Original article

Prevalence of neurological dysfunction and irregularities in people suffering from auto-immune conditions: An Iraqi perspective

Ali Abdulhussain Fadhil1[1], Ahmed W. AL Rubaye[2], Mazin Abdullateef Alzubaidi[3], Ghanem Hussain Tawfik[4], Hind Ali Nasser[5], Israa Abed Jawad[6], Mohammed Shnain Ali[7], Borhan Mustafa Mohammed[8], Khulood Majid Alsaraf[9]

[1] College of Medical Technology/ Medical Lab techniques, ; Al-Farahidi University/Iraq

[2] Al-Manara College For Medical Sciences/ (Maysan)/Iraq

[3] Department of anesthesia , Al-Mustaqbal University, Babylon, Iraq

[4] Department of Anesthesia Techniques, AlNoor University College, Nineveh, Iraq

[5] College of pharmacy, Al-Ayen University, Thi-Qar / Iraq

[6] Department of anesthesia , Al-Nisour University College/ Baghdad/Iraq

[7] Department of Dentistry, Al-Zahrawi University College, Karbala

[8] Department of Anesthesia Techniques / Mazaya university college/ Iraq

[9] Department of Anesthesia Techniques / Al-Esraa University College, Baghdad, Iraq

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ABSTRACT

Post-traumatic stress disorder is linked with neurological abnormalities that may lead to an increased risk of auto-immune diseases. This study has aimed to evaluate the association between neurological dysfunction and irregularities of post-traumatic stress disorder and auto-immune disorders among Iraq veterans. The study used data on 66,200 Iraq veterans below the age of 55 enrolled in the Veteran Affairs healthcare management from October 2011 to April 2019. The data were analyzed using general linear models with robust error variance and Poisson distribution. Results showed that 28.7% of veterans had PTSD, whereas psychiatric disorders were present in 21.4% of veterans. The findings revealed that veterans with post-traumatic stress disorder are more likely to experience any of the six auto-immune conditions: inflammatory bowel diseases, multiple sclerosis, rheumatoid arthritis, and lupus erythematosus. The adjusted relative risk is significantly higher among veterans with PTSD than veterans with other psychiatric disorders. Female veterans in Iraq with PTSD have an increased risk of auto-immune diseases compared to their male counterparts. The findings of the study warrant the attention of healthcare professionals to identify and treat PTSD and other psychotic disorders in Iraq veterans to improve their quality of life.

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Keywords: Auto-immune disorders, post-traumatic stress disorder, veterans, military sexual trauma

Introduction

A disorder of the central nervous system known as neurological dysfunction reduces the effectiveness of brain functions. Although neurological dysfunction exists to some extent in everyone, it is typically modest. Nervous system impairment is the underlying cause of Neurological dysfunction. The particular causes of neurological issues can fluctuate, but they may involve starvation, head trauma, nerve damage, or nerve impingement[1]. They might also involve inheritable diseases, congenital anomalies or diseases, infection, and behavioral or ecological health issues. Nevertheless, neurological dysfunction levels in some persons e higher than usual. When a neural malfunction is severe, the brain is incapable of compensating effectively, which negatively affects learning, growth, and recovery[2]. Irrespective of the underlying cause, all neurological disorders are the outcomes of injury to the nervous system. The severity to which mobility, intellect, sight, hearing, and communication are affected depends on where the damage occurs. The immune system defends the body from illness. One's immune system may become overactive and erroneously strike normal tissue if one suffers from a neurological auto-immune condition. Among these, multiple sclerosis (MS) is the most prevalent. Other inflammatory illnesses of the neurological system necessitate specialist treatment. It occurs when the patient's immune cells assault the brain or vertebral column, resulting in inflammation and damage[3].

A new type of immune-mediated disorder, auto-immune

Address for correspondence: Khulood Majid Alsaraf, Department of Anesthesia Techniques / Al-Esraa University College, Baghdad, Iraq.
E-mail: lynn10232022@163.com

neurologic diseases display a diverse range of clinical symptoms. Lately, it has been found that sleep abnormalities in people with auto-immune neurological illnesses significantly lower their quality of life[4]. Insomnia in auto-immune neurological disorders may be caused by autoantibodies that harm the brain's sleep-wake control regions. Adequate sleep and care may lower suffering and enhance long-term results[5]. The feature of neurological auto-immune disorders is an unwarranted immune reaction that unintentionally attacks the nervous system. as a consequence, patients experience a variety of neurological problems, such as cerebral hypoventilation, sleep paralysis, sleeplessness, and hypersomnia[6]. Due to differences in the sex chromosomes and hormone imbalances, 80% of people with auto-immune illnesses are typically female. Auto-immune diseases have no identified treatments as of yet[7].

