REVIEW

Preventing and Mitigating Post-Traumatic Stress: A Scoping Review of Resilience Interventions for Military Personnel in Pre Deployment

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Purpose: Resilience is considered as a protective factor that can assist individuals to reduce post-traumatic stress reactions. In recent years, armies in many countries have widely implemented resilience training programs before deployment to prevent or reduce post-deployment combat stress reactions. Therefore, this study aims to review what is known about resilience interventions for military personnel in pre deployment.

Methods: Based on Arskey and O'Malley's framework, a scoping review was completed. This review was performed through searching databases including PubMed, Embase, Web of Science, Medline and the Cochrane Library, and screening literature to extract data, finally summarizing the findings.

Results: A total of 25 studies focusing on resilience interventions for military personnel in pre deployment were involved and analyzed using intervention approaches, outcome measures, intervention effects, and so on.

Conclusion: Based on the existing evidence in this review, it is cautiously believed that the resilience intervention program for military personnel before deployment is effective. However, there is no single effective best method even the same type intervention can make different effects in different situations and populations. Therefore, the population differences and context should be fully considered in constructing and implementing program to build military personnel resilience.

Keywords: resilience, military personnel, prevention, post-traumatic stress response

Introduction

Modern military operations are characterized by their particularity, complexity, and uncertainty. Therefore, military personnel usually face a variety of stressors, including live ammunition, bloody terror, disability, and death. Excessive stress can lead to serious mental disorders and cognitive impairment, manifesting as anxiety, fear, suicide or homicide, lack of attention, and loss of behavioral control. Finally, non-combat attrition may appear.[1,2] Two longitudinal studies on veterans of Operational Iraqi Freedom (OIF) and Operational Enduring Freedom (OEF) have indicated that the incidence of posttraumatic stress disorder (PTSD) is 2 to 3 times higher among those exposed to combat relative to those who did not report significant combat exposure.[3,4]

Large-scale non-combat attrition significantly affects the ability and efficiency of troops to carry out diversified military tasks, lowering overall combat effectiveness and increasing the economic burden of the military's health care system. The US military healthcare system spends $3.1 billion annually on treatment for PTSD alone, depression alone, and comorbid PTSD and depression.[5]

2377

Prophylactic intensive training targeting protective factors of traumatic stress has been found to lower the incidence and severity of post-traumatic reactions.[6,7] Resilience, the ability to resist, adapt, recover, and grow from challenges,[8] is currently recognized as a protective factor in post-traumatic stress response.[9] Multiple studies have revealed that individuals with higher resilience have a more stable emotional state and mental health when experiencing stressful events,[10–12] develop lower stress levels, and are better capable of dealing with challenges and complete tasks.

In a longitudinal study performed by the Canadian Forces,[13] it was found that post-deployment individuals' resilience was higher than that of undeployed individuals at baseline, and deployment experience significantly improved the resilience of some military personnel. Therefore, it is suggested that stress stimulation may positively impact resilience, providing a feasible basis for resilience training strategies.

Realizing the importance of resilience, the US Department of Defense conducted extensive research on measuring and nurturing resilience and launched the Resilience Program in 2007.[14,15] This program aims to transform disease-focused care models within the military into a mental health-focused prevention model. Then, various branches of the US military proposed a series of programs to improve the resilience of military personnel, including the Comprehensive Soldier Fitness (CSF), the Air Force Resilience Training (ART), the Operational Stress Control (OSC), the Naval Operational Stress Control (OSC), and the Marine Corps Combat Operations Stress Control (COSC) program.[16] Many countries around the world have widely taken resilience training as a preventive program rather than a medical program, such as the US military's Master Resilience Training (MRT),[17] and the British Army's Traumatic Risk Management, TRiM.[18]

Unfortunately, many of these programs have not been empirically evaluated prior to implementation,[19] and some resilience-building programs may exert little or no positive impact on mental health outcomes for military personnel, with interventions diminishing over time.[20,21] Based on a systematic review,[22] Skeffington et al discovered that no high-quality randomized controlled study confirmed the effectiveness of PTSD prevention strategies in 2013. However, a study by the Irish Defence Forces showed that an effective resilience intervention plan was necessary before deployment.[23] Hourani et al[24] surveyed resilience interventions undertaken by forces in the United States, the United Kingdom, and the United Nations, concluding that pre-traumatic exposure strategies and stress reduction training methods were the most promising ways to prevent PTSD in 2011. Leppin et al[25] reported that resiliency training programs had a small to moderate impact on enhancing resilience and other mental health outcomes within three months of follow-up in 2014, while the research subjects did not include active military personnel. A recent meta-analysis on randomized controlled trials of resilience interventions for military personnel and emergency responders suggests that cognitive-behavioral interventions and mindfulness training can enhance the resilience of military personnel in pre deployment.[26]

