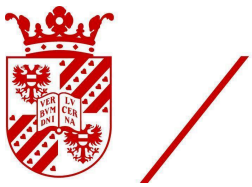

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Can The Freeze Response Lead to Posttraumatic-Stress Disorder?: A Systematic Review

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Abstract

In this systematic review, we investigated the freeze response and its potential relationship to post-traumatic stress disorder (PTSD) symptoms. The freeze response can be explained as the reaction that occurs during trauma exposure, which is characterised by temporary immobility. Tonic immobility (TI) and collapsed immobility (CI) have been identified as more prolonged states of immobility. A literature search across PsycINFO, PubMed, and Web of Science resulted in ten studies that were included in this review. The included studies investigated the link between freezing and PTSD symptom severity. The majority found a positive relationship between these two factors. This review sheds light on the possible mechanisms that underlie the relationship.

Keywords: *freeze response, tonic immobility, collapsed immobility, PTSD, trauma*

Introduction

It is well-known that different people react differently to stressful or dangerous situations. When we are faced with a stressor, some people would run away, while others would confront the situation without hesitation. Cannon's (1927, 1929) "fight-or-flight" framework explains these reactions to stress. He stated that fighting and fleeing are associated with a number of physiological alterations, including enhanced heart rate and production of stress hormones. Although this framework provides the most well-known responses to trauma exposure (Bracha et al., 2004), there is a third response - also known as the freeze response.

Think about the following scenario: you are all alone and walking through a pitch-black alley late at night. You get a very strong sense that someone is following you. Out of the corner of your eye, you spot a person's silhouette. Suddenly, you are paralyzed with fear and find yourself unable to move. This is what we call the freeze response. A lot of research on this response has been focused on animals (e.g., Blackshaw et al., 1998; Power & McGaugh, 2002), while research on humans remains scarce. In the current systematic review, we aim to discover the association between the freeze response and the development of PTSD symptoms.

According to Marx et al. (2008), the function of the initial freeze response serves to buy some time for evaluating whether it is best to fight or flee from the situation at hand. The freeze response is associated with an increased situational awareness and an alert posture (Marks,

1987). When there are no options to confront (fight) or escape (flight) the situation, one can enter a more prolonged state of immobility (Schmidt et al., 2008). One state of prolonged immobility is called tonic immobility (TI), during which an individual is unable to move, speak, or think (Gallup, 1977). Furthermore, collapsed immobility (CI) can also cause prolonged paralysis, during which heart rate and blood pressure drop which can result in fainting (Kozlowska et al., 2015). It is important to keep in mind that although these responses are often used interchangeably by researchers, they are actually separate constructs. However, in the current investigation we will be examining all of these responses. Our rationale for doing so is that we consider TI and CI as extreme demonstrations of the freeze response, and thus, as different forms of freezing.

Some individuals can develop PTSD as a result of traumatic experiences such as sexual abuse of physical violence (Bisson et al., 2015). People with PTSD often experience recurring negative thoughts about the traumatic event, trying to avoid reminders of it, hyperarousal, and low mood. These are the core symptoms of PTSD, according to the American Psychiatric Association (2013). In our society, this psychiatric disorder is commonly observed (Sareen, 2014). Researchers have attempted to find a link between individuals' responses to traumatic experiences and their influence on the development and manifestation of PTSD. Research has revealed that immobility responses, specifically TI, may have a link with the emergence and intensity of PTSD symptoms (e.g., Abrams et al., 2009; Lima et al., 2010; Kalaf et al., 2015).

There has been a growing body of evidence supporting the relationship between the freeze response and developing PTSD symptoms and the subsequent PTSD diagnosis (e.g., Lawyer et al., 2006; van der Hart et al., 2008). The majority of research, despite the freeze response's acknowledged importance as a peritraumatic response, focuses on other peritraumatic

reactions (e.g. dissociation) and how they relate to PTSD (Kalaf et al., 2015; Portugal et al., 2012). Importantly, during immobility states such as TI, the individual remains aware at all times, in contrast to other peritraumatic responses (Bovin et al., 2014). This stresses the need for further investigation.