Within past years, a range of neurological illnesses affecting both the peripheral and the central nervous systems have seen an increase in the validation of autoimmunity. The term "auto-immune disorders of the nervous system" (ADNS) refers to a wide range of profoundly distressing symptoms marked by the aberrant auto-immune response on central nervous cellular proteins that are misinterpreted for foreign antigens[8]. Due to the intricacy of auto-immune illnesses and the paralyzing effects of neurological system issues in individuals with ADNS, prompt and effective care, as well as thorough clinical management, are imperative. These illnesses induce the immune response to target numerous tissues in a systemic reaction, or it may only affect one tissue locally, like the skin. Although the precise process of such inflammatory diseases is not precisely known, the presumptive process often varies among ailments[7]. The average age of onset for significant auto-immune diseases is illustrated in fig 1.

Autoimmune condition	Average age of onset
SLE	15-55
Systemic sclerosis	20-50
Rheumatoid arthritis	30-60
Psoriasis	15-35
Sjogren's syndrome	40-60

Figure 1. **Estimated incidence age of auto-immune diseases**

Source: **Angum et al.[7]**

The auto-immune disorder of the nervous system (ADNS) often exhibits mental impairment or restlessness as well as a confidence decline. All these psychological issues can coexist with depression conditions. The improved clinical focus is required due to the depressive disorders' high prevalence and detrimental effects in ADNS. When there is a significant hormonal change or when there is a high level of stress, for instance, during pregnancy, several auto-immune illnesses commonly affect women. Annually, much more women than males are plagued by auto-immune disorders, which has led experts to try and figure out what might be the root causes of this imbalance[7]. Additionally, systemic inflammatory biomarkers have been connected to a lack of therapeutic efficacy, and elevated numbers of inflammatory responses in children and adolescents have been associated with a greater likelihood of psychotic disorders[9]. Anti-inflammatory treatments have also been discovered to be particularly effective in an acute inflammatory subset of patients[10].

The aim of this study is to measure the prevalence of neurological abnormalities and dysfunction in people who are suffering from auto-immune diseases in the demography of Iraq. The obstacles or important questions for neurologists in the evaluation and treatment of Auto-immune disorders of the nervous system were revealed in this research. This research hopes to create an integrative approach to future therapy recommendations. This study will raise awareness of this healthcare profession and help people better comprehend the symptoms of auto-immune nervous system disorder.

Literature Review

Neurological Dysfunction and auto-immune diseases

Auto-immune illness, which manifests as an aberrant immune response in particular regions or physiological processes, could be affected by psychological effects with life circumstances. Numerous studies have shown a connection between auto-immune diseases and neurological disorders. According to a study, widespread auto-immune conditions, for instance, are more common in epilepsy sufferers than in the average public. This raises the possibility that the two diseases may have similar pathophysiology. The incidence of epilepsy is heightened across the spectrum of widespread auto-immune illnesses, but it is greatest in the first category of diabetes and systemic lupus erythematosus. The most significant intermediaries between systemic auto-immune diseases and epilepsy are vascular and metabolic variables. In addition to natural immunological response and blood-brain interface disturbance, which are present in the majority of epilepsies, systemic immunological impairment can also alter neuronal excitability in auto-immune encephalitis and other auto-immune diseases.[11, 12] Furthermore, the lifetime probability of auto-immune illnesses rises with schizophrenia detection. According to two German registration investigations, those with psychotic illnesses had a 50 percent higher likelihood of developing auto-immune illnesses as a result. In accordance with this, a new study discovered that people with a history of psychotic disorders had a probability of developing an auto-immune condition which was 55 percent greater. Another auto-immune condition with a high prevalence of neuropsychological issues, including anxiety and depression, is systemic lupus erythematosus, which affects between twenty-one and ninety-five percent of sufferers. The finding of auto-immune encephalitis also greatly increased attention on auto-immune disease as a factor in psychological disorders. The limbic region is the most often impacted area of the brain in these diseases, which are all defined by the existence of neuronal membrane antibodies and exhibit signs such as mental and cognitive changes, seizures, and motor problems. According to a few other investigations, people with schizophrenia have a substantially higher incidence of psoriasis.[13]