This study aims to review what is known about resilience interventions for military personnel in pre deployment. Using a scoping approach, the intervention of building military resilience can be discussed and elucidated, which is beneficial for understanding how to enhance resilience and formulate effective military personnel resilience intervention programs. It is of great significance for promoting the resilience building of military personnel, preventing and alleviating post-traumatic stress response, lowering the adverse consequences of post-traumatic stress and strengthening the overall combat effectiveness of troops in future studies.

Materials and Methods

This scoping review was based on the scope review framework proposed by Arksey et al[27] and the scope review guidelines issued by Peters et al[28] The stages are shown below:

1. Identifying questions
2. Identifying studies
3. Selecting studies
4. Extracting data
5. Collating, summarizing, and reporting results

Stage1: Identifying Questions

This scoping review was performed to deal with the following questions:

1. What resilience interventions are available for pre deployment military personnel?
2. Which concepts do these interventions use and what theories do they depend on?
3. What are the characteristics, purposes and contents of these resilience interventions?
4. What are the (main) outcomes and effects of these resilience interventions?

Stage 2: Identifying Studies

A systematic search was performed between November 2023 and March 2024. Five databases, namely PubMed, Embase, Web of Science, Medline and the Cochrane Library, were chosen. In terms of each database, there was a detailed research string combining the term "military personnel" or "military" or "army" or "soldier" or "national guard" or "marines" or "navy" or "airforce" or "pilots" or "airman" or "armed forces" or "coastguard" or "sailor" or "submariner" and "Resilience" or "psychological, adaptation" or "psychological, stress" or "psychological, adjustment" or "stress" or "adjustment disorders". The search was performed within titles, abstracts, and keywords. Furthermore, an additional search was made by snowballing the reference lists of retrieved literature.

Two review authors independently assessed the titles and abstracts of studies which were identified by the literature search following the predefined inclusion criteria. We resolved any disagreement through consensus or, if necessary, by consultation with a third review author. If necessary, the original study author was contacted by Email or telephone to acquire uncertain but vital information for the present study. A total of 1645 papers were retrieved (772 PubMed, 206 Embase, 595 Web of Science, 9 Medline, and 63 The Cochrane Library). Among them, 421 repetitive papers were removed, while 105 studies were included after reading the title and abstract. Finally, 25 studies were involved after reading the full text.

Inclusion Criteria

1. Participants: military personnel of all services and arms, including the National Guard Force and the reserve service.
2. Intervention Characteristics: any specifically resilience-based intervention, irrespective of content, duration, setting, or delivery media in pre deployment.
3. Outcome Measures: resilience (measured with specific resilience scales) and resilience related indicators in mental health, physical health, psychological functioning, and work performance.
4. Study Design: randomized controlled trials (RCTs), cluster-RCTs, cross-over trials, Quasi-RCTs, and controlled trials.
5. Published in English and peer-reviewed

Exclusion Criteria

1. Studies evaluating treatment interventions for established psychological illness.
2. Unable to get full text.

Stage 4: Extracting Data

Selected data were tabulated. Extracted information includes the first author, publication year, location, study design, duration of intervention, sample size and pertinent outcomes (see Table 1).

Stage 5: Collating, Summarizing, and Reporting Results

Types of Interventions

Cognitive–behavioral therapy-based interventions were performed in six studies; seven studies adopted mindfulness and relaxation-based training; two studies were concentrated on stress inoculation training; four studies used biofeedback-based programmes; two studies applied neuropsychological-based programmes; two studies used psychoeducational-based programmes, and in the final two studies, family-centered resilience interventions were performed (See Table 2 for a brief description of each intervention).