The aim of our systematic review was to examine the freeze response, including both TI and CI, and its potential link to the development and emergence of PTSD. We delved into the possible pathways by which the freeze response could contribute to the emergence of PTSD symptoms. We expected that the freeze response would lead to higher PTSD symptomatology, higher risk of PTSD diagnosis, and more severe PTSD symptoms. In the end, we aim to find valuable answers and insights into the question: “Can the freeze response lead to the development of PTSD?”.

Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) were followed during data collection and analysis.

Literature search

A systematic search was conducted in PsychINFO, PubMed, and Web of Science with a focus on articles identifying useful, peer-reviewed publications on the freeze response and its presumed relationship with PTSD (and PTSD symptoms). The following search syntax was used: [(freeze response OR tonic immobility OR collapsed immobility) AND (post-traumatic stress disorder OR posttraumatic stress disorder OR post traumatic stress disorder OR PTSD OR trauma)]. During data collection, no restricted filters were utilised. The literature search was conducted on October 16th, 2023.

Inclusion and exclusion criteria

Articles were eligible for inclusion if they explored the freeze response as a reaction to trauma and its potential relationship to the subsequent development, presence, or risk of PTSD. Furthermore, the articles had to involve human participants (not restricted to age or gender). Another criterion was that the articles had to be written in either Dutch or English and needed to be peer-reviewed. There were no restrictions in terms of the year the article was published. Articles were excluded if they were unrelated to the research question. Furthermore, meta-analyses and systematic reviews were not included.

Data extraction

To ensure the efficient organisation of the data from the eligible studies, a worksheet was used to collect the crucial data. The information collected included the title, author(s), year of

publication, study type, aims, hypotheses, and conclusions. This method helps to efficiently enhance the process of data sorting and analysing from the studies.

Results

Search results

The process of identifying articles that were included in the literature review is depicted in the PRISMA Flow diagram (Figure 1). The search initially yielded 310 articles from PsychINFO, Pubmed, and Web of Science. After deleting 45 duplicates, the remaining 265 articles were screened based on their titles and abstracts. Following this screening, 225 articles were excluded. The remaining 40 articles were full-text screened, of which 10 articles that met the inclusion criteria were included in the current systematic review.

Figure 1. PRISMA flow diagram

Study characteristics

The most important characteristics of the included studies are shown in Table 1. The number of participants in these studies varied, ranging from 29 to 4781. Notably, the vast majority of the studies that were analysed in this review featured a predominantly female or exclusively female sample. The only exception to this was the study conducted by Lima et al. (2010), which had a slightly larger proportion of male participants in their sample. Additionally, almost all studies focused exclusively on adults, except for two studies that also incorporated adolescents in their sample. The included articles investigated a wide range of traumatic experiences, with most of them being related to sexual abuse. The Tonic Immobility Scale (TIS) was most commonly used to assess the freeze response or TI, with some studies using a shortened version of the TIS such as the Tonic Immobility Scale - Adult Form (TIS-A) or the Tonic Immobility Scale - Child Abuse Form (TIS-C).

Objectives and findings

The objective and main findings of the ten included articles in this systematic review are displayed in Table 2. The main objective of the majority of the included articles focused on examining the potential link between the freeze response and developing PTSD symptoms. However, additional aims were found in the included studies. For instance, examining the relationship between the freeze response and the subsequent diagnosis of PTSD, while another article focused on the effect of TI on the response to treatment. Additionally, every study used a cross-sectional design to measure the objectives.

PTSD symptom severity

The majority of the studies analysed aimed to explore the association between the freeze response and the severity of PTSD symptoms. Out of the ten studies, six were particularly focused on this relationship. All of them arrived at the same conclusion that there is a positive association between the two. Therefore, these findings suggest that there is concrete evidence to support the idea that freezing during a traumatic event is linked to the severity of PTSD symptoms.