Post-traumatic stress disorder and auto-immune diseases

PTSD is also a physical disorder along with a psychological illness, and it has been discovered that individuals with PTSD have physiological changes in a number of key immunological and neuroendocrine pathways. Persistent mental stress activates the nervous system's sympathetic mechanism and hypothalamic-pituitary-adrenal system stress reaction circuits, similar to physical stress, which results in the production of

glucocorticoids and catecholamines. The main intrinsic GC hormone in people, cortisol, influence the immunological function, metabolism mechanism, and central nervous system to regulate the stress reaction. By attaching to the GC receiver (GR) within cells on target tissues, GCs have an effect on biology and conduct. This interaction results in cascading consequences such as immune-compromised, enhanced energy usage, and adverse response suppression of the HPA pathway. Consequently, a high prevalence of comorbidities, such as cardiac diseases, pulmonary, gastric, inflammatory, and auto-immune illnesses, as well as poor physiological conditions, are linked to PTSD. The prevalence of auto-immune disorders is two times higher in those with PTSD relative to people with no mental condition, and it is fifty-one percent higher relative to people with other mental conditions, according to recent massive prospective longitudinal research of 666,269 Iraq former soldiers. Impairment in the immune system brought on by the intricate interactions between the neuroendocrine and immunological processes in Post-traumatic stress may reveal or hasten the development of auto-immune or/and inflammatory illnesses, adding to the illness severity in these individuals.[14, 15]

Furthermore, PTSD sufferers may be at an enhanced danger for auto-immune illnesses and physiological irregularities due to elevated tobacco usage, restless sleep, unhealthy eating habits, and drug and alcohol drinking. Individuals who have PTSD are more prone to utilize illegal drugs and drinking, all of which are significant threat variables for a variety of persistent medical illnesses. Several systematic evaluations observed that despite the heterogeneity of the research, PTSD sufferers typically exhibited more unfavorable dietary habits and reduced levels of bodily movement. Additionally, numerous studies have shown that people with PTSD indicate lower adherence to all drugs as well as those prescribed for medical disorders, such as high blood pressure. Last but not least, disturbed sleeping, which is a defining characteristic of PTSD, can exacerbate metabolic diseases like being overweight and is a standalone threat component for heart illness. Cognitive and behavioral factors, such as reduced socio-cultural and economic possibilities, an absence of interpersonal care, and unpleasant experiences with the healthcare system, could exacerbate these physical and genetic factors.[16-18]

Additionally, it is probable that auto-immune illnesses, along with post-traumatic stress, are influenced by similar hereditary and environmental susceptibility characteristics, such as impaired glucocorticoid transmission, increased immunological cell maturation, and early trauma. Due to gender variations in innate immunity, females had a thrice higher chance of developing auto-immune illnesses than males. Females typically exhibit higher levels of antibody activation to physiological stress, vaccines, and infectious disease than males do, which is believed to provide defense from contagious illnesses but increases the likelihood of auto-immune illnesses.[19]

The strong correlation between auto-immune thyroid illness, diabetes, regional lupus erythematosus, irritable intestinal illness, and multiple sclerosis has also been reported in research. It's worth noting that taking specific serotonin-release drugs within one year of receiving a PTSD assessment decreased the comparative likelihood of auto-immune diseases, adding support to the idea that addressing Post-traumatic stress may have physical advantages.[16]

Materials and Methods

For this study, about 66,200 Iraq veterans in the "Department of Veterans Affairs National Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND)" roster were selected who had their VA healthcare management from October 2011 to April 2019. Special selection criteria were considered for this study; the participants who were older than 55 years were not included in the study. Additionally, the participants who already had a psychiatric diagnosis in the context of targeted disorders were also removed from this study.

The data regarding military services and demographics for the selected Iraq veterans was obtained from the "VA OEF/OIF/OND Roster." For this study, the e-medical records of the veterans were also obtained. For this purpose, the "National Patient Care Database" (NPCD) was taken into account.

