ASSOCIATIONS BETWEEN POSTTRAUMATIC STRESS SYMPTOMATOLOGY AND LIFESTYLE FACTORS

A thesis presented to the faculty of the Graduate School of Western Carolina University in partial fulfillment of the requirements for the degree of Master of Arts in Psychology

By

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ABSTRACT

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The current study examines the potential associations between symptoms accompanying Posttraumatic Stress Disorder (PTSD) and key lifestyle variables, including sleep components, nutrition, and general physical fitness. The purpose of this study is to determine if there are associations between the lifestyle variables of nutrition, sleep components, and physical fitness levels and PTSD-related symptomatology. Rather than relying on a dichotomous/categorical definition of PTSD as represented, for example, in the DSM-5,] this syndrome will be operationalized using relevant symptom constructs based on current dimensional models of psychopathology. The sample of 288 participants filled out a Consent Form, the MMPI-2-RF, the Pittsburgh Sleep Quality Index, a nutrition survey, a fitness survey, and demographic information. A canonical correlation analysis was conducted using the three lifestyle variables as predictors of the 4 posttraumatic stress dysfunction variables to evaluate the multivariate shared relationship between the two variables sets. The full model was statistically significant with a Wilk's λ of .741, F (12, 632.63) = 6.300, $p < .000$. After reviewing previous research and the findings of this study, it is speculated that the symptoms associated with PTSD have consequences on one's daily lifestyle health behaviors and/or that the way one lives in terms of

their health can make posttraumatic stress worse or better depending on directionality. Therefore, by altering one's lifestyle behaviors to create habits consistent with healthy levels of sleep, fitness, and nutrition it is possible that the intensity and duration of PTSD symptoms can be reduced.

CHAPTER ONE INTRODUCTION

The current study examines the potential associations between symptoms accompanying Posttraumatic Stress Disorder (PTSD) and key lifestyle variables, including sleep components, nutrition, and general physical fitness. PTSD affects a number of people following trauma and can present itself in various ways. In some cases, emotional or behavioral symptoms are most salient, while in others negative cognitions and anhedonia are more compelling symptoms (American Psychiatric Association, 2013). No matter how the symptoms present themselves, the effects of PTSD on the individual's life are substantial. Within the United States, rates of lifetime risk of PTSD are between 7.8% and 8.7% and the yearlong prevalence among adults is 3.5% (American Psychiatric Association, 2013; Jeffreys, Capehart, & Friedman, 2012). The population with the highest rates of PTSD, ranging from one-third to one-half of all exposed, are survivors of rape, military combat and captivity, and ethnic or political genocide (American Psychiatric Association, 2013; Iribarren, Prolo, Neagos, & Chiappelli, 2005; Jeffreys et. al., 2012). Females are more likely to develop PTSD even though they are not more likely than males to undergo trauma (Tolin & Foa, 2006; Torchalla et al., 2014.) PTSD is relatively prevalent in the veteran population, with over 500,000 veterans diagnosed in 2011 (American Psychiatric Association, 2013; Hawkins, 2015). Numerous people have to cope with symptoms of this disorder as part of their daily life.

PTSD Implications on Work, School, and Personal Adjustment

There are several negative consequences of Posttraumatic Stress Disorder on an individual's well-being, their ability to create a successful future, and their ability to sustain positive interpersonal relationships. For example, PTSD has been found to affect one's ability to reach their potential both academically and occupationally (American Psychiatric Association,

2013). Ness, Middleton, and Hildebrandt (2015) studied 214 veterans who were students at five different institutions. They found that PTSD symptoms were significantly associated with lower self-efficacy for learning, lower levels of persistence during academic work, and dysfunctional goal orientation. Another study, with 1,002 participants, found that students who had developed PTSD in their first year at college had a lower GPA and experienced more negative consequences deriving from alcohol use (Bachrach & Read, 2012). Boyraz, Granda, Baker, Tidwell, and Waits (2016) also found that PTSD was related to GPA. They found that 12.4% of their 928 participants had PTSD. Those with PTSD had lower levels of effort regulation. This had a significant indirect effect on second year enrollment through first year GPA (Boyraz et al., 2016). Boyraz, Horne, Owens, and Armstrong (2013) completed a study with 569 participants, of which 74% reported experiencing a trauma and 20.6% had PTSD. They found that an increased level of PTSD symptomatology was associated with exiting college prior to the end of the sophomore year; however, this finding was only significant for females.