According to Gama et al. (2022), individuals who experienced TI as a result of COVID-19-related trauma, such as the death of a patient or a close relative due to the virus, are more likely to develop more severe symptoms of PTSD. The researchers have found that there was a corresponding increase in the score of PTSD symptoms by a factor of 1.044 for every unit increase in TI. Similarly, Hagenaars (2014) discovered the same positive association, but in a large representative sample with a range of traumatic experiences, including sexual abuse or physical violence. Furthermore, Portugal et al. (2012) found this association in a non-clinical group of individuals who experienced TI as a result of a range of traumatic experiences, such as being physically abused or losing a loved one. Similar to what was found in the above-mentioned

studies, Kalaf et al. (2015) established the TI-PTSD symptom severity in a large group of representative people. Additionally, they studied whether there was a difference between the occurrence of the freeze between genders. Interestingly, they found four times higher TI scores in women. Rizvi et al. (2008) discovered that women who froze during sexual or physical assault generated higher levels of PTSD. In this study, the Peritraumatic Dissociative Experiences Questionnaire - Rater Version (PDEQ) was utilised, which measured the occurrence of freezing. The rest of the above-mentioned studies utilised a variation of the TIS-scale, such as TIS-C.

Two studies focused on the TI-PTSD relationship in people who had experienced childhood sexual abuse (CSA). To start, Humphreys et al. (2009) found that women who froze during CSA were more likely to develop severe symptoms of PTSD. Similarly, Tsur et al. (2021) found that freezing was positively associated with the development of severe PTSD symptoms in individuals who had experienced CSA.

Development of PTSD

Regarding the development of PTSD, two studies were analysed in this review (Gama et al., 2022; Möller et al., 2017). To start, Gama et al. (2022) found that healthcare workers who had experienced TI during COVID-19-related trauma exposure were 9.08 more likely to develop PTSD. This association remained even after controlling for confounders (e.g. age, gender, severity of traumatic event). They state that TI is an essential risk factor for developing PTSD. Additionally, Möller et al. (2017) investigated TI and the emergence of PTSD in women who had experienced sexual assault. It was discovered that TI increases the likelihood of developing PTSD (OR 2.75; 95% CI 1.50-5.03, $p = 0.001$). Furthermore, a connection between TI and the development of severe depression was found in this study. Notably, TI was evaluated within one

month after the attack occurred. The probability of receiving a PTSD diagnosis after six months was three times more likely if TI was present during the assault.

Response to treatment

Lima et al. (2010) investigated TI, panic, and dissociation which are termed as peritraumatic responses. They sought to ascertain which one is the best predictor of poor outcome of pharmacological treatment (e.g., SSRI or SNRI) for PTSD. TI was the best predictor of poor response to PTSD treatment when all of the peritraumatic responses were compared.

Mediators

One study focused on mediating factors that may account for the relationship between the freeze response and the emergence of PTSD. The study by Bovin et al. (2014) investigated whether guilt could explain the TI-PTSD link. They found that posttraumatic guilt may serve as a mechanism through which TI can result in the later development of PTSD.

Table 1

Summary of important study characteristics

Author(s)	Year	Country	Population	Size of sample (N)	Age range	% female in sample	Type of trauma reaction	Measure scale	Type of trauma
Gama et al.	2022	Brazil	Healthcare workers	1001	19-83 years	76.5%	Tonic immobility	Tonic-Immobility Scale (TIS)	COVID-19-related trauma
Hagenaars	2016	The Netherlands	Community sample	4781	16-93 years	54%	Tonic immobility	Tonic-Immobility Scale (TIS)	Various life-threatening situations
Möller et al.	2017	Sweden	Community sample	189	17-59 years	100%	Tonic immobility	Tonic-Immobility Scale-Adult Form (TIS-A)	Sexual assault
Bovin et al.	2014	USA	Community sample	63	19-52 years	100%	Tonic immobility	Tonic-Immobility Scale-Adult Form (TIS-A)	Various life-threatening situations
Portugal et al.	2012	Brazil	Undergraduate students	198	18-52 years	80%	Tonic immobility	Tonic-Immobility Scale- Child Abuse Form (TIS-C)	Various life-threatening events