Data Analysis

The relevant risks (RR), confidence intervals (CI 95%), and adjusted RR (ARR) were determined by using general linear models along with robust error variance and Poisson distribution. ARR and RR were determined in the primary models in the context of any auto-immune disease solely or in combination with another diagnosis. This was later compared with "(a) veterans without any psychiatric diagnoses, and (b) veterans with psychiatric diagnoses other than PTSD." In the case of follow-ups, the association between the group with psychiatric disorders and gender was also determined. The comorbid psychiatric disorders and military sexual trauma contributions were also examined by using the linear models. However, the risk for auto-immune disorders in accordance with anxiety, psychotic disorders, alcohol, and substance abuse was also determined in both concepts (with and without PTSD). No separate analysis was conducted in the context of PTSD because the PTSD symptoms overlap with the context of other psychiatric disorders. For this study, the models were adjusted according to primary care visits, gender and age, and military rank. SAS version 9.3 was used for conducting statistical analysis for the present study. For this purpose, STATA 13 was also used. Two-sided tests were performed, and the significance level was $p \leq 0.05$.

Results

Characteristics of respondents

For this cohort study, a total number of 66,200 Iraq veterans were selected. 49.8% had no psychiatric disorders, whereas 21.4% had different psychiatric disorders, and 28.7% had PTSD. The results obtained showed that most of the veterans were male. Twenty-three thousand of the male veterans had no psychiatric disorders, whereas 13,000 suffered from PTSD, and 10,000 had other psychiatric issues. In contrast to this, the number of female veterans was low, and 10,000 had no psychiatric disorders, while 6,000 suffered from PTSD. The veterans aged 25 to 33 years and 34 to 44 years were more likely to suffer from a psychiatric disorder and PTSD, as the value of p was less than 0.05. About 7,200 veterans with PTSD had primary care visits, 2,200 had mental health visits, and 2,500 had a visit for military sexual trauma. The PTSD patients and patients with other psychotic disorders were also found to be significantly associated with anxiety, depression, alcohol and substance

abuse, and CPD with a value of p less than 0.05). They were also positively linked to adjustment disorder and psychosis.

Table 1. **Characteristics of respondents**

Characteristics	Number (N= 66,200)	No PD (33,000) 49.8% (n)	Other PD (14,200) 21.4% (n)	PTSD (19,000) 28.7% (n)	p-value
Gender					
Male	55,000	23,000	10,000	13,000	< 0.0011
Female	11,200	10,000	4,200	6,000	< 0.0011
Age (years)					
19-24	11,000	4,000	4,000	3,000	< 0.0011
25-33	43,000	20,000	10,000	13,000	< 0.0011
34-44	10,000	6,000	2,000	2,000	< 0.0011
45-53	2,200	1,200	-	1,000	< 0.0011
Military Rank					
Enlisted	52,000	23,000	13,000	16,000	< 0.0011
Other	14,200	10,000	1,200	3,000	< 0.0011
PC visits		-	4,500	7,200	< 0.0011
MH visits		-	1,200	2,200	< 0.0011
MS Trauma		-	1,300	2,500	< 0.0011
Psychiatric diagnosis					
Depression		-	4,000	6,500	< 0.0011
Anxiety		-	3,000	5,000	< 0.0011
Adjustment disorder		-	1,000	1,500	< 0.0011
Psychosis		-	1,300	1,800	< 0.0011
AUD		-	1,200	1,500	< 0.0011
SUD		-	700	1000	< 0.0011
CPD		-	1,200	1,900	< 0.0011

PD= psychiatric disorder; AUD= alcohol use disorder; SUD= substance use disorder; MH= mental health; CPD= Comorbid Psychiatric Disorders; MS= military sexual.

RR and Auto-immune Diseases

Table 2 shows RR and ARR in the context of PTSD, other psychiatric disorders, and auto-immune diseases. For this study, six auto-immune diseases were taken into account, which included thyroiditis, inflammatory bowel diseases (IBD), multiple sclerosis (MS), rheumatoid arthritis (RA), and lupus erythematosus (LE). The results show that the veterans with PTSD alone were more likely to experience different auto-immune diseases as compared to other psychiatric disorders. Table 2 shows that ARR for all psychiatric disorders was lower as compared to patients with PTSD.