In addition to academics, PTSD symptomatology is related to relationships with others and with oneself. Taft, Watkins, Stafford, Street (2011) completed a meta-analysis of 31 studies and found that there was a stronger correlation between PTSD severity and relationship discord in veterans and their partners compared to civilian partners. One study of 287 couples found that PTSD was associated with more presentations of hostility and mental/emotional abuse, as well as fewer expressions of acceptance and humor, in both the person with PTSD and with their partners (Miller et al., 2013). Byrne and Riggs (1996) studied 50 couples and found that those couples that included an individual with PTSD were more likely than couples with no presence of PTSD to express aggression in the relationship. Leifker, White, Blandon, and Marshall (2015) also studied couples and found that for those with PTSD, the receipt of intimacy was related to

increased negative emotions, chiefly fear, and the expression of intimacy was connected to decreased negative emotions. In relation to the effect PTSD can have on one's self evaluation, Dyer, Borgmann, Kleindienst, and colleagues (2013) completed a study with 84 females who were suffering from childhood sexual trauma and found that those with PTSD had significantly worse body images than those without PTSD. Another study of survivors of sexual assault with PTSD found that perceptions of self-image and self-concept on certain body areas, such as the inner thighs and pubic region, were significantly associated with strong negative emotions including guilt, shame, disgust, and anger (Dyer, Feldmann, & Borgmann, 2015).

PTSD Consequences on Health

Not only does PTSD have significant effects on wellbeing and interpersonal relationships, but also on one's health due to the various ways in which the disorder causes dysfunction. PTSD is known to have a high comorbidity with substance use disorders (SUD) (American Psychiatric Association, 2013; Lynch et al., 2014; Petrakis, Rosenheck, & Desai, 2011). PTSD's high comorbidity with substance use and abuse affects not only lifestyle, but health as well. Bowe and Rosenheck (2014) studied a sample of 638,451 veterans, of whom 21% had a duel diagnosis of substance abuse disorder and PTSD. Those who were dually diagnosed were more likely to be homeless and to have a history of in-patient mental health treatment than those without both PTSD and a substance use disorder. The dual-diagnosed were also more likely than those without dual diagnoses to have a seizure disorder, liver disease, and HIV (Bowe & Resenheck, 2014). Another study found that SUD and PTSD dual diagnosis and PTSD alone were associated with homelessness more in females than males (Torchalla, Strehlau, Linden, Noel, & Krausz, 2014). Meier and colleagues (2014) found that prescription opioid use was significantly related to PTSD symptom severity. This finding was three times more

significant among females than males. Meier and colleagues (2014) also found that the use of prescription opioids in combination with sedatives or cocaine was also related to PTSD severity and that 18 to 34-year olds were at a higher risk of misuse than were people 35 and older. Hawkins (2015) completed an in-depth evaluation at the use of benzodiazepine and opioids in relation to PTSD. He discussed how these medications are commonly prescribed to PTSD patients as a way to help treat anxiety, sleep problems, and pain, and that these medications taken for long period of time, either together or separately, are very dangerous. These medications are related to overdoses, fall-related injuries, vehicular accidents, and deterioration of the respiratory system. Hawkins (2015) found that 16% of veterans with PTSD are co-prescribed benzodiazepines and opioids, and long-term use is increasing over time. Hawkins (2015) stated that long-term use of both medications went from 3.6% in 2003 to 52.7% in 2011. In his sample of 66,210 participants, Hawkins (2015) found that opioid use disorder increased from 2003 to 2011, whereas alcohol, stimulant, and other drug use disorders decreased.

PTSD demonstrates consequences on physical health in many ways in addition to substance use, some of which include obesity and cardiovascular concerns. Sixty-seven percent of veterans with PTSD suffer from chronic diseases as compared to 48.6% of veterans without PTSD (Bedi & Rohit, 2007). A Veteran's Affairs database of outpatient care was used in one study that found that women with PTSD had 7 medical conditions on average as compared to the 4.5 without PTSD and that men with PTSD had an average of 5 medical conditions as compared to 4 among those without PTSD (Frayne et al., 2010). One study found that rates of obesity were 24.1% in people without PTSD and 32.6% in people with PTSD (Pagoto et al., 2012). The same study also found no gender differences in the rates of obesity based on PTSD diagnosis, whereas two other studies found that PTSD leads to an increase in becoming overweight or obese

particularly in women (Mitchell et al., 2013; Pagoto et al., 2012; Suliman et al., 2016). Smith, Tyzik, Neylan and Cohen (2015) completed a study with 380 participants under 60 years old and 365 participants over 60 years old and found that PTSD was associated with being overweight and obese, particularly in older adults. Bedi and Rohit (2007) found that patients with PTSD suffer from increased resting heart rate, blood pressure, and startle response. The same study also found that sexual assault survivors, combat veterans, and survivors of vehicular accidents who had developed PTSD have shown greater physiological reactivity compared to those who underwent the same trauma without meeting PTSD criteria (Bedi & Rohit, 2007). Wolf and Schnurr (2016) found that PTSD is associated with an increased risk of cardio-metabolic health problems produced from both behavioral and biological reasons, including poor sleep, cigarette use, poor diet, autonomic reactivity, and inflammation. Chwastiak, Rosenheck, and Kazis (2011) corroborated this finding when their study also found that veterans with PTSD are more likely to have multiple poor health behaviors of which increase cardiovascular risk. Another study found that PTSD was associated with increased odds of developing a cardiac condition such as hypertension, angina, and tachycardia (Pietrzak, Goldstein, Southwick, & Grant, 2012).