Table 1 *(continued)*

Author	Year	Country	Population	Size of sample (N)	Age range	% female	Type of trauma reaction	Measure scale	Type of trauma
Humphreys et al.	2009	USA	Childhood sexual abuse survivors	131	25-45 years	100%	Tonic immobility	Tonic-Immobility Scale-Child Abuse Form (TIS-C)	Childhood sexual abuse
Lima et al.	2010	Brazil	Community sample	36	NR	42.7%	Tonic immobility	Tonic-Immobility Scale-Child Abuse Form (TIS-C)	Various life-threatening events
Kalaf et al.	2015	Brazil	Community Sample	3231	15-75 years	55.7%	Tonic immobility	Tonic-Immobility Scale (TIS)	Various life-threatening events
Rizvi et al.	2008	USA	Female crime victims	296	18-77 years	100%	Freeze response	Peritraumatic Dissociative Experiences Questionnaire-Rater Version (PDEQ)	Sexual or physical assault

Tsur et al.	2021	Israel	Child abuse survivors	180	18-60 years	92.7%	Freeze response	The Multifaceted Peritraumatic Responses To Child Abuse Inventory (MPR-CA)	Childhood abuse

Table 2

Key findings and objective of the articles

Author(s)	Year	Objective(s)	Key findings	Study design
Gama et al.	2022	The aim is to explore the presence of TI responses during COVID-19-related trauma in healthcare workers and find out whether there is a relationship between TI and PTSD symptoms, as well as the diagnosis of PTSD.	• TI present in COVID-19-related trauma • TI associated with severity of PTSD symptoms • TI associated with PTSD diagnosis	Cross-sectional
Hagenaars	2016	The aim is to discover the occurrence of TI within a big representative sample, and to investigate whether it is linked to PTSD.	• TI present in community sample • TI associated with PTSD symptom severity	Cross-sectional
Möller et al.	2017	The goal is to determine the occurrence of TI during sexual assault and the increased risk of developing PTSD and severe depression.	• TI present during sexual assault • TI associated with increased risk of the development of PTSD	Cross-sectional
Bovin et al.	2014	The aim is to find out whether guilt mediates the TI-PTSD symptom severity relationship in women who experienced trauma.	• Guild mediates the relationship between TI and severity of PTSD symptoms	Cross-sectional
Portugal et al.	2012	The goal is to analyse the relationship between TI and PTSD symptoms.	• Association between TI and PTSD symptoms • Even after controlling for confounders	Cross-sectional
Humphreys et al.	2009	The study focused on TI occurrence in CSA survivors and the link to symptoms of PTSD.	• TI associated with PTSD symptomology • TI partially mediated the link between peritraumatic fear and PTSD symptoms	Cross-sectional
Lima et al.	2010	The goal is to analyse the effect of TI on standard PTSD treatment in terms of responsiveness.	• TI predicts poorer response to standard PTSD treatment • Even after controlling for confounders	Cross-sectional

Table 2 *(continued)*

Author(s)	Year	Objective(s)	Key findings	Study design
Lima et al.	2010	The goal is to analyse the effect of TI on standard PTSD treatment in terms of responsiveness.	• TI predicts poorer response to standard PTSD treatment • Even after controlling for confounders	Cross-sectional
Kalaf et al.	2015	The goal is to discover the association between peritraumatic TI and PTSD. Also aims to find the differences between gender.	• TI during trauma is associated with subsequent PTSD. • Twice as likely to have a PTSD diagnosis when you experienced TI • Women score four times higher on the TIS-scale	Cross-sectional
Rizvi et al.	2008	The goal is to discover the occurrence of peritraumatic reactions and evaluate their potential as indicators of PTSD and depressive symptoms.	• Freezing during sexual assault predicts greater PTSD symptoms	Cross-sectional
Tsur et al.	2021	This study aims to examine the automatic and behavioural peritraumatic responses during CA and determine whether these responses have varying effects on PTSD symptoms.	• Freezing during CA resulted in greater PTSD symptomatology	Cross-sectional

Discussion

In this systematic review, a thorough examination of ten articles was conducted to determine whether there is an association between the freeze response during a traumatic event and the developing symptoms of PTSD. The results provide strong support for the idea that experiencing the freeze response during a traumatic event is strongly associated with PTSD, with compelling evidence pointing towards greater severity of PTSD symptoms. Thus, the existing body of literature on the freeze response supports the hypothesis that freezing plays a role in PTSD symptoms.