Table 2: **RR and ARR**

	RR (CI 95%)			**Adjusted RR (CI 95%)**		
	No PD	**Other PD**	**PTSD**	**No PD**	**Other PD**	**PTSD**
Veterans						
AD	1 (ref)	1.32 (1.25, 1.40) b	1.82 (1.73, 1.88) b	1 (ref)	1.22 (1.27, 1.30) b	1.92 (1.83, 1.89) b
Thyroiditis	1 (ref)	1.41 (1.32, 1.48)	1.91 (1.81, 2.02) b	1 (ref)	1.41 (1.32, 1.48) b	2.15 (1.81, 2.02) b
IBD	1 (ref)	.93 (.78, 1.05) b	1.33 (1.21, 1.51) b	1 (ref)	.83 (.78, 1.05) b	2.33 (1.15, 1.51) b
MS	1 (ref)	2.34 (1.87, 2.92) b	2.22 (1.82, 2.72) b	1 (ref)	2.24 (1.87, 2.92) b	2.02 (1.82, 2.72) b
RA	1 (ref)	1.01 (.77, 1.27) b	1.71 (1.41, 2.03) b	1 (ref)	1.51 (1.17, 1.27) b	1.71 (1.41, 2.03) b
LE	1 (ref)	1.65 (1.25, 2.18) b	1.62 (1.27, 2.08) b	1 (ref)	1.55 (1.25, 2.18) b	1.64 (1.27, 2.08) b
Female						
AD	1 (ref)	1.25 (1.13, 1.38) c	2.13 (1.96, 2.32) b	1 (ref)	1.20 (1.13, 1.38) b	2.13 (1.96, 2.32) b
Thyroiditis	1 (ref)	1.21 (1.06, 1.33) b	2.11 (1.92, 2.32) b	1 (ref)	1.21 (1.06, 1.33) c	2.11 (1.92, 2.32) b
IBD	1 (ref)	1.32 (.91, 1.94) b	1.98 (1.43, 2.77)	1 (ref)	2.32 (.91, 1.94) b	2.98 (1.43, 2.77)

			b			b
MS	1 (ref)	2.64 (1.73, 4.03) b	2.93 (1.94, 4.42) b	1 (ref)	2.67 (1.73, 4.03) b	2.8 (1.94, 4.42) b
RA	1 (ref)	1.23 (.82, 1.82) b	2.57 (1.85, 3.55) b	1 (ref)	1.23 (.82, 1.82) b	2.57 (1.85, 3.55) b
LE	1 (ref)	1.36 (.92, 2.06) b	2.05 (1.44, 2.95) b	1 (ref)	1.36 (.92, 2.06) b	2.05 (1.44, 2.95) b
Male						
AD	1 (ref)	1.28 (1.22, 1.37) b	1.78 (1.71, 1.89) b	1 (ref)	1.28 (1.22, 1.37) b	1.78 (1.71, 1.89) b
Thyroiditis	1 (ref)	1.42 (1.31, 1.53) b	1.98 (1.86, 2.11) b	1 (ref)	1.45 (1.31, 1.53) b	2.18 (1.86, 2.11) b
IBD	1 (ref)	.86 (.75, 1.03) b	1.27 (1.14, 1.45) b	1 (ref)	.86 (.75, 1.03) b	1.27 (1.14, 1.45) b
MS	1 (ref)	2.13 (1.64, 2.77) b	2.13 (1.71, 2.71) b	1 (ref)	1.23 (1.64, 2.77) b	2.13 (1.71, 2.71) b
RA	1 (ref)	.84 (.61, 1.14) b	1.53 (1.23, 1.89) b	1 (ref)	1.14 (1.61, 1.14) b	1.53 (1.23, 1.89) b
LE	1 (ref)	1.67 (1.17, 2.48) c	1.58 (1.13, 2.11) c	1 (ref)	1.67 (1.17, 2.48) c	1.58 (1.13, 2.11) c

AD= auto-immune disease; IBD= Inflammatory bowel disease; MS= multiple sclerosis; RA= rheumatoid arthritis; LE= Lupus erythematosus

b $p \leq .001$ "when compared with veterans with no psychiatric disorder."

c $.001 < p < .05$

Auto-immune diseases and PTSD

Table 3 shows that veterans with PTSD were at higher risk of different auto-immune diseases as compared to veterans with other psychiatric disorders.