In addition to obesity and cardiovascular concerns, PTSD has been found to have other effects on health. Bedi and Rohit (2007) found that patients with PTSD have higher rates of somatic complaints than those without PTSD and that burn victims with PTSD have a lower pain tolerance than those without PTSD. Zen, Whooley, Zhao, and Cohen (2012) found those with PTSD are more likely to forget or skip medications and also have a greater history of smoking than those without PTSD. Frayne and colleagues (2010) assessed 20 different health concerns comparing those with PTSD to those without; they found that all 20 health conditions were more common in the with PTSD condition, including obesity, headaches, hearing and seeing problems,

upper respiratory infections, joint disorders and injuries, sleep disturbances, and urinary tract infections. O'Toole and Catts (2008) found that veterans with PTSD were more likely to have greater health service usage, more days off of work, more stomach, pain, and tranquilizer medications, more likely to have asthma, digestive diseases, eczema, back and other musculoskeletal diseases, endocrine conditions, hypertension, and arthritis than non-PTSD veterans. It is apparent from the above studies that PTSD can be detrimental to the wellbeing and health of those who suffer from it.

PTSD Relationships with Sleep, Nutrition, and Fitness

The focus of this study is specifically on the associations between PTSD and nutrition, sleep, and fitness levels as potential moderators between PTSD and the multitude of health problems described above. While there is significant prior research regarding the influence of PTSD on sleep, less research exists regarding PTSD's relations to physical activity, and even less on the relationship of PTSD to nutrition. A study of 143 participants who went through the 1995 Hanshin earthquake in Japan at 3 and 8 weeks following the incident found that sleep disturbance was the most reported symptom at both the 3 and 8 week follow-ups (Kato et al., 1996). Some ways in which PTSD and sleep affect each other are through sleep onset, nightmares, body movement during sleep, and sleep-disordered breathing. Ohayon and Shapiro (2000) found that participants with PTSD had more difficulty getting to sleep (41%) than those without PTSD (13%). Forty-four percent of veterans with PTSD in one study reported issues with the onset of sleep either "sometimes" or "very frequently" compared to 6% of veterans without PTSD and 5% of civilians (Neylan, Marmar, Metzler et al., 1998). In the same study, 52% of veterans with PTSD experienced nightmares compared to the 5% without PTSD and 3% of civilians (Neylan et al., 1998). Ohayon and Shapiro (2000) also found that 19% of those with

PTSD reported having nightmares compared to 4% without PTSD. Another study found that female physical and sexual assault survivors with PTSD reported having nightmares an average of five times a week (Krakow et al., 2002). Inman, Silver, and Doghramji (1990) assessed 35 veterans with PTSD and 37 without PTSD but with insomnia. No differences were found in regards to insomnia; however, those with PTSD were more likely to wake up with covers off, restless legs, and excessive body movement during sleep. Sleep-disordered breathing was linked to severe PTSD in female sexual assault survivors and crime victims (Krakow, Germain, &Tandberg, 2000; Krakow, Melendrez, Pedersen, et al., 2001). A case study of a 42-year old veteran with PTSD and sleep apnea showed that when sleep apnea was treated, the PTSD symptoms decreased (Youakim, Doghramji, & Schutte, 1998). Krakow and colleagues (2000) found that when given treatment for sleep-disordered breathing, those with PTSD had a 75% improvement in symptoms of PTSD and those with no treatment had a 43% worsening of PTSD symptoms.

Even though obesity was previously discussed as a health outcome associated with PTSD, it is important to also focus on physical activity and fitness as potential moderators. Zen and colleagues (2012) found that those with PTSD were more likely to report physical inactivity. Thirty-two participants were enrolled in a 2-week aerobic exercise program; results showed it was effective in reduction of PTSD symptoms of avoidance, in regard to anything which caused memories, flashbacks, or recollections of the trauma, hyperarousal, and with general anxiety, physical, and social symptoms of anxiety (LeBouthillier, Fetzner, & Asmundson, 2015). Even though the previous study found fitness as an effective treatment for PTSD, another study found that veterans with PTSD had poorer weight loss outcomes as compared to those without PTSD

when assessing the Veteran's Affairs national MOVE! weight management program (Hoerster et al., 2014).