Table 1 Characteristics of Included Studies

Reference	Year	Location	Study Design	Duraion	Sample Size (IG/CG)	Pertinent Outcomes
Adler et al[29]	2015	USA	Cluster-RCT	10 weeks	2019 (1019/1000)	Anxiety (GAD-7)
						Depressive symptoms (PHQ-D)
						Sleep problems
						Group Cohesion
Bouchard et al[30]	2012	Canada	RCT	3 days	41 (21/20)	Objective stress levels: cortisol; heart rate
Cacioppo et al[31]	2015	USA	RCT	5 days	1138 (688/450)	Empathy (the Empathic concern sub scale)
						Generalized trust (Rosenberg's Faith in People Scale)
						Loneliness (revised UCLA scale)
						Hardiness
						Alcohol misuse (TICS)
Chongruksa et al[32]	2015	Thailand	RCT	12 weeks	60 (30/30)	Resilience (THMI: adapted from CD-RISC)
						Mental well-being (THMI-54)
						anxiety, social dysfunction, depression (GHQ-28 (Thai))
Cohn and Pakenham[33]	2008	Australia	RCT	45 days	174 (101/73)	Attributional Style (Real Events Attributional Style Questionnaire)
						Coping Strategies (Brief COPE scales)
						Questionnaire-12 (GHQ-12)
Crane et al[34]	2018	Australia	Cluster-RCT	4 weeks	226 (130/96)	Stressor frequency (23 item list created by the researchers)
						Depression symptoms (PHQ-8)
						Anxiety (GAD-7)
Fikretoglu et al[21]	2019	Canada	Cluster-RCT	9 weeks	2831 (1452/1379)	Psychological distress (K-10)
						Subjective levels of distress (SUDS)
						Resilience (CD-RISC)
						Anxiety (GADS-7)
						Depression (PHQ)
						Mental health service use (CAF-MHSUQ)
Fornette et al[35]	2014	French	Quasi experimental	11 weeks	21 (10/11)	The Profile of Mood States (POMS) questionnaire
						The State-Trait Anxiety Inventory
Hourani et al[36]	2016	USA	Cluster-RCT	7 months	348 (251/97)	Heart period (HP)
						Respiratory sinus arrhythmia (RSA)
						PTSD (PCL-C)
						Perceived Stress (coping; Perceived Stress Scale)
Hourani et al[37]	2017	USA	Cluster-RCT	18 months	891 (469/422)	Perceived stress (Personal Stress Situation)
						PTSD symptoms (PCL-M)
Jha et al[38]	2010	USA	Quasi experimental	8 weeks	48 (31/17)	The Ospan score
						Positive and negative affect (PANAS)
Johnson et al[39]	2014	USA	Cluster-RCT	8 weeks	287 (153/134)	Heart rate.
						Breathing rate.
						Neuropeptide Y and norepinephrine levels

Jones et al[40]	2019	UK	RCT	9 weeks	707 (358/349)	Symptoms of common mental disorder
						General Health Questionnaire (GHQ)
						Symptoms of PTSD (Caseness; PC-PTSD-5)
						Alcohol use (AUDIT-C)
Keynan et al[41]	2019	Israel	RCT	4 weeks	180 (90/90)	Emotional regulation: measured using resilience training on the eStroop task
						Anxiety (STAI, Hebrew version)
						Alexithymia (TAS-20, Hebrew version)
Lester et al[42]	2012	USA and Japan	Quasi experimental	8 sessions	488 unique families	Brief Symptom Inventory (BSI)
						the McMaster Family Assessment Device (FAD)
Lester et al[43]	2016	USA and Japan	Quasi experimental	8 sessions	2165 unique families	The self-report Brief Symptom Inventory-18 (BSI-18)
						the McMaster Family Assessment Device (FAD)
						PTSD (PCL-C)
Lewis et al[44]	2015	USA	Cluster-RCT	15 minutes	891 (469/422)	PTSD (PCL-C)
						Heart rate and Respiratory sinus arrhythmia (RSA)
Meland et al[45]	2015	Norwegian	Quasi experimental	12 months	21	Five Facet Mindfulness Questionnaire (FFMQ)
						Norwegian Mental Skills
						Questionnaire for Athletes (NMS–42)
						A Norwegian version of the Sport and Anxiety Scale
Pyne et al[46]	2018	USA	Cluster-RCT	12 months	342 (200/142)	PTSD (PCL-M)
						Heart rate variability (HRV)
Regula et al[47]	2023	Switzerland	RCT	15 weeks	99 (35/46)	The Primary Appraisal and Secondary Appraisal Questionnaire (PASA)
						Visual analogue scales (VAS)
						Positive and negative affect (PANAS)
						Cortisol
						Heart Rate
Stanley et al[48]	2011	USA	Case report	8 weeks	47	Five Facet Mindfulness Questionnaire (FFMQ)
						Perceived Stress Scale (PSS)
Taylor et al[49]	2011	USA	RCT	12 days	18 (10/8)	Dissociation (CADSS)
						PTSD symptomatology (IESR)
Wald et al[50]	2016	Israel	RCT	6 weeks	719 (363/356)	PTSD prevalence
						Self reported PTSD (PCL-M)
						Depression symptoms (PHQ-9)
Wessemann et al[51]	2016	Germany	RCT	1.5 days	67 (36/31)	Current mental state (BSI)
						PTSD symptoms (PDS, German version)
Williams et al[52]	2007	USA	Cluster-RCT	9 weeks	1199 (583/616)	Beck Depression Inventory, Second Edition (BDI-II)
						Perceived Stress Scale (PSS)
						Interpersonal Relationship Inventory
						Sense of Belonging Inventory-Psychological (SOBI-P)
						Coping Styles Questionnaire (CSQ)
						Perceived Cohesion Scale (PCS)

