed to determine if there are pathophysiologic explanations for fibromyalgia in Gulf War veterans or to address the cause of the psychological distress and physical complaints of this group. Rather, it was designed to compare psychological manifestations in a sample of veterans with fibromyalgia.
to the psychological manifestations of psychogenic non-epileptic and epileptic seizure cases. MMPI-2 profiles of Gulf War veterans with fibromyalgia more closely resembled the MMPI-2 profile of psychogenic non-epileptic seizure cases than they did the epileptic seizure cases. This finding indicates that fibromyalgia cases show similar psychological manifestations to those found in cases where there is a likely somatoform disorder and dissimilar psychological manifestations to cases where there is a medically explained neurological disorder. This pattern of finding suggests that there is a significant psychological component to fibromyalgia.

Present findings need to be replicated among diverse populations. Our fibromyalgia sample consisted of Gulf War veterans only, and therefore does not indicate whether these results can be generalized to non-veteran fibromyalgia patients, although previous research indicates that this is highly likely (Ahles, Yunus, Gaulier, Riley, & Masi, 1986; Ardiç & Toraman, 2002; Blasco et al., 2006; Ellertsen et al., 1991; Gerson & Fox, 2003; Kaplan et al., 1992; Landro, Isdal, Lillegård, & Winnem, 1992; Trygg et al., 2002). Our FM participants, unlike our PNES and ES cases, were not drawn from archival patient databases. We do not know how many FM participants were seeking compensation from the Department of Veterans Affairs for their symptoms at the time of the study. Research into multiple chemical sensitivities—another medically unexplained condition—shows higher MMPI-2 elevations in a group seeking compensation for their symptoms than for a group who were not seeking compensation (Binder et al., 2006; Fiedler, Kipen, DeLuca, Kelly-McNeil & Natelson, 1996). Finally, our FM group was 63.3% male, while typically fibromyalgia occurs more often in women than in men (Godfrey & Mackey, 2008). T-tests for equality of means revealed no significant gender differences in the FM group on clinical scales Hs, D, Hy, Pd, Pa, Pt, and Si, however gender differences were found on clinical scales Mf, Sc, and Ma (p < .05, p < .05, and p < .01 respectively). There may be MMPI-2 profile differences between various FM samples associated with gender.

Future research in this area would also benefit from more detailed analysis of MMPI-2 response patterns across groups. Present data did not include MMPI-2 subscale values. The MMPI-2 was administered to the Gulf War veteran sample (the FM and healthy control groups) via the Health Screening System (HSS), a computerized test administration system (Kovera et al., 1996). HSS software only calculates scores for the primary scales using the first 370 items of the MMPI-2 and does not support calculations of subscales. Examination of Harris-Lingoes subscales for Hy may have been particularly useful in determining contributing factors to the significant difference in Hy elevations between the FM and PNES groups. Future research should address this possibility.

Finally, only the first 370 items on the MMPI-2 were given to the FM and healthy control participants, whereas the full 567-item version of the MMPI-2 was given to the ES and PNES participants. The abbreviated administration given to the FM and healthy control groups contained all of the data necessary to apply traditional correlates for MMPI clinical and validity scales; however, it did not include all items needed to interpret supplementary, content, and validity scales that are specific to the MMPI-2 (Butcher & Hostetler, 1990). For example, due to our use of the 370-item version in the FM and healthy control groups, we were unable to compare “variable response inconsistency” and “true response inconsistency”
across groups. As such, our interpretation of response style across groups is limited. Despite these limitations, this abbreviated item-administration approach is thought to be the least risky of the item-reduction approaches for obtaining traditional MMPI information (Butcher & Hostetler, 1990).

REFERENCES


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