The research on the relationship between PTSD and nutrition is severely lacking. Some research does suggest that poor nutrition can exacerbate mental illness, and there are suggestions that improved nutrition (i.e., increases in essential vitamins and minerals) can contribute to treatment (Korn, 2016). Mitchell and Wolf (2016) found that PTSD correlated positively with eating disorder symptoms and food addiction.

The purpose of this study is to determine if there are associations between the lifestyle variables of nutrition, sleep components, and physical fitness levels and PTSD-related symptomatology. Rather than relying on a dichotomous/categorical definition of PTSD as represented, for example, in the DSM-5,] this syndrome will be operationalized using relevant symptom constructs based on current dimensional models of psychopathology. The study will specifically be using dimensional measures in the Minnesota Multiphasic Personality Inventory – 2 – Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011). Previous research by Ricketts, Haugh, and McCord (2016) found that eight of the MMPI-2-RF clinical scales were significantly correlated with the PTSD diagnosis: EID (Emotional/Internalizing Dysfunction) measures a broad range of emotional and internalizing problems such as sadness, anhedonia, hopelessness, feelings of worthlessness, stress, worry, and anxiety; BXD (Behavioral/Externalizing Dysfunction) is another broad scale, measuring a range of maladaptive behavioral issues such as aggressiveness, hyperactivity, and antisocial personality traits; THD (Thought Dysfunction) measures difficulties associated with abnormal thinking processes; RCd (Demoralization) measures general life dissatisfaction; RC1 (Somatic Complaints) measures physical symptoms; RC2 (Low Positive Emotions) measures anhedonia and depressivity; RC7

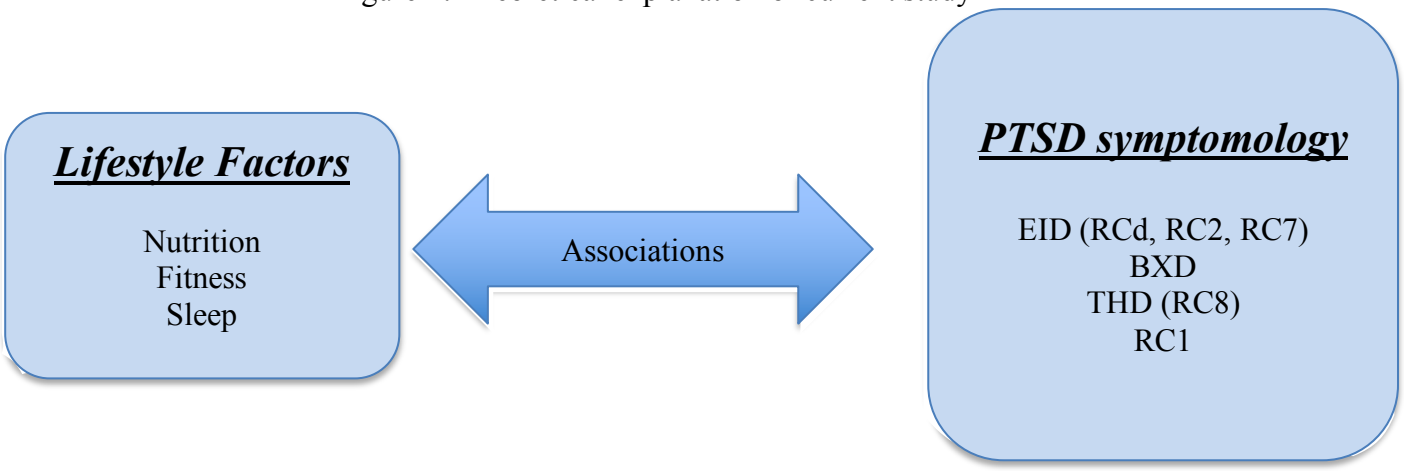
(Dysfunctional Negative Emotions) measures anxiety, fear, and stress reactivity; and RC8 (Aberrant Experiences) measures unusual thinking and unusual perceptual experiences. Because of the overlap in content between the MMPI-2-RF scales being that there are overarching scales and 4 subscales, the right-hand side of the canonical correlation with be conducted with only these 4 overarching scales including EID, THD, BXD, and RC1.

If it can be determined that there is a correlation between the lifestyle factors (fitness, nutrition, sleep) and PTSD symptomatology, then further research can be conducted to determine the direction of the correlations, key predictors, and so forth. This type of research could potentially create alternative and less invasive/harmful treatments for those suffering from PTSD by replacing medications with changes in lifestyle behaviors. The hypotheses of this study are (1) that there will be a significant overall canonical correlation between the eight MMPI-2-RF scales, considered as a group, and the three lifestyle variables, also considered as a group; (2) each of the lifestyle variables will be significantly predicted by the MMPI-2-RF scales as a group.