Abbreviations: IG, intervention group; CG, control group; GAD, Generalised Anxiety Disorder; PHQ, Patient Health Questionnaire; UCLA, University of California, Los Angeles; TICS, two-item conjoint screen; TMHI, Thai Mental Health Indicator; CD-RISC, Connor Davidson Resilience Scale; GHQ, General Health Questionnaire; Brief-COPE, Brief Coping Orientation to Problems Experienced; K-10, Kessler Psychological Distress scale; SUDS, Subjective Units of Distress Scale; CAF-MHSUQ, Canadian Armed Forces Mental Health Service Use Questionnaire; PCL-C, PTSD Checklist- Civilian Version; PCL-M, PTSD checklist-Military version; AUDIT-C, Alcohol Use Disorders Identification Test; STAI, State-Trait Anxiety Inventory; TAS-20, Toronto Alexithymia Scale.

Table 2 A Brief Description of Interventions

Type	Reference	Population	Intervention	Comparator
Cognitive–behavioral therapy-based interventions	Cacioppo et al[31]	US Army Soldiers	Social Resilience Training (SRT) was delivered in largely a psycho-educational format with some skills based rehearsal. Then, it was designed to address feelings of isolation and maladaptive social cognition with an emphasis on modifying maladaptive social cognition.	Afghanistan cultural awareness training
	Chongruksa et al[32]	Thai Army Rangers	The used integrated Group Counselling (IGC) was an 'Interactive model of existential therapy incorporating art therapy by drawing mandalas, and CBT practices.	Informational control
	Cohn and Pakenham[33]	Australian Army recruits	Brief cognitive–behavioral program was consisted of two 40-minute sessions of psychoeducation on cognitive restructuring and coping strategies.	Discussion of training experiences
	Fornette et al[35]	French Air Force flying school cadets	Cognitive adaptation training involved in automatic mental mode and adaptive mental mode was aimed to enhance metacognitive skills pertaining to the two major types of human cognitive processes.	Basic flying training
	Regula et al[47]	Switzerland officer cadets	Resilience training (RT) is based on a cognitive behavioral approach and on positive psychology and adopted for the needs of the Swiss Armed Forces to improve skills for managing stressful situations and build resilience to prevent negative stress outcomes.	Diversity management training (DMT)
	Williams et al[52]	US Navy recruits	BOOT Camp Survival Training included learning and practicing strategies for coping, and managing emotional responses and stress.	No additional training
Mindfulness-and relaxation-based training	Crane et al[34]	Australian Army recruits	Self-reflection training was operationalised by means of guided coping and emotion regulatory self-reflection in order to increase resilience.	Coping skills training
	Fikretoglu et al[21]	Canadian military recruits	Road to Mental Readiness (R2MR) training was consisted of stress management skills training, psycho-educational instruction and small group based vignette exercise to reinforce skills learned.	Delayed intervention control condition
	Jha et al[38]	US Marine Corps reservists	Mindfulness-Based Mind Fitness Training (MMFT) blended mindfulness skills training with concrete applications for the operational environment and information and skills concerning stress, trauma, and resilience.	Assessment only
	Johnson et al[39]	US Marine Corps	MMFT	No additional training
	Meland et al[45]	Norwegian combat aircraft squadron	Mindfulness Training (MT) was consisted of theoretical lectures, guided practice on yoga, body scanning and seated meditation.	Not applied
	Stanley et al[48]	US Marine Corps reserve	MMFT blended mindfulness skills training with concrete applications for the operational environment and information and skills about stress, trauma, and resilience.	No additional intervention
	Taylor et al[49]	US Navy personnel	Psychological skills training (PST) was consisted of arousal control, mental imagery, goal setting, and positive self-talk.	No treatment control condition
Stress inoculation training	Hourani et al[36]	USMC Marines	Pre-deployment Stress Inoculation Training (PRESIT) consisted of education, skills acquisition and practice in a simulated environment.	"Current best practice" brochure + lecture on stress management
	Hourani et al[37]	US Army Soldiers	PRESIT	Stress management training