Severity of PTSD symptoms

The American Psychiatric Association (2013) highlights that individuals with PTSD often go through the distressing symptom of reliving the traumatic event even after it has happened. Bovin et al. (2014) and Hagenaars et al. (2008) suggest that individuals in an immobilised state remain conscious and aware, making the memory of the traumatic event and the associated immobility clearer and easier to recall. This, in turn, results in more severe symptoms of PTSD. Furthermore, people who experience TI during trauma exposure exhibit decreased levels of control, which makes them more sensitive to the development of unwanted thoughts and memories about the traumatic experience.

It has been claimed that self-blame, guilt, and shame may be a possible pathway through which TI can lead to symptoms of PTSD and the severity of these symptoms (Bovin et al., 2014). They discovered that TI during traumatic exposure may lead to self-blame and guilt. These feelings can in turn lead to the development of PTSD symptoms. They found this in sexual assault victims and discussed that these feelings arise as a consequence of not being able to resist the attack. Moreover, a direct link between guilt and developing PTSD has been found by several

researchers (Henning & Frueh, 1997; Machado et al., 2020). According to Bovin et al. (2014), guilt mediates the TI-PTSD relationship. Therefore, is it crucial to educate the trauma survivors who experienced TI in order to help them reduce feelings of shame and guilt, and potentially alleviate the symptoms of PTSD. For instance, during therapy sessions, a psychologist can explain the nature of freezing behaviours and challenge the client's negative thoughts, such as the belief that it was their fault because they did not fight back.

Development of PTSD

We reviewed a few articles regarding the freeze response and its link to the development of PTSD. Even though freezing was identified as a risk factor for developing PTSD (Gama et al., 2022; Möller et al., 2017; Kalaf et al., 2015) research is in need of more longitudinal studies researching the duration of PTSD.

Potential underlying mechanism

The mechanism that underlies the relationship between the freeze response and PTSD is still not fully uncovered. However, it has been found that several mediators could play a role in this relationship. For example, self-blame and guilt (Bovin et al., 2014) may act as a mechanism that drives the TI-PTSD relationship. Additionally, the judgments of others regarding the inability to respond during trauma exposure may be linked to severity of PTSD symptoms (Marx et al., 2008). Other factors that might play a role in the TI-PTSD link are severity of the traumatic experience (Bovin et al., 2008; Ozer et al., 2004) or feelings of not being able to escape or having control (Bovin et al., 2008).

Limitations and further research

It has been discovered that the included articles have certain limitations. One of the limitations is that, due to the retrospective nature of the majority of the articles, the assessment of

the freeze response may be subjected to memory biases (Möller et al., 2017). However, there is one exception - the study conducted by Möller et al. (2017) assessed the participants within one month after the assault occurred, which minimises the recall bias. The recall bias can occur when the participants have difficulties recalling aspects of the traumatic event due to the passage of time since it happened (Rhodes et al., 2019). For example, the study by Humphreys et al. (2009) that was included in this review included adult participants that needed to recollect what happened in their childhood. Additionally, participants may overreport their symptoms for attention, incorrect attribution or faking an illness (Constans et al., 2014). Future studies should account for these factors that can cause over reporting of PTSD symptoms. Another limitation is that four studies only had female participants in their sample. Even though it was a methodological choice it raises questions about the gender differences. It has been found that women have a higher chance of developing PTSD (Olff et al., 2007). So, the results should be analysed with caution. Therefore, inclusion of a more representative sample would enhance reliability and understanding of gender-specific results. For further research, these limitations should be taken into account.

Conclusion

The body of literature suggests that the freeze response can indeed lead to PTSD symptoms and eventually a PTSD diagnosis. The experience of freezing during trauma exposure has been established as a prominent risk factor for the development of PTSD. The exact mechanism that underlies this relationship is still not completely uncovered. However, it is of high importance to educate individuals about the nature of freezing, which indicates that immobilisation is not due to the fact that you do not want to fight but instead it is impossible.

This should be incorporated into standard practice of PTSD, because the prevalence of TI is high.

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