This study is evaluating any possible links between the eight MMPI-2-RF scales which have been found to represent the symptoms of PTSD and lifestyle variables of sleep, nutrition, and fitness. The variables of interest, thus, are separated into two groups, one of which represents a specific combination of both internal and external dysfunctions that are consistent with PTSD, and the other group represents health behaviors. With regard to the lifestyle variables, if sleep quality and quantity are optimal, nutrition emphasizes fruits, vegetables, and lean proteins, and fitness habits are present and consistent, then the lifestyle variables as a group are representative of healthy lifestyle behaviors. On the other hand, if sleep is poor and limited, nutrition includes high fats and fried, processed foods, and fitness behaviors are not present, then the group

represents unhealthy lifestyle behaviors. Evaluating how a person carries out their daily life in terms of these healthy or unhealthy habits and separately determining the level of dysfunction in their life, both internal and external, and then analyzing to determine if a connection is present between the two groups can potentially elicit innovative, less evasive ways to treat the dysfunction that is present in people with PTSD. Figure 1 below represents the theory behind the study and how the variables relate to each other.

Figure 1: Theoretical explanation of current study



CHAPTER TWO. METHOD

Participants

Participants included 288 students attending Western Carolina University (WCU). Participants in this study were recruited through the research pool system at WCU. Participants with invalid MMPI-2-RF validity scores, specifically TRIN-r $\geq$ 80, VRIN-r $\geq$80, F-r = 120, and Fp-r >_100, (n = 42) were removed from the analyses; therefore, analyses were completed on 246 participants. It is speculated that the large number of invalid MMPI-2-RF scores may be due to extreme levels of psychopathology and/or consequences of the extended timing that the assessments took the participants that resulted in boredom and random responses. Participants included 180 (62.5%) females and 108 (37.5%) males between the ages of 18 and 69. The mean age was 18.9 (SD = 3.8). The majority of the sample was Caucasian (80.2%), followed by African American (10.1%), Hispanic/Latino (4.2%), Native American and Asian (both 1.7%), and other (2.1%). Majority of the sample was college freshman (80.6%), single (58.3), enjoyed exercising (79.9%), and worked out 1 to 3 days a week (54.2%).

Materials

A Consent Form was used to inform the participants of the study, specifically, the purpose of the study, potential risks and benefits, and volunteer participation that could be revoked at any time. Additional materials included the MMPI-2-RF, the Pittsburgh Sleep Quality Index, a nutrition survey, and a fitness survey, the latter two instruments being constructed specifically for this study. Finally, a brief set of demographic variables was requested (age, gender, ethnicity).

Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF). The MMPI-2-RF is a personality inventory that measures a variety of constructs including the broad

constructs of behavioral/externalizing dysfunction, emotional/internalizing dysfunction, and thought dysfunction. The MMPI-2-RF is a 338 item self-report form in a true/false layout that measures psychopathology. The validity and reliability of the MMPI-2-RF are acceptable, meaning that these scale scores can serve as valid indicators of meaningful psychological constructs, and specific information can be found in the MMPI-2-RF Technical Manual. (Ben-Porath & Tellegan, 2008/2011; Tellegen & Ben-Porath, 2008/2011)

Pittsburgh Sleep Quality Index (PSQI). The PSQI is a widely used sleep inventory which combines 19 questions into seven different sleep components, which sum together for a global score (Buysse, Reynolds III, Monk, Berman, & Kupfer, 1988). The PSQI exhibits an overall Cronbach's alpha of 0.83 (Cronbach, 1951) and acceptable validity, in that it has been shown to correlate significantly with sleep quality and quantity. (Buysse et al., 1988).

Nutrition Survey. The nutrition survey was developed for the use of this study due to the lack of a current, general nutrition inventory that is suitable for use in research. The initial item pool consisted of 20 items. Both a factor analysis and a reliability analysis were completed on the current sample, after which items were retained based on content, loading on the first factor, and Cronbach's alpha. Eleven items were retained which yielded a Cronbach's alpha of 0.795 (Cronbach, 1951). The final questionnaire is included as an Appendix.

Fitness Survey. The fitness survey was developed for the use of this study due to the lack of a current, general fitness inventory that is suitable for use in research. The initial item pool consisted of 14 items. Both a factor analysis and a reliability analysis were completed on the current sample, after which items were retained based on content, loading on the first factor, and Cronbach's alpha. Nine items were retained which yielded a Cronbach's alpha of 0.871 (Cronbach, 1951). The final questionnaire is included as an Appendix.