Biofeedback-based programmes	Bouchard et al[30]	Canadian Soldiers	Immersion and Practice of Arousal Control training (ImPACT) was a stress-management training programme with biofeedback. Tactical breathing (TB) involved a process of timed inhalations, holds and exhalations.	Training as usual control condition
	Lewis et al[44]	US Army Paratroopers	Predeployment stress inoculation therapy (PRESTINT) began with "Battle Breathing" techniques, followed by biofeedback training, ending with a Multimedia Stress Environment exercise.	
	Pyne et al[46]	US National Guard Soldiers	Heart rate variability biofeedback (HRVB) and Cognitive Bias modification for interpretation (CBM-I). CBM-I intervention shifted a soldier's interpretive style by presenting an increased proportion of neutral or non-negative interpretations of an ambiguous deployment-related scenario.	Training as usual control condition
	Wessemann et al[51]	German army medical unit personnel	Chaos Driven Situations Management Retrieval System (Charly) refers to a technology-based approach consisting of blended learning, Internal differentiation, simulation techniques and biofeedback.	Training as usual control condition
Neuropsychological-based programmes	Keynan et al[41]	Israeli Soldiers	The theoretical underpinning of amygdala electrical fingerprint neurofeedback (Amyg-EFP-NF) is Cognitive Neurofeedback. Downregulation of the amygdala activity is considered a vital mechanism in emotional control and the programme aiming to achieve this through NF.	Control electroencephalography NF or NoNF
	Wald et al[50]	Israeli Soldiers	Attention Bias Modification Training (ABMT) proposed that mechanism of anxiety reduction is its targeting of disruptions in a threat monitoring system responsible for focusing on potential threats in the environment.	Attentional Control Training (ACT) and no-training
Psychoeducational-based programmes	Adler et al[29]	US Army Soldiers	This resilience training (RT) programme was consisted of cognitive-education-positive psychology facets, including normalising symptomatology, and encouraging optimism and model of adversity-belief-consequence.	Military history lectures
	Jones et al[40]	UK Royal Air Force recruits	"SPEAR" is a programme which emphases social networks, capitalising on personal strengths, managing emotions as well as enhancing awareness of psychological symptoms and learning methods to promote resilience.	Training as usual
Family-centered resilience interventions	Lester et al[42]	US military families	Families OverComing Under Stress (FOCUS) project	Not applied
	Lester et al[43]	US military families	FOCUS project	Not applied

Effects of Interventions

Cognitive–Behavioral Therapy-Based Interventions

Cognitive Behavior Therapy (CBT) is a psychological intervention to change or reconstruct negative cognition through cognitive and behavioral techniques. The core of CBT is to change irrational negative beliefs and thoughts, which can thus alter an individual's psychology and behavior.[53]

Cacioppo et al[31] reported significant improvements in military hardiness, military environment tolerance, loneliness, empathy, and compassion after the SRT. Similarly, Chongruksa et al[32] considered that the Rangers' resilience scale (CD-RISC) score was dramatically higher than that of the control group after Integrated Group Counselling (IGC). However, this intervention program adopted Buddhist concepts and may not apply to groups of other religious or cultural beliefs. Cohn and Pakenham[33] found that the intervention group reported less self-blame, better perceived coping, greater positive states of mind and lower psychological distress than the control group at the end of the brief cognitive–behavioral program. Fornette et al[35] discovered that cognitive adaptation training changed their stress management practices, while no differences existed in mood and anxiety between the intervention group and the control group. Regula et al[47] indicated that cortisol increased in both resilience training (RT) and diversity management (DMT) groups during stress, while there was a slighter cortisol increase in the RT group thereafter. The RT group perceived the military stressor as more challenging, exhibiting higher values in motivation and exerting positive impacts than the DMT group. Williams et al[51] pointed out that BOOTSTRAP Recipients were more likely to develop significantly higher cohesion, better perceived problem-solving strategies and social support, and had less anger-based coping strategies than controls.