Table 3. Auto-immune diseases and PTSD

PD W & WO PTSD	Number	AD Diagnosis Number	RR (95% CI)	ARR*a* (95% CI)
Depression				
WO PTSD	5,313	1247	1.00 [ref]	1.00 [ref]
W PTSD	26,796	11,831	1.15 (1.07, 1.22) *b*	1.33 (1.26, 1.44) *b*
Anxiety				
WO PTSD	4,632	875	1.01 [ref]	1.01 [ref]
W PTSD	7,187	2,224	1.48 (1.35, 1.61) *b*	1.61 (1.46, 1.72) *b*
Adjustment Disorder				
WO PTSD	7,516	792	1.01 [ref]	1.02 [ref]
W PTSD	8,110	1,620	1.66 (1.52, 1.82) *b*	1.76 (1.64, 1.96) *b*
Psychosis				
WO PTSD	1377	16	1.01 [ref]	1.01 [ref]
W PTSD	2193	356	1.13 (.88, 1.46)	1.17 (.86, 1.52)
AUD				
WOPTSD	5,913	292	1.01 [ref]	1.01 [ref]
W PTSD	10,169	1,257	1.78 (1.56, 2.02) *b*	1.81 (1.61, 2.11) *b*
SUD				
WO PTSD	3,382	136	1.02 [ref]	1.01 [ref]
W PTSD	3,988	670	1.76 (1.46, 2.13) *b*	1.87 (1.55, 2.31) *b*

PD= psychiatric disorder; W= with; WO= without

b $p \leq .001$ "when compared with veterans with no psychiatric disorder."

c $.001 < p < .05$

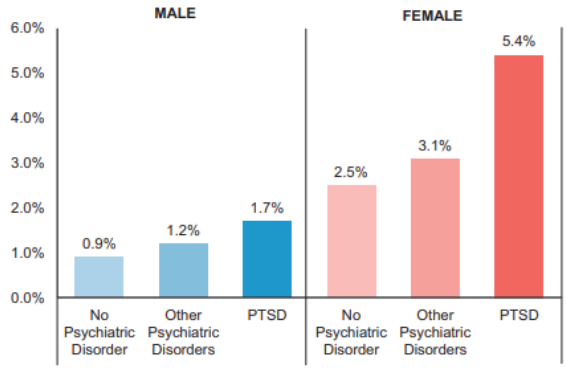

Figure 2. % Of male and female veterans suffering from auto-immune diseases.

Discussion

The current study investigated the association between the neurological dysfunction of post-traumatic stress disorder and auto-immune diseases among veterans in the context of Iraq. The results and figures of the research highlight that individuals diagnosed with post-traumatic stress have a higher probability of developing and being identified with auto-immune diseases as compared to people who are not PTSD sufferers. The current study has generated results similar to previous studies, which provided evidence of the relationship between stress-related disorders and auto-immune conditions.[12] It further elaborates that individuals with comorbid neurological disabilities are more likely to develop auto-immune diseases than people without comorbid psychiatric disorders. Further, it is observed that females have a higher probability of developing auto-immune diseases when they are diagnosed with post-traumatic stress issues as compared to males since their immune systems and structure are different from men. Research suggests that females' immune systems respond with higher antibodies amount as compared to men, which makes them more vulnerable to auto-immune disorders. Further, the stress reaction processes among men and women are distinct, differentiating the risks between the two genders.[20] The current study proved the association between higher risk in women with PTSD and the development of auto-immune issues. PTSD has been linked with several different auto-immune disorders, such as auto-immune thyroid disease, lupus erythematosus, systematic sclerosis, rheumatoid arthritis, Guillain-Barré syndrome, and Addison's disease.[12] The current research has provided further information in the literature as it has also confirmed the relationship between different auto-immune diseases with PTSD.

Furthermore, the association between PTSD and different brain alterations, such as impaired HPA pathway increased irritation, increased maturation of immune cells, and changed the structure of immune cells gene appearance, which has been provided by previous research [21], can be highlighted here to clarify and explain the connection between PTSD and auto-immune conditions.