Design and Procedures

As participants arrived they were asked to sit at a computer that had been set up with a Qualtrics survey, which included the informed consent, fitness, nutrition, and demographic inventories, and the MMPI-2-RF. (Another tab on the computer had a second Qualtrics survey that was a part of a different research study.) Participants were asked to complete the surveys by themselves. When participants were finished, the examiner checked that all surveys were completed. Either before or after the participant took part in the computer-based surveys, the participant's body fat percentage and BMI were calculated using a bioelectrical impedance monitor.

CHAPTER THREE. RESULTS

As noted above, inclusion criteria required having a valid MMPI-2-RF protocol. This excluded all protocols with the following validity scores: TRIN-r ≥ 80, VRIN-r ≥80, F-r = 120, and Fp-r >_100. Application of these criteria reduced the original sample of 288 participants to 246 participants. Descriptive statistics for the lifestyle factors and MMPI-2-RF Scales can be found in Tables 1 and 2, respectively. Data were then examined by both bivariate and canonical correlations.

Table 1: Descriptive Statistics for Lifestyle Factors.

Lifestyle Factors	**N**	**M**	**SD**	**Min-Max**
Nutrition Survey	246	43.61	11.60	16-73
Fitness Survey	246	41.71	12.13	13-63
Sleep (PSQI)	246	4.75	2.04	0-13

Table Note: Higher numbers indicate more optimal nutrition and fitness. High numbers indicate less optimal sleep quality and quantity.

Table 2: Descriptive Statistics for MMPI-2-RF Scales

MMPI-2-RF Scales	**N**	**M**	**SD**	**Min-Max**
EID	246	55.20	11.26	30-90
THD	246	52.53	9.62	39-84
BXD	246	50.05	7.95	32-81
RCd	246	58.18	10.25	37-85
RC1	246	58.76	10.76	36-95
RC2	246	50.80	11.58	34-95
RC7	246	56.96	12.06	34-91
RC8	246	54.36	10.70	39-86

Table 3: Bivariate Correlations Between Lifestyle Variables and MMPI-2-RF scales forming symptoms consistent with a PTSD diagnosis

MMPI-2-RF Scales	Fitness	Nutrition	Sleep
EID	-.279**	-.213**	.298**
THD	.022	.006	.084
BXD	.147*	.000	.143*
RCd	-.241**	-.185**	.298**
RC1	-.211**	-.166**	.319**
RC2	-.315**	-.164**	.256**
RC7	-.113	-.135*	.238**
RC8	.003	.013	.091

Table Note: *: $p \leq 0.05$ **: $p \leq 0.01$

Bivariate correlations were computed between the hypothesized MMPI-2-RF scales and the three lifestyle variables of fitness, nutrition, and sleep (see Table 3). The focus of this study is on the eight MMPI-2-RF scales that have been found to be statistically associated with a PTSD diagnosis and that include PTSD symptomology in item content. This includes Emotional Internalizing Dysfunction (EID), Thought Dysfunction (THD), Behavioral/Externalizing Dysfunction (BXD), Demoralization (RCd), Somatic Complaints (RC1), Low Positive Emotions (RC2), Dysfunctional Negative Emotions (RC7), and Aberrant Experiences (RC8). The most significant correlations across all lifestyle variables were with EID, RCd, RC1, and RC2. EID showed significance at the 0.001 level for fitness, nutrition, and sleep. That is, the higher one's Emotional Internalizing Dysfunction, the worse their fitness, nutrition, and sleep are. For example, if one has high Emotional Internalizing Dysfunction, such as anxiety, depression, and demoralization, then they are less likely to be physically active, eat healthy, and get an optimal amount of quality sleep. This also applies for Demoralization, Somatic Complaints, and Low Positive Emotions.

Behavioral/Externalizing Dysfunction was negatively correlated with fitness and sleep at the 0.005 level and showed no significant correlation with nutrition. Dysfunctional Negative Emotions was negatively correlated with nutrition (at 0.005 level) and sleep (at 0.001 level) but showed no correlation with fitness. There were no significant correlations with any lifestyle variables in regard to THD and RC8. This is very likely due to the participant sample. Being that the study was completed with college students, there is a low amount of thought dysfunction and aberrant experiences in the population and therefore no significance resulted.

A canonical correlation analysis was conducted used the three lifestyle variables as predictors of the 4 posttraumatic stress dysfunction variables to evaluate the multivariate shared relationship between the two variables sets. The analysis yielded three functions with squared canonical correlations (R_C2) of .211, .058, and .002 for each successive function. The full model was statistically significant with a Wilk's λ of .741, F (12, 632.63) = 6.300, p < .000. Because Wilks's λ represents the variance unexplained by the model, 1 – λ yields the full model effect size in an r^2 metric. Thus, for the set of four canonical functions, the r^2 type effect size was .259, which indicates that the full model explained a small to moderate portion, about 26%, of the variance shared between the variable sets.