Mindfulness-and Relaxation-Based Training

Mindfulness refers to focusing on the present moment while paying attention to observing, and describing feelings, thoughts, and sensations. It is a protective factor for physical and mental health.[54] In 1979, Kabat-Zinn proposed mindfulness-based stress reduction therapy and pioneered mindfulness training in the medical community.[55]

Crane et al[34] discovered that relative to the control group, participants in the self-reflection group had improvements in mental health outcomes on depression, anxiety symptoms, and perceived stressor frequency at longer-term follow-up. Nevertheless, no difference was found in depression symptoms at initial follow-up. Fikretoglu et al[21] conducted a mindfulness-based program, named the Road to Mental Readiness (R2MR), with Canadian military recruits. Then, it was found that no difference existed in levels of depression and resilience at a five-week follow-up or at a nine-week follow-up. Jha et al[38] pointed out that marines receiving greater Mindfulness-Based Mind Fitness Training (MMFT) experienced lower levels of negative emotion and higher levels of positive emotion. Johnson et al[39] discovered that recipients exhibited greater reactivity (heart rate), enhanced recovery (heart rate), breathing rate after stressful training and lower plasma neuropeptide Y concentration after MMFT. Meland et al[45] considered that reductions in somatic anxiety associated with performance occurred, and improvements in self-perceived skills related to mindfulness, attention regulation and arousal regulation were observed after mindfulness training. Taylor et al[49] reported that psychological skill training (PST) did not notably lower symptoms of post traumatic stress versus a control condition; there existed a reduction in symptoms of post traumatic stress at 24 hours, 1 month, and 3 months after completing training. Nevertheless, the difference in recovery between intervention and control was not significant. Stanley et al[48] carried out MMFT with Marine Corps, and confirmed that spending more time in engaging in MMFT corresponded with greater self-reported mindfulness, and that increases in mindfulness were related to reductions in perceived stress.

Stress Inoculation Training

Stress Inoculation Training (SIT) refers to a psychological training model that aims to provide a form of vaccination-like immunity against possible future stressors. The idea is that early exposure to stressful events of a certain intensity can prevent future negative stress effects.[56] SIT, proposed by Meichenbaum in 1985, is a three-stage model, including the concept stage, skill acquisition and consolidation stage, and application and follow-through stage. It mainly involves cognitive restructuring, relaxation training, self-guidance, and self-monitoring, and is used to improve negative emotions, enhance stress resistance, and prevent post-traumatic stress disorder.[57]

Hourani et al[36] in 2016 reported that Pre-Deployment Stress Inoculation Training (PRESIT) was not successful at lowering PTSD diagnosis and self-reported Perceived Stress Scale (PSS) scores compared to the control condition. However, when baseline mental health issues were controlled, participants in the control condition were at 6.9 times the risk of a diagnosis of PTSD compared with the intervention group. Nevertheless, Hourani et al[37] in 2017 mentioned that PRESIT was not efficient in lowering the number of subsequent clinical diagnosis and symptoms of PTSD and the score on the PSS.

Biofeedback-Based Programmes

Biofeedback involves using electrical mechanical equipment for measuring physiologic processes occurring in a person and subsequently feeding this information back to them with the purpose of developing a greater awareness and capability of controlling changes within their bodies.[58]

Bouchard et al[30] considered that the participants in the biofeedback-assisted management training group were less stressed than control group members in stressful first-aid simulation. Additionally, the intervention group had greater anticipated self efficacy than the control group participants. Lewis et al[44] indicated that symptoms of post traumatic stress were not significantly decreased by their predeployment stress inoculation training (PRESTINT) compared to controls, while experimental subjects showed greater heart rate variability (HRV) during a post-training combat simulation. HRV is considered a protective factor for reducing traumatic stress.[59] Pyne et al[46] believed that no observable overall effect of the "heart rate variability biofeedback" program was found on post-deployment symptoms of post traumatic stress, and there was no obvious difference between intervention and the control arms at 12-month post-deployment. Wessemann et al[51] conducted Chaos Driven Situations Management Retrieval Systems (CHARLY) programme with German military medical personnel. The CHARLY group exhibited a significantly lower level of traumatic stress on the PDS scale following deployment relative to the control group.