There are several behavioral changes resulting from the development of PTSD. Since the disease is linked to changes in the amygdala region, hippocampus area, medial prefrontal cortex part, anterior cingulate cortex, and insula, which are neurological areas important for terror, stress, and danger identification. Therefore, assessing how inflammation influences these areas is essential for comprehending the attitudinal alterations related to PTSD.[15, 21] PTSD sufferers are found to have several behavioral issues and unhealthy habits. They are more prone to use several illegal drugs, intoxicant drinks, unhealthy food consumption, lack of consistency in taking prescribed medicines, dysfunctional sleeping patterns, addiction, and substance abuse. This has been observed in PTSD patients and has been found to influence the physical condition, increasing impairments and hence contributing to the development of auto-immune disease in the patients. There are several other factors that are related to nature and nurture, impacting the growth of post-traumatic stress issues in people, such as lack of social support, early trauma experienced in adolescence, and poor circumstances experienced in life leading to higher chances of auto-immune diseases. It could also result in several other issues, such as cardiac diseases and the persistence of other illnesses[17].

The current study has therefore proposed and proved a strong association between post-traumatic stress and the higher probability of the development of auto-immune conditions, providing further evidence in addition to previous studies.

Conclusion

The present research has significantly contributed to the studies and knowledge of neurological disabilities and their association with auto-immune conditions. It has increased the generalizability of the associations and its implication in the context of veterans residing in Iraq. It has also clarified the cultural and gender-specific differences affecting the link between PSTD issues and auto-immune conditions among veterans. The current study has built up on the assumption that since the veterans live in uncertain conditions and experience horrific incidents, they may have a higher rate of PTSD, and since PTSD influences brain functions as well, it is likely that they experience some physiological side effects of the disease. The study provides that post-traumatic stress issues cannot be considered only as a mental condition and its physiological effects require the attention of researchers. The study further implies the increasing need for early diagnosis and treatment for post-traumatic stress disorder to prevent and, if it occurs, treat the physiological issues that come with the disease. Comorbidity of different diseases may make it difficult for doctors to treat several issues and hence can result in adverse effects on the overall health of patients. The study will help doctors in assessing and examine the symptoms of other diseases linked with PTSD so that they can be treated in a timely manner. Different techniques can be used to treat PTSD since its nature is more understandable by the considerations provided by the given study. In summary, the study has contributed to the developing connections between mental and physical diseases and has indicated the need to treat both kinds of diseases as part of a single system rather than distinct issues.

Limitations & Future Research

The current research has a few limitations in addition to the benefits. The current study is restricted to veterans located within the context of Iraq. It is possible that a different population other than veterans has different effects since they live in a situation of constant fear and uncertainty. Further, only one country is included in the sample, which could restrict the

application of results in other contexts. Moreover, the study is limited to the impact of PTSD on auto-immune diseases. Further research is required to analyze the connection between different neurological disabilities, which are not yet evaluated for their effects on the physiology of the patients. Physical diseases other than auto-immune issues, which occur simultaneously with psychological disorders, can be investigated in the future with the cohort method to analyze the long-term effects. It is also possible that two simultaneous conditions could occur together, and one may be impacting the other; however, it could be conditions other than PTSD that were affecting some of the auto-immune conditions. Hence extended research could further clarify the associations.

Practical Implications

The current research results have provided several implications that could be beneficial for physicians and diagnosticians. The doctors can investigate the assessment and examination of different psychological illnesses which could be impacting the physiological health of the patients. The psychological issues can hinder the healing and betterment of physiological conditions and hence can delay the cure. Therefore, physicians must look into psychological conditions and treat them simultaneously to achieve physical recovery as well. The current finding will assist doctors in finding links between different psychological and physiological diseases in order to treat the disease in a more effective manner so patients can achieve a speedy recovery. It will also assist doctors in finding the behavioral changes that occurred due to mental disorders, which can become an obstacle in getting the patient to recover in time.

References

[1] MONTANA.Gov. "Neurological Disorders." https://dphhs.mt.gov/schoolhealth/chronichealth/neurologicaldisorders#:~:text=Structural%2C%20biochemical%20or%20electrical%20abnormalities,and%20altered%20levels%20of%20consciousness. (accessed 2023).

[2] B. I. R. a. Development. "What is neurological dysfunction." https://www.birdcharity.org.uk/work/neurological-dysfunction/ (accessed 2023).

[3] U. Hospital. "Autoimmune Neurological Disorders." https://www.uhhospitals.org/services/neurology-and-neurosurgery-services/conditions-and-treatments/multiple-sclerosis-and-neuroimmunology/conditions-we-treat (accessed 2023).