As noted, the full model (Functions 1 to 4) was statistically significant. Function 2 to 4 was also statistically significant, F (6, 480) = 2.529, p < .05. Function 3 did not explain a statistically significant amount of shared variance between the variable sets, F (2, 241) = .246, p = .783. Given the R_C2 effects for each function, only the first function was considered noteworthy in the context of this study (21% shared variance). The last two functions only explained 5.8% and 0.02%, respectively, of the remaining variance in the variable sets after the extraction of the prior functions.

Tables 4 and 5 present the standardized canonical function coefficients for Functions 1, 2, and 3 for the dependent variables (lifestyle) and the predictor variables (PTS dysfunction), respectively. Looking at the Function 1 coefficients, one sees that relevant criterion included all three dependent variables, with the most influential being sleep. With the exception of sleep, all of these variables' structure coefficients had the same sign, indicating that they were all positively related. Sleep was inversely related to the other lifestyle variables.

Regarding the predictor variables set in Function 1, EID, RC1, and THD were the primary contributors to the predictor synthetic variable, with a secondary contribution by BXD. Because the structure coefficient for EID, BXD, and RC1 were positive, those were negatively related to all of the personality styles except for sleep. The higher the internal, behavioral, and somatic dysfunction, the worse the fitness and nutrition levels and the higher the sleep dysfunction. These results are supportive of the theoretically expected relationships.

Moving to Function 2, Table 4 suggests that the criterion variables with most relevance were Fitness and Sleep, with Nutrition being secondary, being inversely related. Looking at the posttraumatic stress variables, BXD was the most relevant. BXD was positively related to fitness and sleep dysfunction and negatively related to nutrition. This means that high levels of behavioral dysfunction are associated with high levels of fitness and sleep dysfunction and low levels of nutrition.

These results suggest that if a person has symptoms of posttraumatic stress that presents with increased Emotional Internalizing Dysfunction and Somatic Complaints in conjunction with low levels of Thought Dysfunction then they are likely to also have poor nutrition and fitness habits, as well as, poor quality and quantities of sleep. If their symptoms are exhibited with high

levels of Behavioral Dysfunction then they are likely to have high levels of fitness and high levels of sleep dysfunction as well as poor nutrition habits.

Table 4: Standardized Canonical Function Coefficients of the Dependent Variables

Variable	Function Number 1	Function Number 2	Function Number 3
Fitness	-.472	.939	-.390
Nutrition	-.247	-.252	.091
Sleep Dysfunction	.682	.655	.371

Table Note: Data were rounded to the nearest thousandth of a decimal

Table 5: Standardized Canonical Function Coefficients of the Posttraumatic Stress Variables

Variable	**Function Number 1**	**Function Number 2**	**Function Number 3**
EID	.697	-.280	-.658
THD	-.372	-.098	.828
BXD	.028	1.01	-.448
RC1	.573	.235	.643

Table Note: Data were rounded to the nearest thousandth of a decimal

CHAPTER FOUR. DISCUSSION

A final sample of 246 participants yielded results which supported the hypothesis that Posttraumatic Stress Symptomology is associated with lifestyle variables. The canonical correlation showed a significant association between the group of MMPI-2-RF scales representing a Posttraumatic Stress symptomology and the group of three lifestyle variables. This analysis does not allow for a conclusion on a causal relationship or the possibility of a third variable (or more) relating the two groups. However, after reviewing previous research and the findings of this study, it is speculated that the symptoms associated with PTSD have consequences on one's daily lifestyle health behaviors and/or that the way one lives in terms of their health can make posttraumatic stress worse or better depending on directionality. Therefore, by altering one's lifestyle behaviors to create habits consistent with healthy levels of sleep, fitness, and nutrition it is possible that the intensity and duration of PTSD symptoms can be reduced.

PTSD affects the brain in a way that executive functioning and judgement are obscured (Lanius et. al., 2010). Because of this, the "fight or flight" response can be triggered from events, people, or objects with that have no real danger associated with them, which in turn creates a myriad of physiological symptoms such as increased heart rate, pressured breathing, sweating, and tremors; this reaction is what creates the hyperactivity symptoms that occur with PTSD (Friedman, 2014). On the other hand, the reaction to these stimuli could result in a "freeze" response, which leads to emotional detachment and withdrawal (Jeffreys, 2017). Following trauma focused therapy, medication is a highly utilized treatment of PTSD and its symptoms (Jeffreys et. al., 2012). Commonly used medications include antidepressants, mood stabilizers, antipsychotics, tricyclic antidepressants, monoamine oxidase inhibitors, opioids, and

benzodiazepines (Jeffreys, 2017; Hawkins, 2015; Hawkins et. al., 2013). These medications effect the neurotransmitters connected to fear and anxiety including serotonin, norepinephrine, gamma-aminobutyric acid (GABA), dopamine, and others (Jeffreys, 2017; Watts et. al., 2013). Research demonstrates that commonly prescribed medications for PTSD tend to be helpful in minimizing symptoms, but not in elimination of symptoms (Watts et. al., 2013).