Neuropsychological-Based Programmes

Keynan et al[41] revealed the specificity of neurofeedback learning to the targeted amygdala electrical fingerprint (Amyg-EFP) signal, resulting in reduced alexithymia and faster emotional stroop. This suggested better stress coping skills following Amyg-EFP-NF relative to controls. Wald et al[50] conducted attention bias modification training (ABMT) which is an intervention method, where a pre-designed processing mode is used to directly manipulate attentional bias through task scenarios,[60] and they reported four sessions of ABMT reduced risk for PTSD associated with the no-training condition. In addition, no other between-group differences were found.

Psychoeducational-Based Programmes

Adler et al[29] considered that there existed no obvious differences between conditions concerning depression symptoms, anxiety symptoms, or sleep problems, and resilience training was rated as less useful than military history classes by participants. Jones et al[40] reported that levels of PTSD, common mental disorder symptoms, alcohol misuse, help-seeking and homesickness were not of significant difference between groups at post intervention or at three-month follow-up.

Family-Centered Resilience Interventions

Family and social support is a protective factor of resilience.[61] The Mental Health Task Force of the US Department of Defense recognizes that maintaining the overall combat effectiveness of the force requires support for the resilience of military personnel and their families. In 2008, the US Marine Corps launched the Families Overcoming Under Stress (FOCUS) project, enhancing communication and understanding among family members through structured narrative to cultivate family resilience and cohesion.[62] Lester et al[42] conducted the FOCUS project, and the results indicated that the parents who participated in the project had significantly lower stress, anxiety, depression index, and Family Assessment Device (FAD) unhealthy family function score. In addition, Lester et al[43] also suggested that FOCUS training before deployment vastly alleviated parents' anxiety and depression symptoms and positive coping skills, and improved the overall resilience of the family.

Conclusion and Expectation

By reviewing previous studies, it is evident that the contents and methods of resilience building for military personnel are diverse, when cognitive–behavioral therapy-based interventions, mindfulness and relaxation-based training, stress inoculation training, biofeedback-based programmes, neuropsychological-based programmes, Psychoeducational-based programmes and the family-centered resilience interventions are included. In addition, there is no single effective method; even the effects of the same resilience intervention method can vary in different situations and populations. Therefore, when constructing and implementing intervention program to build military personnel resilience, the population differences and context should be fully considered. For example, cognitive behavioral intervention methods have a certain "cultural specificity" and lack of generalizability.[63] Stress inoculation training should further clarify the critical values for different populations to produce learned helplessness and training effects; Besides, ABMT should select appropriate training times that can activate the reward system and reduce stress based on different populations.

Resilience is a complex, multidimensional structure. Therefore, the effectiveness of resilience interventions cannot be measured solely by the diagnosis of PTSD and other psychological disorders, and there is no "gold standard".[26] Mcclung et al[64] provided an overview of physiological factors impacting or predicting resilience in military populations, which included physical performance, body composition, nutrition and diet quality, and biomarkers. It is no predictive value considering any single influencing factor alone for individual resilience.[65] Therefore, linking psychological and physiological indicators of resilience in future studies plays a vital role in forming more comprehensive assessments of resilience in military populations.

In future studies, algorithms could be developed and validated to predict PTSD by integrating various data sources, including self-report, vital signs, demographics, psychological traits, stress response, genomics, proteomics, transcriptomics, metabolomics, and epigenetics. Moreover, a multidimensional and multimodal approach across multiple systems, paths, or mechanisms could be employed to build personalized, systematic, and diversified resilience intervention programs enhancing the overall combat effectiveness of the military. The Maximal Adaptability Model predicts that when stressors progress to the extremes of hyper-stress, limits of maximal psychological and physiological adaptability may be exceeded, causing dynamic instability. Thus, we should choose and adjust the appropriate training level and training content according to psychological status and cognitive behavior monitoring of different individuals when carrying out the SIT.[66] For instance, a smartphone-delivered version of Skills for Life Adjustment and Resilience (SOLAR) could be implemented to manage stress and prevent PTSD.[67] Similarly, the Biofeedback Assisted Resilience Training (BART) digital health platform could support remote intervention and physiological and behavioral information collection.[68] Finally, Mcclung et al[64] believed that various perspectives of physical performance, nutrition, body composition, and biomarkers contribute to physiological resilience in military personnel, which can provide potential targets for future resilience intervention research.

Disclosure

The authors report no conflicts of interest in this work.

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