[4] D. Yin, S. Chen, and J. Liu, "Sleep Disturbances in Autoimmune Neurologic Diseases: Manifestation and Pathophysiology," *Frontiers in Neuroscience,* vol. 15, 2021.

[5] M. S. Blattner, G. S. de Bruin, R. C. Bucelli, and G. S. Day, "Sleep disturbances are common in patients with autoimmune encephalitis," *Journal of neurology,* vol. 266, no. 4, pp. 1007-1015, 2019.

[6] A. Iranzo, "Sleep and neurological autoimmune diseases," *Neuropsychopharmacology,* vol. 45, no. 1, pp. 129-140, 2020.

[7] F. Angum, T. Khan, J. Kaler, L. Siddiqui, and A. Hussain, "The prevalence of autoimmune disorders in women: a narrative review," *Cureus,* vol. 12, no. 5, 2020.

[8] Y. Liu and X. Tang, "Depressive syndromes in autoimmune disorders of the nervous system: prevalence, etiology, and influence," *Frontiers in psychiatry,* vol. 9, p. 451, 2018.

[9] S. A. Metcalf *et al.*, "Serum C-reactive protein in adolescence and risk of schizophrenia in adulthood: a prospective birth cohort study," *Brain, behavior, and immunity,* vol. 59, pp. 253-259, 2017.

[10] R. R. Girgis *et al.*, "A randomized, double-blind, placebo-controlled clinical trial of tocilizumab, an interleukin-6 receptor antibody, for residual symptoms in schizophrenia," *Neuropsychopharmacology,* vol. 43, no. 6, pp. 1317-1323, 2018.

[11] C. Steriade, M. J. Titulaer, A. Vezzani, J. W. Sander, and R. D. Thijs, "The association between systemic autoimmune disorders and epilepsy and its clinical implications," *Brain,* vol. 144, no. 2, pp. 372-390, 2021.

[12] H. Song *et al.*, "Association of stress-related disorders with subsequent autoimmune disease," *Jama,* vol. 319, no. 23, pp. 2388-2400, 2018.

[13] R. Jeppesen and M. E. Benros, "Autoimmune diseases and psychotic disorders," *Frontiers in Psychiatry,* vol. 10, p. 131, 2019.

[14] G. N. Neigh and F. F. Ali, "Co-morbidity of PTSD and immune system dysfunction: opportunities for treatment," *Current opinion in pharmacology,* vol. 29, pp. 104-110, 2016.

[15] H. Hori and Y. Kim, "Inflammation and post-traumatic stress disorder," *Psychiatry and Clinical Neurosciences,* vol. 73, no. 4, pp. 143-153, 2019.

[16] A. L. Ryder, P. M. Azcarate, and B. E. Cohen, "PTSD and physical health," *Current psychiatry reports,* vol. 20, no. 12, pp. 1-8, 2018.

[17] K. M. Jain, M. Davey-Rothwell, N. L. Crossnohere, and C. A. Latkin, "Post-traumatic stress disorder, neighborhood residency and satisfaction, and social network characteristics among underserved women in Baltimore, Maryland," *Women's Health Issues,* vol. 28, no. 3, pp. 273-280, 2018.

[18] W. Akosile, R. Young, B. Lawford, J. Voisey, and D. Colquhoun, "PTSD symptoms associated with myocardial infarction: practical clinical implications," *Australasian Psychiatry,* vol. 26, no. 1, pp. 60-64, 2018.

[19] A. O'Donovan *et al.*, "Elevated risk for autoimmune disorders in Iraq and Afghanistan veterans with posttraumatic stress disorder," *Biological psychiatry,* vol. 77, no. 4, pp. 365-374, 2015.

[20] A. L. Roberts *et al.*, "Association of trauma and posttraumatic stress disorder with incident systemic lupus erythematosus in a longitudinal cohort of women," *Arthritis & Rheumatology,* vol. 69, no. 11, pp. 2162-2169, 2017.

[21] S. Katrinli, N. Oliveira, J. C. Felger, V. Michopoulos, and A. K. Smith, "The role of the immune system in posttraumatic stress disorder," *Translational Psychiatry,* vol. 12, no. 1, pp. 1-14, 2022.