As previously discussed the use of many of these medications can be harmful, addictive, and create lifelong help concerns from the long-term use and side effects (Bowe & Resenheck, 2014; Frayne et al., 2010; Bedi & Rohit, 2007; Jeffreys, 2017; Hawkins, 2015; Hawkins et. al., 2013). Hawkins and colleagues (2013) completed a study on 5,236 veterans from 2004 to 2010 and found that those who were on selective serotonin reuptake inhibitors (SSRIs) or serotonin/norepinephrine reuptake inhibitors (SNRIs), benzodiazepines, and opioids had more mental health and medical hospitalizations, emergency room visits, and harmful or adverse events than those who were only prescribed an SSRI or SNRI.

Because a typical treatment regimen of PTSD includes many medications, of which present issues of harmful side effects and addition, it is necessary to complete research to find other ways to treat PTSD symptoms without the harmful consequences. The purpose of this study is to discover correlations to lead to just that. The results of this study showed that there are connections between sleep, fitness, and nutrition and many aspects of PTSD symptomology. Further research needs to be completed to look at a causal relationship, but it is possible that changing a person's sleep regimen, eating, and fitness habits can reduce PTSD symptomology. This can be done by instilling sleep hygiene techniques and habits, teaching meditation, mindfulness, and yoga, and educating those with PTSD on what healthy eating is and what a healthy fitness regimen looks like. Pairing this with psychoeducation of what PTSD is and the

findings from this study that altering sleep, nutrition, and fitness habits can positively affect their internal and external dysfunction without the harmful side effects is optimal in PTSD treatment.

CHAPTER FIVE. LIMITATIONS AND FUTURE RESEARCH

The main limitation of this study is with the sample; the sample consisted entirely of college students. This is a concern because of the thought dysfunction (THD),or having abnormal perceptual experiences such as hallucinations and delusions, that is an element of the eight MMPI-2-RF scales used to signify PTSD symptomology. College students on average are not a population with a large amount of thought dysfunction; one study looking at the prevalence of schizophreniform psychoses, schizoaffective psychoses, and borderline psychotic cases in Romanian college students was found to be 0.093% (Nica-Udangui, 1983). Behavior Dysfunction has the same concerns; the amount of clinically elevated Behavioral Dysfunction in the average college population is relatively low compared to the presence of internalizing dysfunction. Both Behavioral and Thought Dysfunction have a low representation in this study's sample compared to the level of Internalizing Dysfunction. For future research this study should be replicated with a veteran population; this population will likely have higher levels of dysfunction than that of the current study. In addition, future research should explore possible causal relationships among PTSD symptomology and fitness, nutrition, and sleep in terms of the effects that different levels of lifestyle variables could have on posttraumatic stress symptoms. Future research should include altering healthy levels of fitness, nutrition, and sleep to determine if variation from an individual's normal creates a decrease in dysfunction related to PTSD.

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Appendix 1: Fitness and Nutrition surveys

How strongly do you agree or disagree with the following statements?

	Strongly Disagree	Sort of Disagree	Neutral	Sort of Agree	Strongly Agree
I enjoy eating vegetables					
I eat whole wheat grains (bread, rice, pasta) more than white grains					
I eat fast food more than one time a week					
I eat fast food less than once a month					
I drink at least 6 glasses of water a day					
I drink more than 3 sugary drinks (juice, Kool-Aid, lemonade, sweet tea) per week.					
I eat 4 or more servings of vegetables a day					
I eat 3 or more servings of fruit per day					
I eat breakfast every day					
I believe my diet is overall healthy					
I eat dark greens (spinach, cabbage, romaine, asparagus) at least 1 times a day on average					

NOTE: Items 5 and 10 are reversed scored
Cronbachs alpha = 0.795

How strongly do you agree or disagree with the following statements?

	Strongly Disagree	Sort of Disagree	Neutral	Sort of Agree	Strongly Agree
I work out at least 4 times a week					
I work out for at least 30 minutes at a time					
I enjoy working out					
I have fitness goals which I actively work towards					
I consider myself a fit person					
I take part in sports					
I often do hard labor tasks					
My health is important to me					
I can run a mile without stopping					

Alpha 0.871